Chapter IV

Experience of Development of Small and Medium Enterprises in the Electricity and Electronics industry

Chapter Ⅳ

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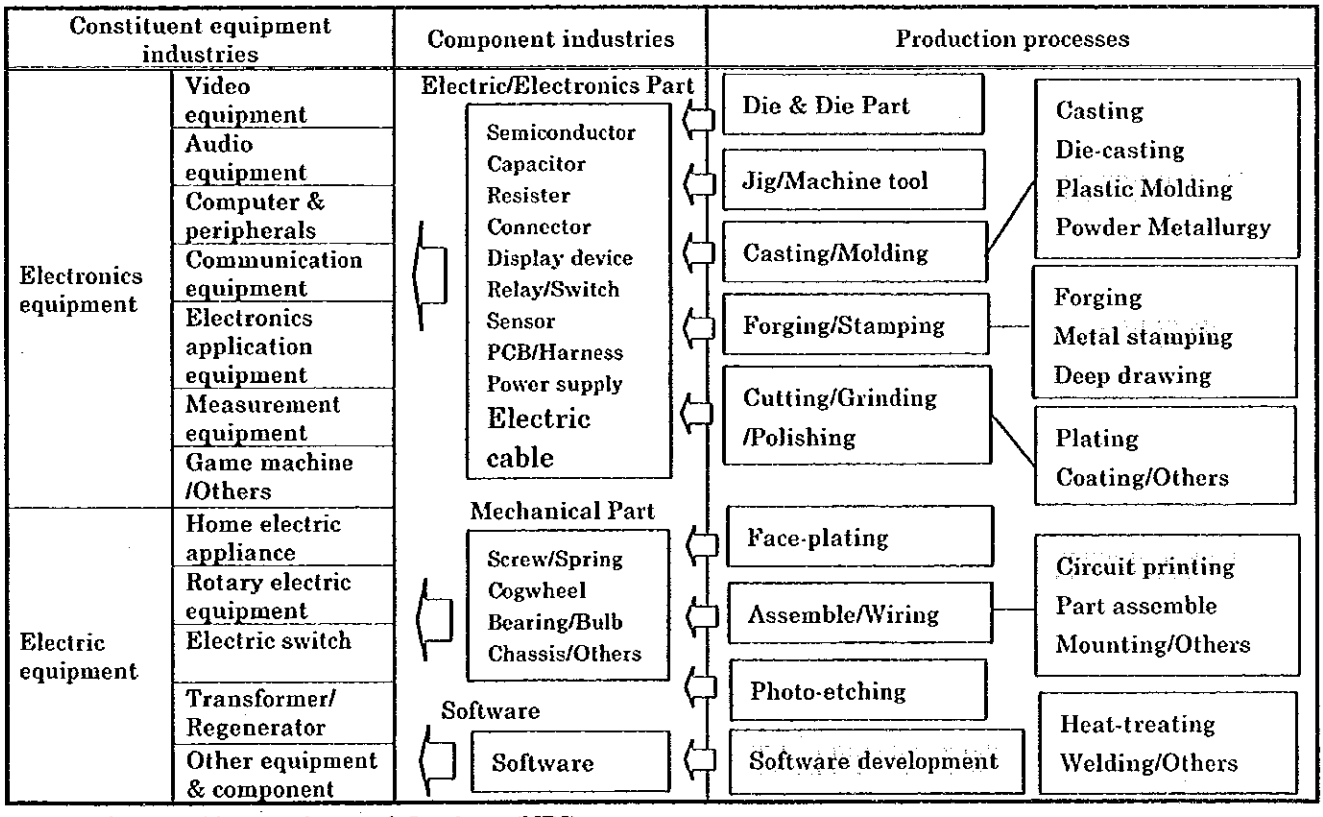
1. Outline of SMEs in the electric/electronics industry

1.1 Industrial structure

As shown in Figure 1-1, the electric/electronics industry consists of equipment industries in various fields and the industries producing the components required for this equipment production. Besides the electric/electronic types such as resistors and capacitors, components include mechanical types such as screws, springs, and chassis as well as software types. Generally speaking, the components are produced with the use of molds, jigs, and other tools in a variety of processes including plastic molding, metal stamping, circuit printing, and software development.

Figure 1-1 Structure of the electric/electronics industry (constituent equipment/component industries and production processes)

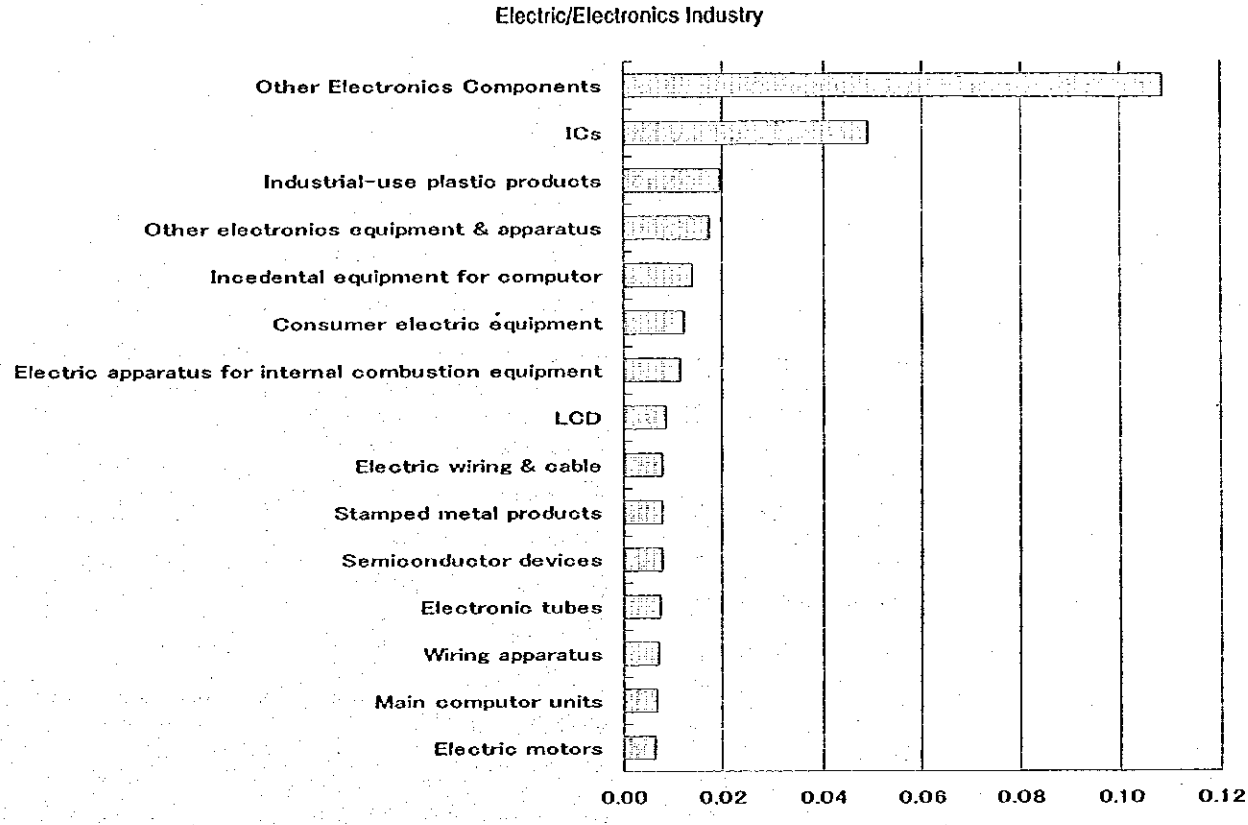


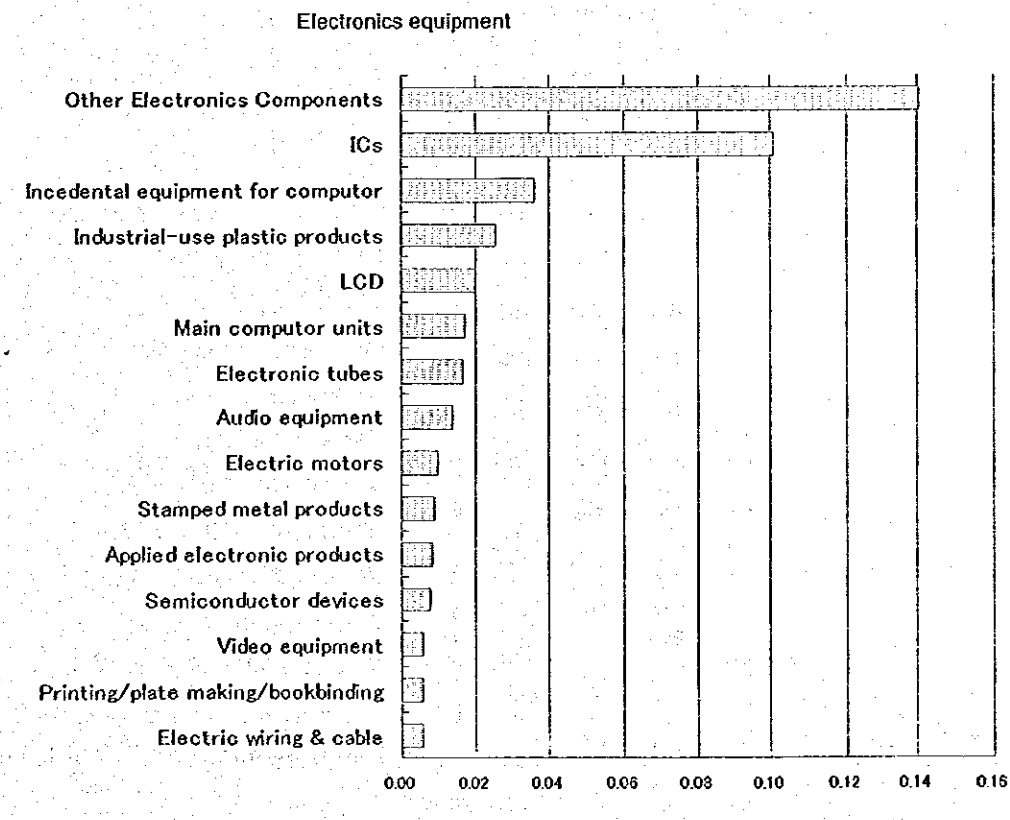
Source: Nomura Research Institute (NRI)

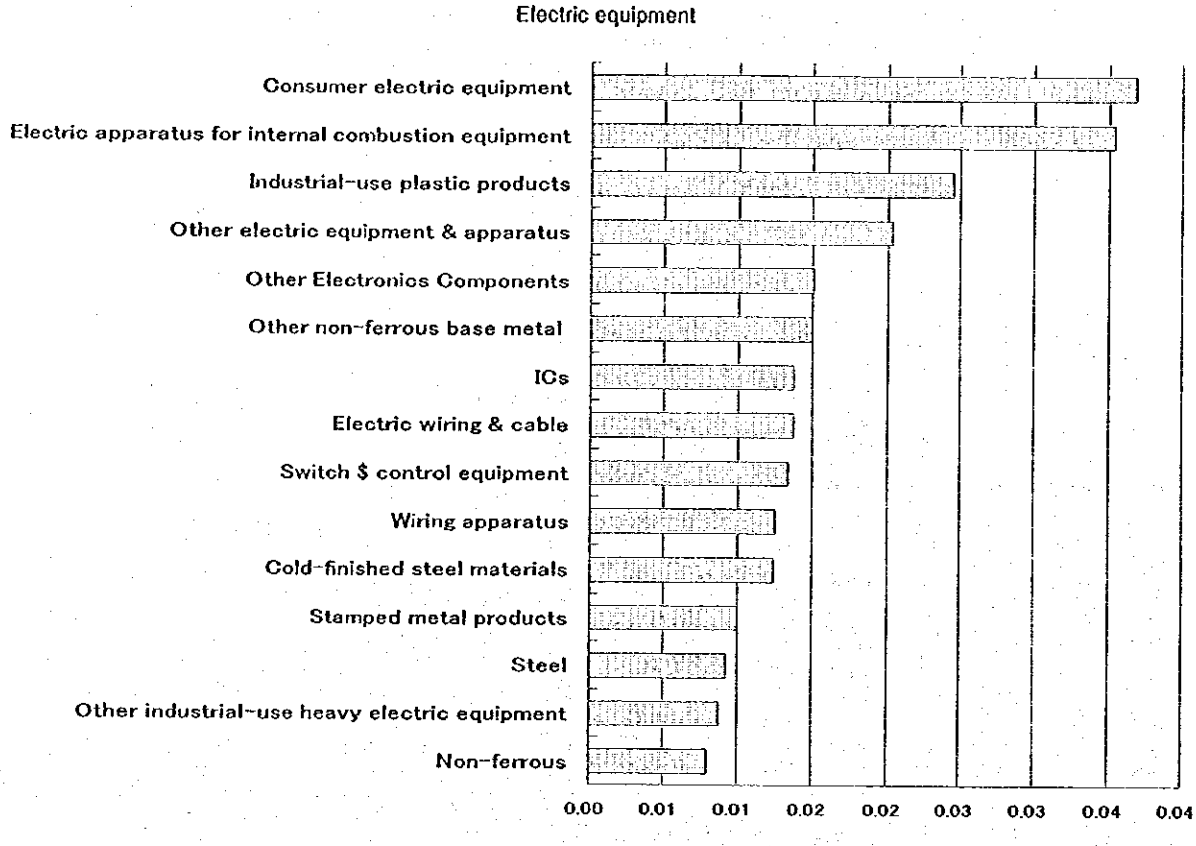
Calculation based on the 1995 table of industrial linkage (see Figure 1-2) reveals that, in monetary terms, the demand for components generated by Japanese production of electric/electronic equipment came to 26 percent of the equipment production. Electric/electronic types accounted for about 17 points of this percentage, and the mechanical and software types, about 4 points each.

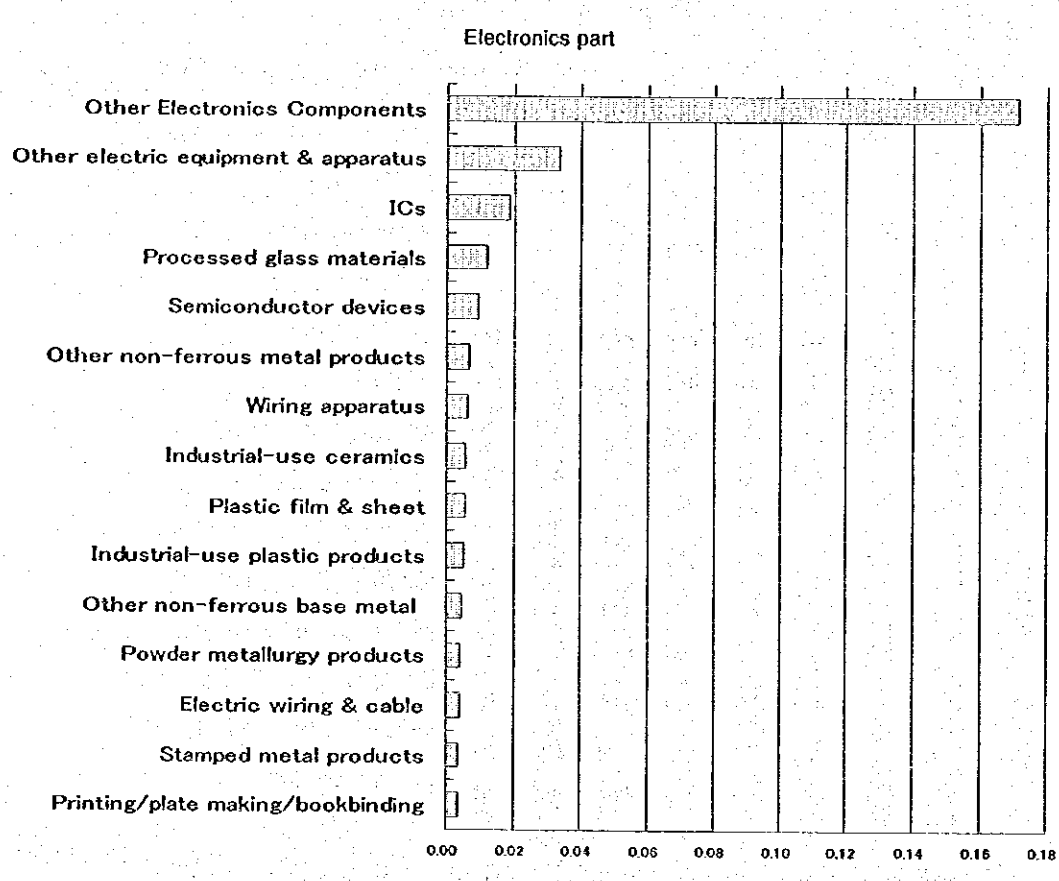
As shown in Figure 1-2, large shares are occupied by assembled and processed components such as semiconductors and general-purpose components (resistors, etc.). The respective percentage-point shares for the component categories of printed circuits, molded plastic, stamped metal, and software are estimated at 4, 3, 1 and 4 points.

Figure 1-2 Demand-creating effects for components and processed items in the electric/electronics industry based on Japanese industrial linkage tables (1995)









Source: Industrial linkage tables (1995, Management and Coordination Agency)

While the individual shares are by no means high, the components in question account for a fairly large part of the diverse and complex interrelationship of processes in the industry (see Figure 1-4). Whereas the production of assembled and processed components such as semiconductors and general-purpose components is undertaken mainly by large firms, the related circuit printing, plastic molding, metal stamping, and software development are undertaken mainly by small and medium enterprises of (SMEs).

Figure 1-3 Equipment production value and demand-creating effect for components in the Japanese electric/electronics industry (1995)

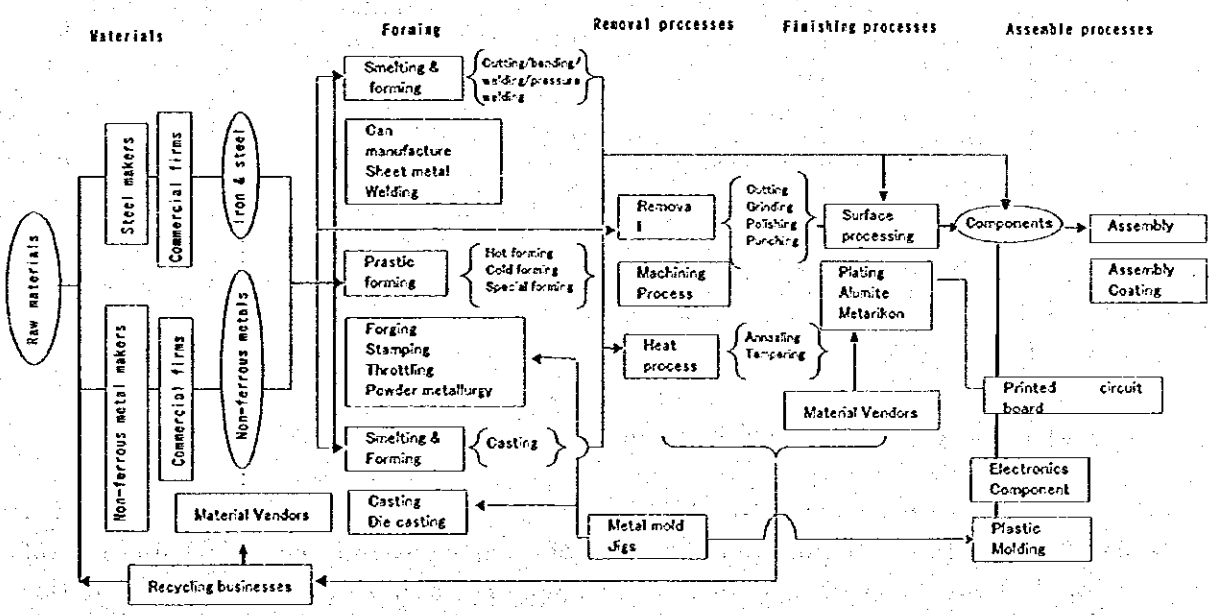
(Unit : billion yen)

Equipment production value		Demand-creating effect for components		Demand-creating effect by major component type	
Electronics equipment	19,610	Electric/Electronics components	6,180 (17)	Printed circuit fabrication	1,558 (4)
				Plastic molding	1,098 (3)
Electric equipment	16,333	Mechanical components	1,560 (4)	Metal stamping	280 (1)
		Software	1,640 (4)	Software (development)	1,640 (4)

Note: Estimates based on the 1995 table of industrial linkage in Japan; figures for printed circuits were based on the production of printed interconnection boards appearing in materials of the Japan Printed Circuit Association (inclusive of mounting and special processing); figures for software development were based on software industry sales appearing in the materials of the Information Processing Business Association. Figures in parentheses indicate level as percentage of the equipment production value.

Source: NRI

Figure 1-4 Conceptual diagram of interrelations in the electric/electronics industry (machinery and metals industry)



Source: 「Over the hollowing」 (Mr.Mitsuhiro Seki)

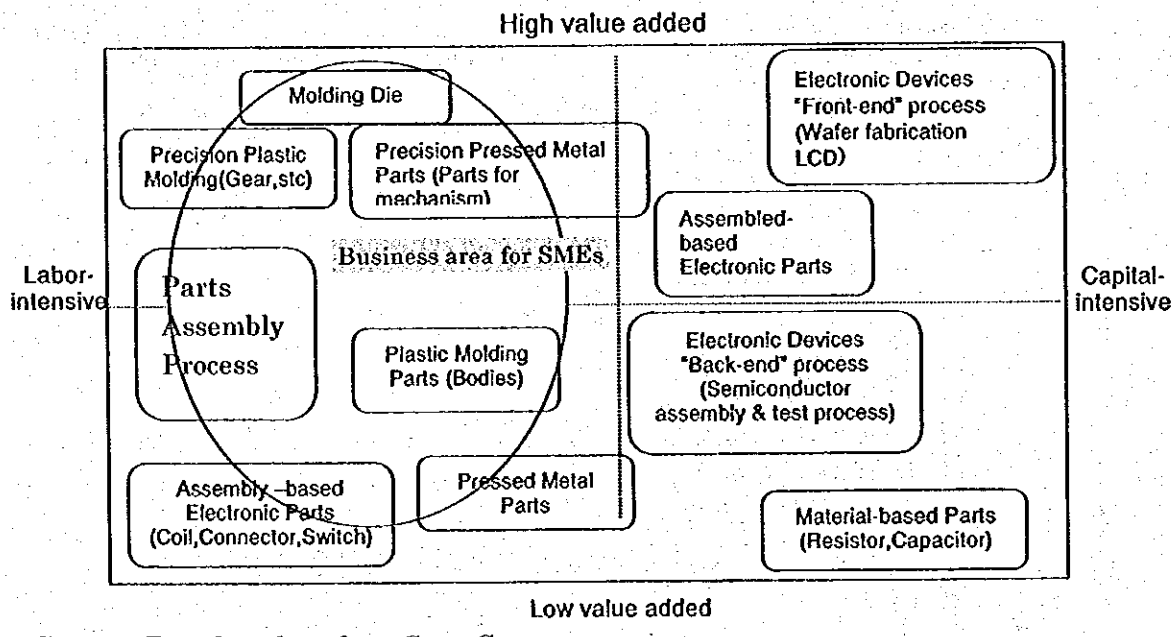
Source: Industrial linkage tables (1995, Management and Coordination Agency)

1.2 Positioning of SMEs

Divisions of production labor are proceeding along with the expansion of production of equipment and components in the electric/electronics industry. Mass production/sales and basic/applied research and development require enormous commitments of capital and human resources. Most such activity is consequently carried out by large firms engaging primarily in assembly and inspection. In the case of semiconductors and materials components such as resistors and condensers, huge capital investment and formidable development setups are needed for the main processes, which are consequently performed mainly by large firms.

The various processes supporting the industry are also part of the production processes for equipment and components by the large firms. As shown in Figure 1-5, however, small and medium enterprises (SMEs) now carry out much of the material and component processing. This is a result of the trend toward divisions of labor in pursuit of a higher economic merit and specialization against the background of increasing levels of technical diversity and sophistication. The processes that have been most affected by this division of labor and specialization, and are now performed mainly by SMEs, are printed circuit fabrication, plastic molding, metal stamping, and software development.

Figure 1-5 Business domain of SMEs in the electric/electronics industry

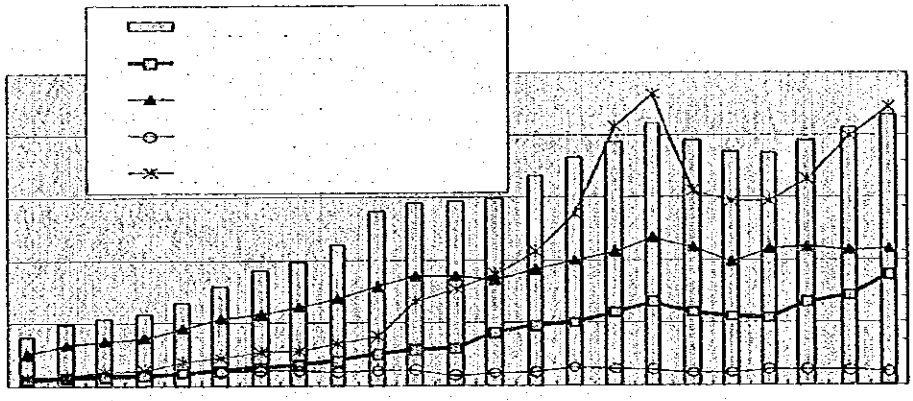


Source: Based on data from Sony Corp.

Figure 1-6 shows the trends of shipments from factories of finished products in Japan's electric/electronics industry and of components in the four industries of printed circuits, plastic molding, metal stamping, and software development (for shipments only to the electric/electronics industry in the case of the plastic molding and metal stamping industries). It is clear that the shipments in each component industry slide with those of the electric/electronics industry. In other words, the

growth of Japan's electric/electronics industry is supported by the shipments in each component industry. It should be added that the trend of shipments of stamped metal components to the electric/electronics industry has long been flat due to the switch to molded plastic versions, as will be related below.

Figure 1-6 Trend of product shipments in the electric/electronics industry and of component shipments in the printed circuit, plastic molding, metal processing, and software development industries



Source: Based on data from industrial statistics released by the Management and Coordination Agency and other sources

The circle of customers for printed circuit fabrication and software development is basically limited to the electric/electronics industry, but the plastic molding and metal stamping industries have a wide range of customers, including the auto industry (however, requirements as regards materials, precision, and processing vary depending on the user industry; not every entrant has transactions with customers in other fields). The SMEs fabricating printed circuits and developing software therefore may be considered supporting industries (SIs) essentially for the electric/electronics industry alone, and those molding plastic and stamping metal, SIs not only for this industry but also a wide range of other industries, including the auto industry and general machinery industry.

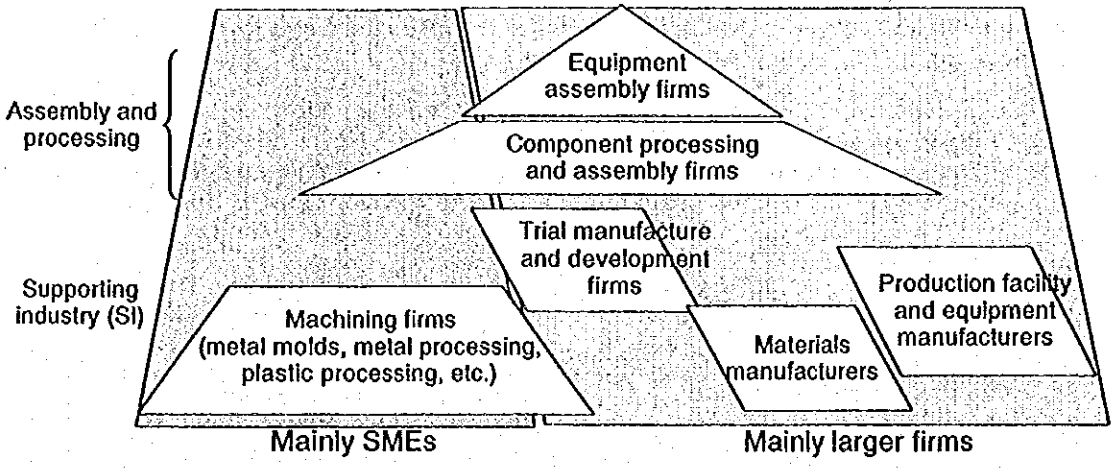
Figure 1-7 SMEs engaged in processing for the electric/electronics industry and their positioning as SIs

Major Process Work	Electric/ Electronics Industry	Automobile Industry	General Machinery Industry	.....	.....
Printed circuit fabrication	◀——▶	◀——▶			
Plastic Molding	◀			——▶	
Metal stamping	◀——			——▶	
Software Development	◀——▶	◀——▶			

Note: ◀——▶ = direct involvement, ◀——▶ = indirect involvement

Source: NRI

Figure 1-8 General structural positioning of SMEs (and SI) in the electric/electronics industry



Source: NRI

2. Successful cultivation of SMEs in the electric/electronics industry

This section investigates cases of successful cultivation of SMEs in industries supporting the electric/electronics industry, i.e., printed circuits, plastic molding, metal stamping, and software development. The investigative focuses are the management and business development of SMEs, and the relationship with public aid.

More specifically, results are presented with attention to four aspects: (a) profile of the industry and positioning of SMEs, (b) official aid for SMEs, (c)keys to success for SMEs and the role of official aid, and (d) cases of individual firms. In addition, cases of success are viewed more in terms of the industry as a whole instead of individual aid projects or firms, due to the approach to official aid in Japan and the limitations of studies of individual firms.

The plastic molding and metal stamping industries are treated separately from the others. This is because of their similarities in respect of industrial characteristics (as described above, both have numerous customer industries other than the electric/electronics industry and use metal forms i.e., molds/dies, in processing) and receipt of official aid.

2.1 Printed circuit industry

(1) Industry profile and positioning of SMEs

Printed circuit boards are basically insulated substrates with copper thin-film wiring patterns fabricated on their surface or in their interior based on circuit designs. They are used for the purpose of connection between electronic components such as resistors, capacitors, coils, and integrated circuits. As for the mode of fabrication, the circuit diagram is printed on the surface of a copper-covered laminated board. Workers may then etch the surface except for requisite conductive sections, open holes at the necessary spots with drills or other implements, or form passages between

layers. The finished products are generally called "printed interconnection boards;" the term "printed circuit boards" is applied to printed interconnection boards that are mounted with electronic components, and the industry producing them, as the "printed circuit industry."

Printed circuits are used in all kinds of electronic equipment, including computer peripherals, communications devices, automotive electronic devices, audio sets, home appliances, and industrial equipment. Manufacturers produce various types of printed interconnection boards (e.g., single-sided, double-sided, multilayer with at least four layers, and flexible) in accordance with the specifications required by the host equipment. Up until the late 1980s, production of home appliances and other goods increased at a rapid pace, and the production of printed interconnection boards enjoyed steep growth led by the one- and double-sided types.

The sharp appreciation of the yen spurred the offshore transplantation of much production in the electronics industry and the development of printed circuit production in Southeast Asia. This, coupled with the full-fledged entry by Taiwanese and Korean firms in the field of multilayer (and primarily four-layer) boards for personal computers, induced a downturn in production in Japan in the early 1990s. Nevertheless, production began to recover in the mid 1990s as the demand rebounded due to expanding sales of the multilayer type to cope with the increasingly small size and high performance of electronic equipment. In 1998, printed circuit production totaled about 2 trillion yen. Of this total, printed interconnection board production accounted for the largest portion at 1.2 trillion yen, followed by mounting at 600 billion yen and other specialized processing at 150 billion yen.

In the printed circuit industry, relatively few entrants perform all processes themselves at a single plant; there are various types of businesses. While some companies engage exclusively in etching, others specialize in drilling, and yet others, in mounting electronic components on the printed circuit boards. The industry is a typical subcontracting one characterized by a high proportion of SMEs and dependence on equipment manufacturers. For this reason, its foundation is unstable, and items such as improved productivity and rationalization of management including development of new technology have been urgent priorities right from its birth. As a result, the Ministry of International Trade and Industry (MITI) gave it the status of a designated/specified industry as provided for by the Law for Modernization of Small and Medium Enterprises as early as 1970, and began supplying it with aid in various forms for the purpose of structural improvement.

The printed circuit industry comprises about 400 major printed interconnection board (or etching) manufacturers. (The industry has divisions of production among various fields such as etching, plating, forming, and design, and consists of many SMEs. Nevertheless, the entrants performing the core process of etching number about 400 counting the large firms with their own in-house etching departments.) The industry has a high share of SMEs; some 80 percent of the entrants have no more than 300 employees, and about 70 percent are capitalized at no more than 100 million yen. In regional terms, siting of both the large firms and SMEs is concentrated in the urbanized prefectures of Tokyo, Kanagawa, Osaka, and Aichi. This pattern derives from the prevalence of siting in proximity to electric/electronics

industry clients (equipment manufacturers) located in the Tokyo-Yokohama, Nagoya, and Osaka-Kobe industrial zones. The tendency to engage exclusively in printed circuit fabrication rises as the company size decreases.

As for the composition of the industry production value by corporate scale, the share of the total occupied by SMEs in Japan increased during the recession in 1993 and 1994 due to the increased shift to offshore plants in production by large firms. More recently, however, the SME share has been steadily declining from the 1994 peak as a reflection of their technical capabilities, which are not fully adequate to cope with the increased demand for fine-pitch multilayer interconnection boards for more sophisticated PCs and cellular phones. While the large firms generally produce high-VA boards of the multilayer and flexible types, comparatively low-VA boards of the single- and double-sided types tend to occupy more of the production at SMEs.

Figure 2-1-1 Distribution of companies and degree of specialization in the printed circuit industry

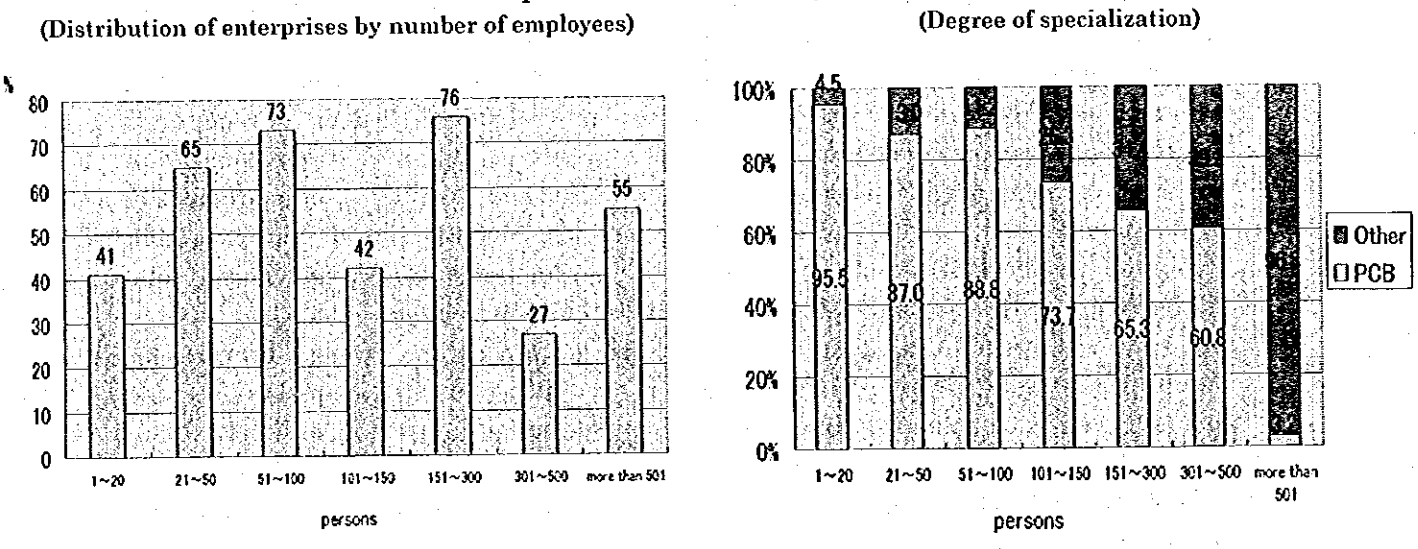
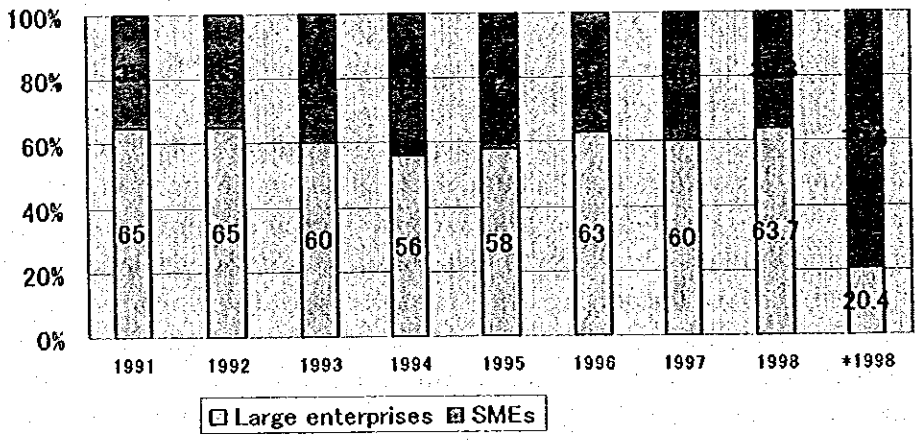


Figure 2-1-2 Composition of printed circuit production by corporate scale



Source: JPCA

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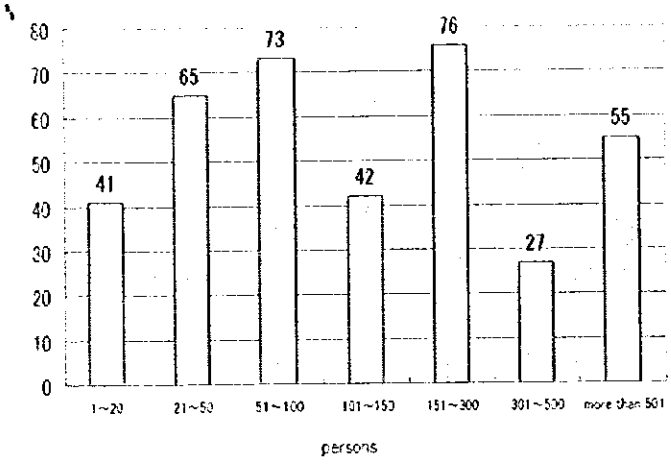
Figure 2-1-1 Distribution of companies and degree of specialization in the printed circuit industry

(Distribution of enterprises by number of employees)



(Degree of specialization)

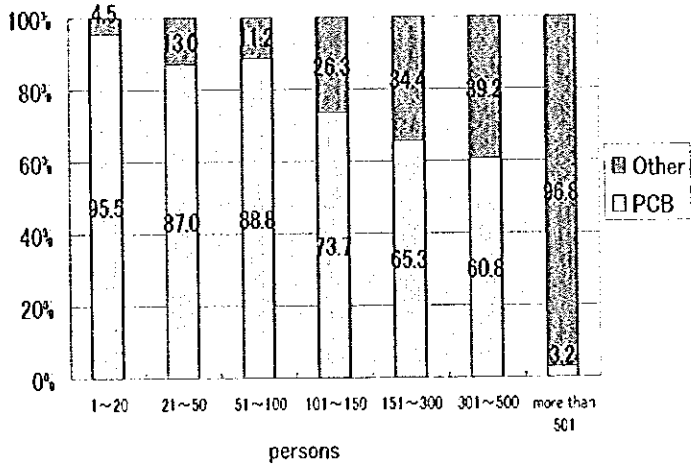
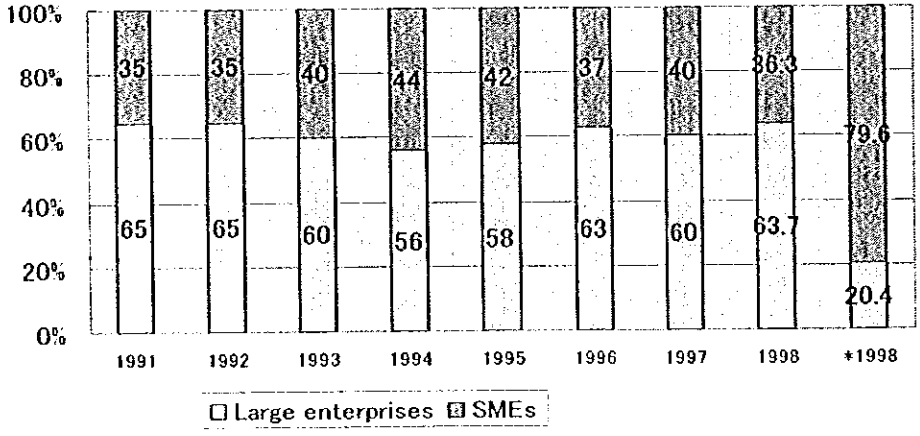


Figure 2-1-2 Composition of printed circuit production by corporate scale



Source: JPCA

The following may be cited as the structural features of the printed circuit industry.

- It is a typical subcontractor industry, and business is heavily influenced by the specifications required by equipment manufacturers. Recent years have seen a widening of application fields and a great rise in needs for production of a higher diversity of products in smaller lots.
- The major application fields fall into two categories: home appliances and information-communications equipment requiring mass production, and medical and other industrial equipment requiring high-diversity, small-lot production. In the former, production is dominated by the large firms. In the latter, SMEs are the main producers and collaborate with large firms in relationships of mutual complementation.
- The product orders carry custom specifications, and circuits must always be designed to meet the specifications of the job. For this reason, the artwork division performs a vital role as a preprocessing step.
- In the initial phase, the industry was of a labor-intensive nature and was able to subsist with some operations on the manual level. However, the higher levels of performance in electronic equipment as well in semiconductors and other components mounted on boards combined with the rising scales of integration to induce installation of automatic welding, NC machine tools, and CAD/CAM facilities. Today, the industry is instead classified as a facility- and capital-intensive one.

(2) Public support for SMEs

In accordance with the aforementioned Law for Modernization of Small and Medium Enterprises, the printed circuit industry was selected as one of the "designated industries" in 1970, and as one of the "specified industries" in 1977. Thus far, it has undergone three projects of structural reform, each with a duration of roughly five years. The Japan Printed Circuit Association (JPCA) has played a coordinating role in these projects, which have supplied the industry with various official aid.

More specifically, a fact-finding study confirmed that the industry has a high proportion of SMEs, and this led to its selection under the Law and the restructuring projects. (The MITI is involved in industrial policy in various fields and must ascertain the situation in each, but would experience difficulty in doing so independently, and therefore in effect consigned the survey to the JPCA.) While the major objective of the Law is the modernization of SMEs, it could be said that the MITI used the scheme to learn the realities of various industries and provide effective "administrative guidance" for each.

To promote structural reform in the industry, the JPCA brought companies together and formulated five-year plans aimed primarily at modernization of facilities, improvement of quality and performance, and increase in VA and productivity. The participating firms engaged in development of new technology and products as well as activities to optimize the scale of production (through collaboration in use of production facilities, purchase of materials, sales of products, etc.). At the same time,

they took advantage of the JPCA organization in promoting joint research toward the major goal of increasing VA productivity (for which targets to be attained five years later were set for each company). The results were constantly translated into actual practice, and the level of target indicators gradually rose.

As will be described below, financial aid was provided to facilitate the incorporation of modern facilities as needed for attainment of the targets. In addition, the authorities essentially condoned cartel-like activities that might otherwise be restricted by antitrust legislation. In order to meet the goals, firms formed various joint setups that cut across company frameworks (involving shared development targets, joint purchase of materials, etc.). Although there was no price fixing, such behavior could possibly be interpreted as an infringement of antitrust law. At any rate, the interaction did much to increase productivity and bolster competitiveness, both at individual firms and, more importantly, in the industry as a whole.

The JPCA performed application procedures for financing and other assistance on behalf of the companies participating in the restructuring project, and so enabled them to receive all such official aid. Of the industry's roughly 400 firms, from 100 to 150 participated in the project. This number includes equipment and materials manufacturers whose cooperation was essential for attaining targets. The following official aid was extended only to SMEs with no more than 300 employees or 100 million yen in capital.

A. Tax privileges

Some of the companies which participated in the initial restructuring project were faced with the need to sell their existing plant property and build a new modern plant. These companies were given tax privileges, e.g., exclusion of land sale and acquisition from taxation.

B. Accelerated depreciation of facilities

Provisions have been made for extra and special depreciation schemes. In the first restructuring project, accelerated depreciation was recognized for 50 percent of all existing facilities, including incidental ones. Similarly, the second project recognized accelerated depreciation for 32 percent of facilities operated for designated types of work. In the third project, extra depreciation (with a great tax-savings effect) was recognized for 21 percent of a prescribed portion of facility depreciation. Moreover, although the service life of facilities required for printed circuit fabrication is generally 12 years, this was shortened first to seven and then to six years under the plans. These steps of extra depreciation and contracted service life stimulated investment by printed circuit SMEs in production facilities, encouraged promotion of technical innovation, and motivated modernization with an accompanying rise in productivity.

C. Low-interest loans from public financial institutions

The SMEs participating in the projects were able to get special low-interest loans in addition to the loans from public financial institutions such as the Small Business Finance Corporation, People's Finance Corporation, and the Shoko Chukin Bank to fund their capital investment for production facilities. Loans from these institutions made provisions for simplification of examination and other procedural requirements even if there was no change in the interest rate per se. Furthermore, they indirectly acted to increase the credit standing of the firms (thus greatly stimulating lending activities among commercial banks) and to facilitate their procurement of both capital investment funds and operating funds. It is estimated that about 50 percent of the eligible companies actually received such loans from public financial institutions.

Figure 2-1-3 Composition of funding for capital investment, etc., in the printed circuit industry by source

(million yen, %)

Funding source (lender)	First project of structural reform (1978~1982)	Second project of structural reform (1984~1989)	Third project of structural reform (1990~1995)
Small Business Finance Corporation	7,701 (4,225)	14,800 (7,725)	14,699 (4,049)
People's Finance Corporation	133	121	414 (25)
Shoko Chukin Bank	4,788	6,678	7,965
Public financial institution total (including others)	15,198	29,406	28,850
Private financial institutions	25,500	87,580	85,279
Owned capital	12,231	58,483	21,820
Total funds raised	52,929 (4,225)	175,469 (7,725)	135,949 (4,174)
Share occupied by public institutions (special interest rates)	28.7 (8.0)	16.8 (4.4)	21.2 (3.1)

Note: In the case of firms participating in the projects; figures in parentheses indicate special-interest-rate loans.
Source: JPCA

Although there was no direct connection with the restructuring projects, the following is an outline of the skill examination system, which is thought to have had a great impact for fostering the development of SMEs in the printed circuit industry.

A. Skill examination system

Skill examinations began to be held on a yearly basis as a result of the 1989 partial amendment of the enforcement ordinance for the Law for Promotion of Vocational Skill Development, which added a national skill examination scheme for printed circuit fabrication and design work. The JPCA instituted an ad-hoc committee for the preparation of texts and staging of classes to assist preparation for the exams in member companies. Besides deliberating on and preparing texts and study programs, the committee cooperated in the staging of the testing by recommending

candidates for membership in concerned committees convened by the Central Vocational Skill Development Association. Each year, 400 to 700 employees passed the examinations. This scheme of official examinations presumably did much to raise the level of technical capabilities in the industry, and especially among SMEs.

B. Designation under the system of loans for facility modernization

In accordance with the Law for Financial and Other Aid for Small Business Modernization, provisions were made for lending to promote modernization of production facilities at SMEs, and companies engaged in the production or processing of printed circuits were designated as eligible to receive such loans. Under this system, prefectural governments furnish interest-free loans to eligible firms for up to half of the funding required for facility modernization.

C. Preferential taxation

- Tax scheme for promotion of investment in new technology by SMEs (mechatronics tax system)

In 1984, the government enacted a tax scheme for promotion of investment in new systems of technology by SMEs (ordinarily known as the "mechatronics tax scheme"). A 1988 revision of this scheme made visual inspection devices and vacuum lamination presses used for fabricating printed circuits eligible for application of privileges. The mechatronics tax was enacted for the purpose of encouraging an increase in productivity and modernization of management among SMEs. It provides for special depreciation schemes and tax deductions in the case of acquisition or leasing of the subject facilities. The JPCA performs procedures for issuance of certificates needed for application. The types of eligible equipment changed with subsequent revisions. As of 1998, those of relevance for the printed circuit industry were visual inspection devices, nitrogen gas atmosphere welders, and laser processing devices.

- Tax scheme for promotion of investment for restructuring of the energy demand ("energy reform tax system")

In 1993, application of the new tax scheme for promotion of investment that acts to restructure the energy demand (ordinarily referred to as the "energy reform tax scheme" and enacted as part of the government's comprehensive package of economic measures) was extended to laser plotters, automatic exposure devices, non-elutriation flux coating equipment, and automatic mounting equipment used in printed circuit fabrication. More specifically, the scheme designates certain equipment as contributing to the energy supply and demand balance in line with the goal of effective energy utilization, and offers the businesses in question a choice between a 30-percent special depreciation or 7-percent tax deduction on the price of purchase, provided that the facilities are put to practical use no later than one year after purchase and meet certain other conditions.

- Tax scheme for promotion of investment for high-level labor reduction

In 1993, the government instated a tax scheme for promotion of investment for high-level labor reduction as part of its comprehensive package of energy measures. The scheme is aimed at stimulating reduction of labor requirements and rationalization with a view to shortening working hours, improving workspaces, preserving the environment, and spurring imports. The scope of equipment designated under the scheme includes NC drilling devices, NC shaping equipment, plating units, etching equipment, wiring inspection devices, in-circuit testers, and function testers. Like the energy reform scheme, this scheme offers special depreciation and tax deductions.

D. Eligibility for employment adjustment aid in accordance with the Employment Insurance Law

Over the years 1992 - 1995, the printed circuit industry was designated by the Minister of Labor as one of the industries eligible for employment adjustment aid under the provisions of the Employment Insurance Law. It consequently was able to receive financial assistance for stabilization of employment.

E. Designation under the Small and Medium Enterprise Credit Insurance Law

Over the years 1993 - 1995, the printed circuit industry was designated as a specified industry under the terms of the 1993 comprehensive package of economic measures. SMEs that belong to such specified industries and have been certified to that effect by the head of the municipality in which they are located are eligible to receive guarantees from credit guarantee associations, and to use another insurance quota in addition to the ordinary one in credit insurance. This in effect doubles the credit insurance which they can receive.

(3) Keys for SME success and public support

As described above, the printed circuit industry is a typical subcontracting industry. In recent years, it has taken on an increasingly capital-intensive nature as ongoing technical advances have made installation of high-performance automation facilities indispensable. In this situation, the following may be cited as prerequisites for success by SMEs in the industry in addition to the ordinary management and business requirements.

- With a view to acquiring and keeping customers, SMEs should be prepared to go beyond mere receipt of orders for postprocessing on the order of plating and to become actively involved right from the design stage. For example, SMEs should be willing to make sizable investments in CAD systems and prepare proposals of value to the client in the aspect of circuit design. In short, improvement of preprocessing capabilities is becoming a key to expanded business. This is corroborated by the case of CMK, which is an archetypal example of growth from a small business into a major player in recent

years. Although it was backed by official aid of the aforementioned types, CMK also raised funds directly from the commercial financial market, and its rapid growth was driven largely by its expansion of such design capabilities.

- While the printed circuit industry rests mainly on execution of orders for plating and other such processes, it also contains technical systems of various other types, such as materials, engineering methods, design, and mounting. Furthermore, its capabilities for development of mounting technology must be improved on a constant basis if it is to meet the needs in the home appliance and information-communications industries, with their ever-rising levels of functionality and scales of integration. In the case of companies such as Ibiden, which succeeded in winning big contracts for Intel MPU substrates, such capabilities for development of advanced technology paved the way to growth.
- SMEs cannot satisfy the diversifying customer requirements unless they have the proper assortment of advanced and automated production facilities. The ability to raise enough funds from the commercial market for the investment required to purchase expensive facilities is therefore becoming another critical requirement for SME growth.

The printed circuit industry was the only member of the electric/electronics industry to be made eligible for application of the provisions of the Law for Modernization of Small and Medium Enterprises, and underwent several projects for restructuring led by the JPCA. This derived from the recognition that it played both a crucial and fundamental role for the overall electric/electronics industry, and that it consisted mostly of SMEs with inferior technical and financial resources when taken separately, in spite of the rising levels of equipment product and manufacturing technology and the deepening technology and capital - intensive disposition. The projects for active restructuring and official aid backed by the MITI were aimed not so much at providing management and business assistance for individual firms as at improving the makeup of the overall industry to bolster its competitiveness. The ultimate goal lay in contributing to the advancement of not only the printed circuit industry but also the electric/electronics industry which it supports.

With the help of the growth of its user industry and official aid, Japan's printed circuit industry was able to invest in sophisticated production facilities in spite of the SME makeup and to promote programs for development of talented human resources. Moreover, it has equipped itself with the competitiveness needed for flexible adaptation to diverse needs in the context of schemes for division of production labor.

In the 1990s, companies in Japan's printed circuit industry began to be overtaken by Taiwanese and Korean counterparts in fields such as printed circuit boards for desk-top personal computers. This field does not have such difficult technical requirements (e.g., four-layer boards) but nevertheless commands a large demand that is, moreover, rapidly growing. In addition, the users make tough demands as regards delivery time and price. However, the Japanese entrants continue to be the most competitive by far in fields characterized by extremely low size and weight requirements (such as notebook PCs, camcorders, and cellular phones) or high-diversity, small-lot production using boards with five or six layers. The mid

2000s are expected to see a tightening of international regulations pertaining to the global environment, and this will presumably set in motion major changes in the area of substrate materials. To adapt to these changes, the SMEs in the printed circuit industry will be able to draw on their technical and management capabilities nourished through the aforementioned restructuring projects and official aid thus far. In the process, Japan's electric/electronics industry should be able to stay at the top worldwide, at least as regards technical innovation and international competitiveness in respect of hardware.

(4) Case study

A. Company E (Printed circuit industry)

Profile

- Company E was established in 1961 as a partnership of two firms (one in the motor business and the other in the name plate business) in Nagano prefecture. At present, it is capitalized at 370 million yen and employs 350.
- Its printed circuit business began with double-sided boards used in switches and other industrial electronic equipment. Thereafter, it made efforts to develop more sophisticated mounting technology of the chip-on-board (COB) type. Today, it produces mainly semiconductor package substrates of the surface mounting type applying this COB technology. It also applies packaging technology know-how in fields outside that of printed circuits, for assembly of items such as power units for computers and adapters.

Restructuring projects

- For participation in the restructuring projects, Company E led the formation of a cooperative with 11 other counterparts in the Nagano area (including Shinko Seisakusho and Kyoden).
- The format of a cooperative, in which the business entity is under the jurisdiction of the prefectural government, was selected for the purpose of receiving financial aid from the national government for the joint use of costly facilities and for R&D programs, as related below. The cooperative still remains in existence. The major measures of restructuring taken by the cooperative are as follows.

a. Joint use of processing facilities

The cooperative worked to improve the level of technology through joint purchase and use of NC drills. It also considered joint use of plating facilities, but decided against it due to the wide gaps in know-how among the members.

b. Joint purchase of materials

Arrangements were not made for joint purchase of substrates per se, for which a schedule of delivery prices sliding with volume had already been agreed upon with

suppliers. However, the members benefited from joint purchase of chemicals and expendables.

c. Joint research and development

The members engaged in joint R&D with financial aid from the prefectural and national governments for the purpose of acquiring high-precision printing technology needed in their production.

d. Human resource development

The cooperative regularly invited experts for presentations to management and engineering personnel.

e. Development of a production control system

Company E led the development of a production control system that was provided to the other members for a fee.

- Nagano was the only area in which JPCA members formed a cooperative for the restructuring projects. In other areas, no arrangements were made for joint use of facilities requiring funding or joint R&D programs with aid from official agencies. Conversely, members in other areas made joint arrangements of the type that were not made in Nagano. These are exemplified by joint order receipt and joint use of CAD/CAM systems in the Nagoya area, and joint treatment and disposal of industrial waste in the Kanto area.

Effective public support

- The use of special and extra depreciation schemes was of immense value for Company E 's management in the growth phase, which entailed a heavy burden of capital investment (a premise here is realization of profit).
- Company E did not receive many loans (low-interest, etc.) from public financial institutions. However, other companies in the same business made extensive use of funding from sources such as the Small Business Finance Corporation, and the schemes are consequently thought to have offered substantial benefit. Company E did not take more advantage of them because its capital exceeded the 100-million-yen ceiling for SMEs and because it eventually became possible to lease high-priced NC equipment as an alternative to purchase.
- Many engineers took and passed the national skill exams, which were instated by the MITI at the urging of the JPCA. Engineers studied hard to obtain qualifications, and the system is therefore thought to have made a great contribution for developing human resources and raising the level of manufacturing technology.

B. Projects of structural reform promoted by the JPCA

From the late 1970s to the mid 1990s, the JPCA promoted three projects of structural reform. The following is an outline of these projects.

The Law for the Modernization of Small and Medium Enterprises was promulgated in March 1963 and put into effect that April. It was aimed at inducing the modernization and restructuring of SMEs in certain industries to assist SME growth and advancement through closer adaptation to the economic environment. The execution of projects under the Law required selection as a designated ("shitei") or specified ("tokutei") industry, and the JPCA played a coordinating role for the printed circuit industry in this connection. The formulation of modernization plans had to be preceded by a fact-finding study. This study was fairly in-depth and covered items including the following.

- The number of companies in the industry and their nationwide distribution
- Distribution of companies by size (i.e., capital, number of employees, etc.)
- Proportion of companies also engaging in other business
- Trend of the industry production and export
- Volume and value of production per company/employee
- Factors impeding improvement of productivity
- State of production facilities (degree of deterioration/obsolescence)
- Labor problems

The printed circuit industry was one of those designated under the terms of the Law on the occasion of the first project (1978 - 1982). At the time, Japan was in the midst of rapid transition to a more open economic order, and the major purpose of the project was to bring SMEs up to international standards. The specific goals included an increase in productivity through installation of the latest machinery and facilities, and rationalization of the scale of production and management through consolidation of entrants. In other words, the project emphasized the "hard" aspects.

The needs and preferences of Japanese consumers began to diversify once the swift economic growth brought income levels up to a certain level. The necessity of accommodating this diversity and other developments generated recognition of the need for restructuring in the "soft" aspects, such as the development of new products and technologies as well as the cultivation of human resources and other programs for knowledge intensification. As a result, new product/technology development was added as a major priority of the second project (1984 - 1988).

When the country entered the phase of only moderate economic growth, it became difficult to react flexibly to the changes in the market on the strength of the capabilities that were the focus of the preceding projects. The times demanded promotion of a project with priority on SME management capabilities in areas such as obtaining an accurate grasp of and responding to changes in demand fields, keeping abreast of the latest technology, building up management resources, and making strategic use of those resources. For further innovation in the management aspect, the third project (1990 - 1995) consequently positioned strategic management capabilities as a third pillar.

2.2 Plastic molding and metal stamping industries

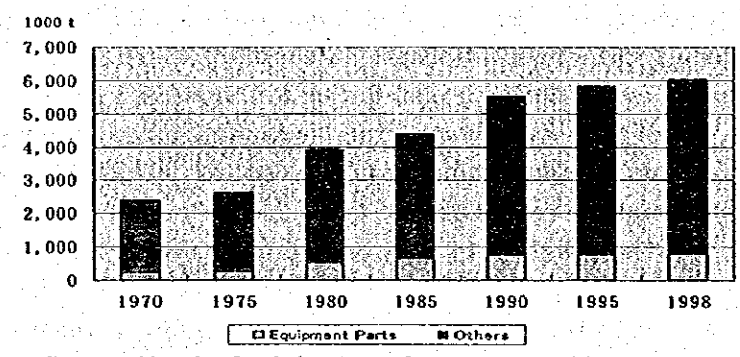
(1) Industry profile and positioning of SMEs

A. Plastic molding industry

According to MITI statistics, shipments from factories in the plastic molding industry rose almost steadily from 2.386 million tons in 1970 to 6.035 tons in 1998, for a roughly 2.5-fold increase. Particularly swift growth was recorded in the category of shipments as components for machinery apparatus, which includes electric and electronic components. Shipments in this category multiplied nearly 3.5 times, from about 236,000 tons in 1970 to 798,000 tons in 1998. In the process, their share of the entire shipments expanded from 10 to 13 percent over the same period.

Besides the expansion of the various user industries in the phase of rapid economic growth, the increase in plastic product shipments may be attributed to a widening of the range of application for key components due to the development of engineering plastics, which ushered in molded plastic items featuring light weight, high precision, and high strength. This, in turn, made possible utilization in place of metal counterparts in numerous areas. The development and spread of engineering plastics apparently did much to expand the demand in the category of machine apparatus components inclusive of electric/electronic components.

Figure 2-2-1 Trend of production of molded plastic products



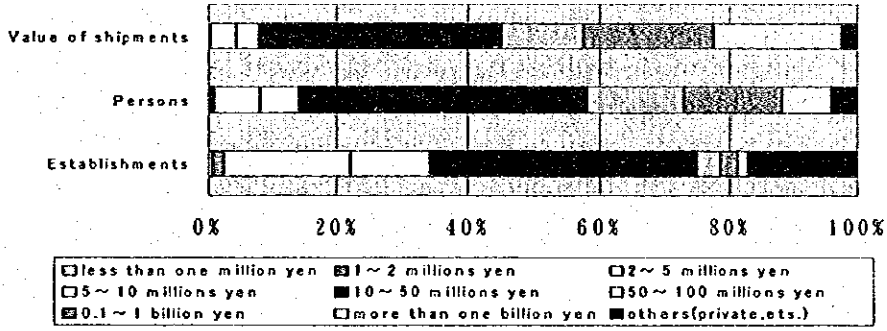
Source: Yearbook of plastic product statistics, MITI

Industrial statistics show that the plastic molding industry is clearly supported by SMEs; companies capitalized at no more than 100 million yen account for 79 percent of the total number of entrants, 73 percent of the total number of employees, and 58 percent of the total shipment volume. Although there are big entrants such as Hitachi Chemical, Achilles, and Sekisui Plastics manufacturing articles of daily use and construction materials, there are almost none in the segment of plastic items for electric/electronic components when the in-house productions of electric/electronics firms are excluded.

The electric/electronics industry is not the destination of such a large share of the total shipments from the plastic molding industry. The lion's share goes for film and sheet, which account for more than one-third of the total on both the volume and

value bases. They are followed by panel, pipe, and joints at 16 percent on the volume basis and 15 percent on the value basis. The electric/electronic component share (here equated with the share of the statistical category of electric/communications) is only about 5 percent on both the volume and value bases.

Figure 2-2-2 Distribution in the plastic molding industry by capital scale



Source: Industrial statistics, MITI

Figure 2-2-3 Composition of shipments from factories of molded plastic products by application field (1998)

Application		Production Volume(1000t)		Sale Value(billion yen)	
Film/Sheet		2,301	38%	2,348	37%
Board/Valve/Joint		953	16%	957	15%
Equipment Part		798	13%	869	14%
	Part for transportation equip.	349	6%	369	6%
	Part for electric/electronics equip.	309	5%	340	5%
	Others	141	2%	160	3%
Daily necessaries		357	6%	417	7%
Receptacle		436	7%	460	7%
Construction materials		338	6%	347	5%
Styrofoam products		387	6%	397	6%
Others		465	8%	524	8%
Total		6,035	100%	6,319	100%

Source: Yearbook of plastic product statistics, MITI

The electric/electronics industry uses molded plastic enclosures for a wide variety of products, including AV goods and home appliances such as TV sets, VCRs, radio-cassette players, and vacuum cleaners, as well as information processing equipment such as computer monitors, notebook personal computers, and printers. It also molded plastic structural members such as gears and other parts making up the drive units of VCRs and CD-ROM drives. As compared to metal, plastic is lighter in weight, easier to work, and cheaper, and its range of application has consequently been widening along with the increase in plastic processing precision and strength. The development of engineering plastics, which are used for precision components, was an especially vital factor for expanding application for electric/electronic components.

Manufacturers of electric/electronic components deal with numerous plastic molding companies in sourcing plastic items. Upon receiving orders, the plastic molding firms fabricate the metal molds, mold the plastic products, and deliver them to the ordering firm. Formerly, electric appliance manufacturers used to fabricate metal molds themselves or consign the fabrication to firms engaged exclusively in such work, and then lease the molds to the plastic molding firms so they could carry out the molding consignment. Recently, however, the technical capabilities of plastic molding firms have risen, and in many cases the big clients are having them consign the mold fabrication directly to dedicated mold manufacturers themselves in order to save time and trouble. It should be added that metal mold ownership rights revert to the firm placing the order (electric appliance manufacturers, etc.); in form, the ordering firm merely lends the mold to the plastic molding firm for the purpose of filling the order.

B. Metal stamping industry

Production in the metal stamping industry rose from 918 billion yen in 1980 to 1,290 billion yen in 1990, when Japan's economic "bubble factor" was at its height. Thereafter, it went into decline, and had fallen to 1,070 billion yen as of 1998. The biggest share of this output is received by the auto industry, which has constantly accounted for about two-thirds of the total shipment. The share occupied by the electric/electronics industry has hovered in the neighborhood of 10 percent; it came to 11.6 percent in 1980, 10.2 percent in 1990, and 11.3 percent in 1998.

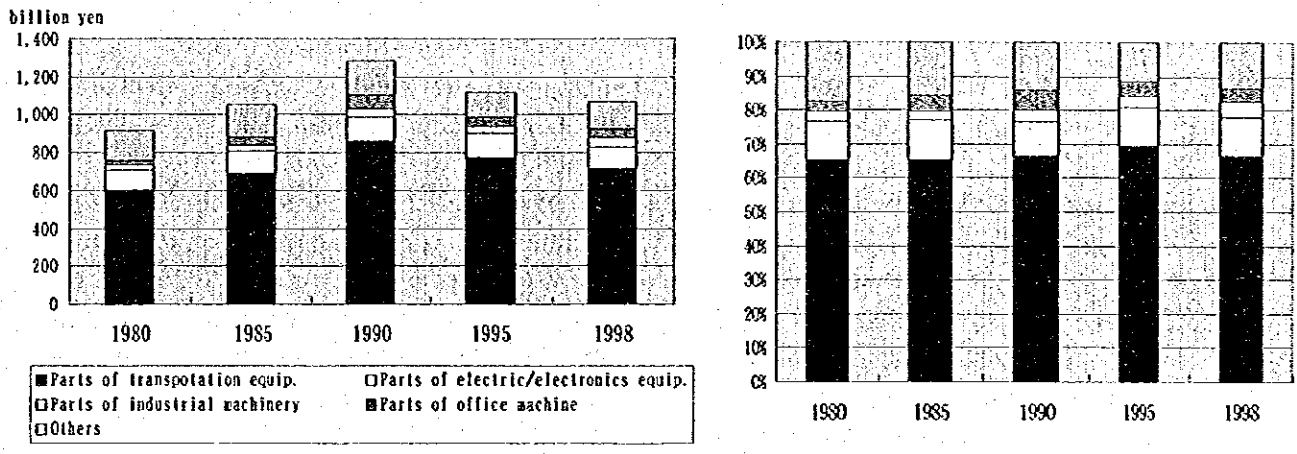
The demand for stamped metal products grew along with the expansion of the scale of the user industry until the bursting of the economic bubble. Subsequently, it went into decline under the influence of the shift to plastic goods and to offshore production among the user industries. In the electric/electronics industry, stamped metal products are in extensive use for "white goods" such as refrigerators and washers as well as chassis for TV sets, VCRs and other AV equipment. Production of such components in Japan was driven down by the offshore siting of production by the companies assembling these products.

Many of the big companies engaged in metal stamping are automotive firms such as Unipress and Yorozu. One of the large entrants producing for electric/electronic companies is Futaba Sangyo. However, the industry is dominated by SMEs; firms capitalized at no more than 100 million yen account for 77 percent of the total number of entrants, 82 percent of the total number of employees, and 82 percent of the shipment value.

In the electric/electronics field, stamped metal products are used for a diversity of applications, including the shells of white goods such as refrigerators and washing machines, the chassis of AV products such as TV sets and VCRs, and various drive components requiring high levels of strength and durability. In recent years, however, the advances in engineering plastics have increased the levels of plastic processing precision and strength, and this has definitely set in motion a switch to plastic for mechanical components and adversely affected the demand for stamped metal equivalents. The arrangement for the fabrication of metal forms is basically the

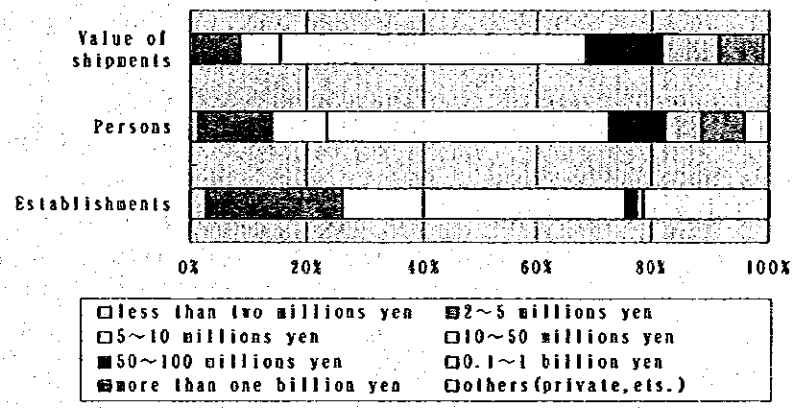
same as in the plastic molding industry related above.

Figure 2-2-4 Trend of production of stamped metal components and composition by application



Source: Yearbook of Machinery Statistics, MITI

Figure 2-2-5 Distributions in the metal stamping industry by capital scale



Source: Census of Manufactures (MITI, 1998)

(2) Public support for SMEs

A. Plastic molding industry

There are two nationwide industrial associations in the plastic molding industry: the Association of Plastic Molders, Japan (APM) and the Federation of Japan Plastic Manufacturers' Association. The former consists of four associations: the Association of Plastic Molders, East Japan (with about 400 member firms in eastern Japan excluding Kanagawa prefecture), Association of Plastic Molders, Chubunippon (with about 200 member firms in the prefectures of Aichi, Gifu, Mie, Ishikawa, and Toyama), West Japan Plastic Products Industrial Association (with

about 400 member firms in other western prefectures), and Kanagawa Plastic Molders Association (KPMA). In each case, the members are firms engaged in plastic molding for industrial components. The latter consists of three cooperative associations (the Japan Plastic Toys Manufacturers Association, Kanto Plastic Manufacturers Association, and Kansai Celluloid Plastic Manufacturers Association), and has a membership of mainly firms producing articles of daily use and toys.

Therefore, the industrial association in the field of electric/electronic components is the APM. However, its activities are led by firms producing mainly intermediate materials for industrial use, such as film and sheet. In addition, the product field varies with the member. As such, the APM could not be regarded as having a high level of activity overall, not to mention that on the part of firms molding plastics for automotive or electric/electronic components.

The major official aid for SMEs engaged in plastic molding was the privilege in the aspect of taxation and financing following designation under the Law for Modernization of Small and Medium Enterprises. These were extended via the industrial associations for the ten-year period from 1960 to 1970. The associations also served as the seat for skill examinations, training programs, and research of new technology. However, there was no particular official aid specifically for plastic molding firms which dealt with electric/electronics firms; aid was extended to all SMEs in the plastic molding industry in common.

Of the provisions for official aid, those which had the biggest benefit for the industry's advancement were the loans from public financial institutions. From the 1960s to the 1970s, order volumes expanded partly due to the switch from metal to plastic, and many firms were able to receive loans from such institutions for installation of the latest production facilities. These loans paved the way for their subsequent expansion of business.

The official aid for technical resources is exemplified by technical guidance through industrial laboratories established in various prefectures and the joint use of test and inspection equipment. From the 1950s to the 1970s, the level of manufacturing and test-and-inspection technology at these laboratories was higher than that among SMEs, and companies interested in technology frequently made use of the laboratory facilities. The technical level of SMEs has since risen, and the frequency of laboratory utilization is in decline.

In the aspect of human resource development, the scheme of certifying examinations in plastic molding was instituted in 1968 and proved extremely effective for raising the level of basic knowledge and skills. Today, however, it tends to be used more for heightening the incentive of engineers as employees than for imparting basic plastic processing skills. There were also programs of guidance and training for corporate accounting and management conducted as part of policy measures promoted by local governments. These programs did much to modernize SME management.

Local governments are currently attaching importance to support for the SME efforts to receive orders through activities such as the staging of trade fairs and preparation of brochures. This support has been very effective for SMEs that are hoping to go beyond subcontracting business and possess the technical ability to develop their own products.

B. Metal stamping industry

The only nationwide association in the metal stamping industry is the Japan Metal Stamping Association (JMSA). Its membership centers around automotive firms. The firms dealing mainly with electric/electronics clients are not as active in the JMSA as the automotive firms.

The metal stamping industry has retained designation under the Law for Modernization of Small and Medium Enterprises ever since 1960. The JMSA has played a coordinating role in the related projects of structural reform, and the participating firms have received official aid in forms such as accelerated depreciation for new facilities and low-interest loans. It has also worked to win other official aid for its members, which are mainly SMEs, on the basis of other laws and provisions. For example, it played an instrumental role in the industry's designation under the Small and Medium Enterprise Credit Insurance Law (in 1974, 1983, and 1992), the employment adjustment financial aid scheme (1976, 1983, 1992, and 1993), the Provisional Law for Promotion of Special Equipment and Information Industries (1979), and the Yen Appreciation Countermeasures Law (1983). In addition, it successfully pushed for the establishment of special lending provisions for safe press machinery (authorized in 1977) that supplied low-interest loans for purchase of the same and so helped to prevent press-related accidents among its membership.

The management and business development of many SMEs in the metal stamping industry benefited in various ways from this official aid brought by JMSA activities. As in the case of the plastic molding industry, a particularly great contribution was made by the provisions for financial aid from public institutions, including low-interest loans for capital investment in new facilities. Although it made up only one part of the total amount of financing including that received from private-sector financial institutions, the raising of funds is a crucial priority for SME management, and the aid was of vital importance while the industry was in the phase of expansion.

In the aspects of raising the level of technology and developing human resources as well, the metal stamping industry received basically the same kind of official aid as the plastic molding industry. More recently, local governments have furnished SMEs with a lot of support for sales. This began with assistance for the staging of and participation in various trade fairs and the preparation of sales brochures. In an increasing number of cases, it now includes ordering information services to match suppliers and sources. Behind this trend lies the reality that the conventional public aid related to taxes and loans will not be enough to enable SMEs to cope with today's circumstances of tough requirements for processing technology and global competition. The focus of SME support has, on the contrary, shifted to active generation of jobs (i.e., work orders).

Figure 2-2-6 summarizes the various types of official aid in the plastic molding and metal stamping industries, and their effects.

(3) Keys for SME success and official aid

The key factors for SME success in the plastic molding and metal stamping industries are the establishment of a solid business foundation, attainment of productivity high enough to withstand economic fluctuation, and sufficient technical and sales capabilities. The particulars are summarized in Table 2-2-7.

Figure 2-2-6 Official aid in the plastic molding/metal stamping industries, and its effects (mainly as regards firms producing electric/electronic components)

Official aid	Examples	Effects	
		1960s - 1970s	1990s
Financing	* Low-interest loans from the Shoko Chukin Bank, etc., to fund investment by SMEs for structural reform in accordance with the Law for Modernization of Small and Medium Enterprises * Low interest financing for installation of safe press machinery	Great benefit for facility investment in the phase of expansion during the period of rapid economic growth	Low needs for capital investment in the phase of only moderate economic growth; however, big benefit for prevention of bankruptcy through loans of operating funds
Taxation	* Accelerated depreciation of facilities (designation under the Law for Modernization of Small and Medium Enterprises)	Effective for hastening facility depreciation to stimulate investment in new facilities during the period of rapid economic growth	Low needs for investment in new facilities and for accelerated depreciation
Technology	* Technical guidance and joint use of facilities at public laboratories * Human resource development programs of industrial associations	High frequency of use by companies with an interest in technological advancement while SME technical capabilities are low	Rise in SME technical capabilities to a level surpassing those of the public laboratories, and emphasis on joint development with public funds
Human resource development	* Skill examination system * Management guidance, etc.	Effective for raising the level of basic skills and capabilities (technician certification in the areas of plastic molding, metal stamping, and metal die making) Management guidance as effective for instruction in corporate accounting, etc., among firms with a shortage of highly educated employees	Greater effect for heightening employee incentives than for imparting basic skills and capabilities
Industrial siting	* Preparation of industrial parks (including apartment complexes)	Great effect for resolution of plant siting in essentially residential districts and for the construction of new plants	Lack of additional sites, and low needs
Sales support	* Support for the staging of trade fairs and participation in them * Ordering information supply service	No particular needs during the period of expansion as a subcontracting industry	Strong needs for support of sales of original products as companies attempt to lower their dependence on subcontracting

Note: Underscoring indicates public support specifically for the plastic molding and metal stamping industries.

Source: Prepared by NRI based on interview data

Figure 2-2-7 Keys for success in the plastic molding and metal stamping industries

Item	Particulars
Business foundation	- Foresight of management (ability to win orders in growth fields, ability to respond flexibly to customer needs, and diversification of demand fields) - Degree of trust by customers (receipt of orders independently vs. in parallel with other firms) - Use of the energies of external processing firms and part-time operations (ability to adapt to order fluctuations) - Capabilities for selection, improvement, and development of excellent molding/stamping machines - Human resource development (instruction and training for workers, establishment of work standards, and appropriate level of technical R&D)
Productivity	- Product output per employee/molding machine, number of molding machines per operator - Number of molded/stamped products per mold/die, die/mold replacement interval - Degree of automation, material yield - Crude profit on outsourced products
Technical capability	- Capabilities for development/level of technology of original products - Depth of knowledge of plastic/metal materials - Level of precision processing for engineering plastics - In-house fabrication of metal molds/recruitment of first-rate mold fabricators
Marketing capability	- Sure observance of delivery deadlines, ability to adapt to design changes during production - Ability receive unit orders (based on possession of an assembly and processing division), ability to manage outsourced work

Source: Prepared by NRI based on interview data

The growth of the plastic molding and metal stamping industries to date has derived largely from the international development of business by the user industries such as the auto industry and electric/electronics industry. The plastic molding industry has also benefited greatly from the demand expansion due to the shift from metals in pursuit of lower weight and cost. From around 1960 to the early 1980s, many plastic molding firms were able to build up their business by making investments in new facilities. In this atmosphere, much depended on the company's own self-help efforts in areas such as management decision-making and cost reduction. The SMEs which succeeded were those which took up the challenge of achieving lower costs yet higher levels of speed and precision, practicing sound management to these ends, building relationships of collaboration with first-rate mold manufacturers, and actively incorporating new technology.

While the SME's own efforts may be regarded as the single-greatest key to success, it is also true that a vital role was played by the official aid from and environmental conditioning by the national government and other authorities to support the development of SME business, as described above. An enormous benefit was also delivered by public financing and the preparation of industrial parks. Furthermore, many firms were able to lower their costs thanks to management guidance in areas such as corporate accounting and technical instruction furnished by the public laboratories.

(4) Case study

The following is a profile of the role of official aid in the plastic molding and metal stamping industries as exemplified in the case of company S (a plastic molding firm located in Higashi-Osaka city) and company M (a metal stamping firm located in Kobe).

A. Company S (plastic molding firm)

Profile

- company S traces the start of its activities to 1939 and was established as a corporation in 1974. It engages in plastic molding for electronic components. It began handling engineering plastics at an early date, and has special competence using them in ultraprecision molding. Its major production items are plastic gears and structural plastic components for HDDs, CD-ROM drives, and printers. It ranks alongside "Enplas" (which is located in Saitama prefecture) as a leading Japanese firm in the area of ultraprecision molding with engineering plastics.
- The company has plants in Shikoku (in the cities of Matsuyama and Iyo). The Higashi-Osaka location is the site of its head office, research and development activities, and warehouse. It does not have any locations overseas.
- Almost all of the company's roughly 200 employees work at the Shikoku plants; only about 10 percent are stationed at the Higashi-Osaka location. It has about 100 molding machines, most of which were manufactured by Sumitomo Heavy Industries.
- The company has many transactions with members of the Matsushita Group (e.g., Matsushita Electric Industrial, Matsushita-Kotobuki Electronics Industries, and Kyushu-Matsushita). Recently, it has expanded its dealings with electric/electronics firms in the Kanto region, such as Canon and Sony.

History

- In 1939, the father of the company's current president, who was employed by the government of Shiga prefecture, began a business in thermoplastic molding. At the time, some of the production was for submarines built by the Mitsubishi Group.
- In 1950, the company commenced transactions with the lighting fixture division of Matsushita Electric Industrial; transaction with the Matsushita Group expanded thereafter.
- In 1972, the company built a new plant at Matsuyama along with the expansion of tape recorder production in the same city by Matsushita-Kotobuki Electronics. This move was made in consideration of the difficulty of recruiting additional employees and enlarging the plant at Higashi-Osaka due to the issue of industrial siting in residential districts, and the presence of customers in Matsuyama.
-The company enlarged the Matsuyama plant in 1976 and 1984, and built the Ehime plant (in Iyo) in 1991.
- While the company was enlarging its existing facilities and building new plants, its production was increasing due to the fast-paced growth of the domestic production in the electric/electronics field and the switch from metal to plastic components. In

recent years, however, its job volume has gone into decline because of the shift to offshore production even for high-tech components.

Public support

- company S relies mainly on commercial banks to raise funds; it turns to the Small Business Finance Corporation and Shoko Chukin Bank as subordinate sources. The construction and enlargement of the Matsuyama plant was funded with loans mainly from commercial banks but partially from the Small Business Finance Corporation. Similarly, the construction of the Ehime plant was financed mainly by commercial banks but also by the Shoko Chukin Bank. The company noted that, while public loans may have lower interest rates, they also tend to have inflexible terms. In contrast, if long-standing relationships are nurtured with commercial banks, they may provide information and offer preferential interest rates and various kinds of service. For this reason, the company is not particularly eager to receive public funding.
- The company has never gone to a public institution of inspection or research. In its view, such institutions are in possession of common equipment and technology only and do not have a high level of special competence or technical capabilities. The company has its own 3D measurement devices and other equipment required for inspection processes. It added that public institutions generally do not have inspection devices of the type needed by plastic molding firms. In the aspect of research, it is collaborating in programs with materials manufacturers and has never made use of public facilities. It is of the opinion that joint research with a public institution poses the risk of a leakage of ideas, and refrains from consulting such institutions as far as possible. It feels more secure about the approach of collaboration with materials manufacturers to raise VA levels and broaden its business. Consultation with university professors, for example, is based on personal relationships.
- The company is a member of the West Japan Plastic Products Industrial Association. As far as it is concerned, the biggest benefits of membership lie in the health cooperative and welfare pension fund, subscription to which can be made for a minor fee. It also sees value in the exams for certification of technicians for heightening the incentives of employees and ideally making them more motivated on the job. Although associations are also vehicles for information collection and exchange, the company did not perceive much benefit in the same because of the general nature of such information.
- In its opinion, the association activities are not very vigorous, for various reasons, including the retirement and other loss of the people who had led activities and the harsh business circumstances, which are making it necessary for firms to concentrate on their own business and participate less in association programs.
- The company regarded the publicity campaign for local SMEs being conducted by the city government of Higashi-Osaka as effective to a certain extent. However, it did not see any direct benefits; instead, it thought that the real value lay in the establishment of a venue for exchange of information with businesses in other fields in the city in the process of preparing the publicity materials.

B. Company M (metal stamping company)

Profile

- Company M started out as a metal stamping factory in 1935. It began processing electronic components in 1958, and became a joint-stock company in 1965. At present, it is capitalized at 80 million yen and employs about 570. Its items of production include chassis and structural parts for all types of AV equipment, FDD units, and CD-ROM drive units. Overseas, it has six production subsidiaries and one administrative firm. The entire group employs about 10,000.
- The company's customers are mainly the big electric appliance manufacturers. It makes many shipments to the offshore plants of these manufacturers. Although its dealings in Japan are essentially confined to affiliates, it has transactions overseas with companies with which it has absolutely no dealings in Japan, partly because it was quick to move overseas. These overseas connections have been linked to an expansion of its operations.

Public support

- In the company's view, the advancement of a corporation basically depends on its own efforts; public aid exists to support those efforts.
- The public aid received by the company took the form of loans from the Shoko Chukin Bank and the Export-Import Bank of Japan, the conditioning of industrial parks, and the activities of the JMSA. It has also made use of the provisions for technician certification and other support for human resource development. It has never received technical assistance.

a. Financing

- The company received loans from the Shoko Chukin Bank and the Small Business Finance Corporation for construction of plants in Japan and public financing from the Import-Export Bank of Japan for the construction and enlargement of the plants of foreign subsidiaries.
- Its new domestic plant (built in 1980) is sited in the Nishigami (western Kobe) machine and metal industrial park. The park was based on establishment of an association which pooled the funding of the tenant firms, received association-sublending loans from the Shoko Chukin Bank, and lent them to its members (i.e., the tenant firms). This was highly effective, because it made unconditional financing available for up to half of the value of the land and buildings. The city government of Kobe invited companies to locate in the park and repeatedly held study groups for applicants regarding the provisions. These study groups served to deepen interchange among the various businesses. Companies which met the conditions proceeded to establish the association and sited in the park upon receipt of the loans from it.
- In the past, the company received a loan from the Small Business Finance Corporation for expansion of its old plant. It took out this loan because, at ten years, the repayment term was longer than the usual one of five years from commercial banks (there were no preferential interest rates).

- It received loans from the Export-Import Bank of Japan in building and expanding plants of overseas subsidiaries, i.e., for the construction of a VCR plant in Thailand in 1988, a plant in the Philippines in 1990, and a plant in Indonesia in 1995. The loans from this bank have preferential interest rates and were extremely valuable.

b. Industrial park preparation

- Kobe city government led the preparation of Nishigami industrial park. The company was facing a shortage of space at its old plant site, and found it extremely helpful that an industrial park was established in a location not so distant from its old plant just when it was looking for a new site. Because it brought together a group of machinery and metal manufacturers, the site also facilitated the formation of cooperative activity on its grounds and was highly convenient in terms of logistics, etc.
- The company's other plants in Japan are located in industrial parks that were basically prepared by public institutions. The company consequently regards the preparation of industrial parks as an effective measure for cultivation of SMEs.

c. Activities of the industrial association

- Thanks to efforts by the JMSA, the metal stamping industry was designated for restructuring. This designation made the company eligible for application of extra depreciation for press machinery and was of great benefit for expansion of its business.
- The company also saw benefit in the skill examination scheme promoted mainly by the JMSA. Although the skills tested may not be the same as those needed on the job, it believed that the exams helped to deepen the fundamental knowledge of employees while heightening their incentive (because a benefit is paid upon certification), and thereby to stimulate activity in plants.
- It also thought that the JMSA was very worthwhile as a venue for exchange of all sorts of information among industry entrants and for collection and sharing of information on systemic provisions of public institutions.

d. Human resource development

- In the company's view, the skill examination system acted to improve the quality and job attitude of employees.
- The load of office work associated with training programs in Japan for the employees of overseas subsidiaries has been lightened through performance of various procedures for entry and exit by the Japan International Training Cooperation Organization (JITCO). The company has many subsidiaries in other countries and stages training programs for many of their employees. Before JITCO was created, it consequently had to spend considerable time and money to execute the bulk of procedures by itself.
- Essentially, the company develops human resources independently and without any official aid. It has its own training facility, and commissions private-sector training

organizations to execute in-house training programs at regular intervals. As noted above, employees of its overseas subsidiaries also receive training at this facility.

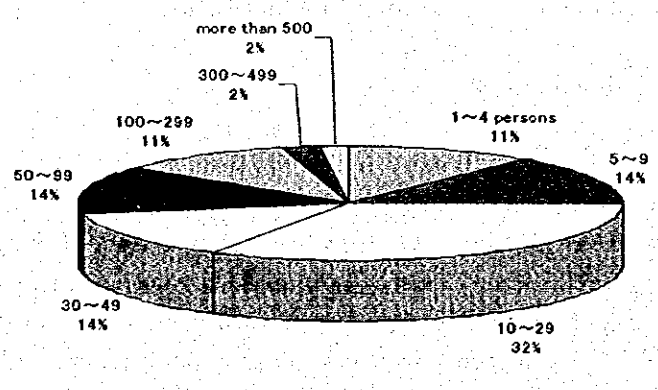
2.3 Software development industry

(1) Industry profile and positioning of SMEs

Software is ordinarily understood as referring to computer programs and all other types of technology used to run computer hardware. It is developed and sold by specialized firms generally known as software houses. The spread of computers broadened recognition of the importance of software and culminated in the birth of firms engaged exclusively in the development and sales of software, i.e., software houses. In Japan, full-fledged software houses were first established in the late 1960s, but most were founded no earlier than the late 1970s. Although the term is generally used in reference to the operating systems and application software for mainframes and personal computers, here it shall be used in the broad sense including the software for microcomputers installed in home appliances and other electric/electronic products as well as for game machines, etc.

A fact-finding study of certain service industries conducted by the MITI found that there were about 4,000 which could be classified as software houses. The number is thought to reach 5,000 - 6,000 when firms not counted in the statistics are included. Generally, software houses are small, and not a few have less than ten employees. According to the results of a survey conducted by the Information-Technology Promotion Agency (IPA) in the mid 1990s, 96 percent of the total number of entrants have no more than 300 employees, 57 percent have sales of no more than 1 billion yen, and 80 percent are capitalized at no more than 100 million yen. As these figures indicate, the industry is largely composed of very small enterprises.

Figure 2-3-1 Composition of the number of information processing enterprises (including software houses) by size (number of employees; 1996)



Source: Fact-finding study of specified service industries by the MITI

In Japan, user industries had a relatively low appreciation of the value of software for a long time. In addition, because of the order-based nature of the business, much of the work was apt to be under the strong control of computer manufacturers and other user industries. As such, the software development industry has had a pronounced subcontracting disposition overall. It is also characterized by a large number of new entrants. Barriers to entry are comparatively low because participation can be effected with little investment and few human resources. It is also easy to go into business by establishing "spinouts" of existing entrants. This is reflected in the distribution of the total number of entrants by capital affiliation: whereas 15 percent are affiliated with manufacturers and 8 percent with users, the majority (77 percent) are unaffiliated.

The software development industry has a low productivity, which is typical of labor-intensive industries. Beginning in the 1990s, attempts were made to computerize the fabrication of software through the application of computer-aided software engineering (CASE), but this proclivity persists, partly because CASE is not widely used. It might be added that, besides developing software in-house, the entrants also second employees to manufacturers and users for development on their premises as a major part of their business. Such seconding began in the 1970s and rapidly grew. In many cases, employees were seconded to second and third firms. The legality of seconding was ensured by the 1986 effectuation of the Worker Seconding Law (which, however, prohibited successive seconding). Although this law was aimed at establishing the position of seconded employees, it also left certain problems unresolved. For example, if the practice of seconding spreads with official acknowledgment, the software development industry is liable to be viewed as merely a manpower service, and this would detract from the image of the entrants.

(2) Public support for SMEs

Initially, Japan's software industry lagged far behind its U.S. counterpart. Concern over this gap motivated the provision of official aid mainly by the MITI. The objectives were to encourage computerization of work at users as described below and to foster the growth of the industry, which is made up largely of SMEs.

The IPA was established in accordance with the Information-Technology Promotion Agency Law, which was enacted in 1970. Its major activities are the promotion of the development and use of programs, and assistance for businesses supplying information processing services. In connection with official aid for SMEs in the electric/electronics industry, the focus falls on the latter, and particularly assistance for software houses.

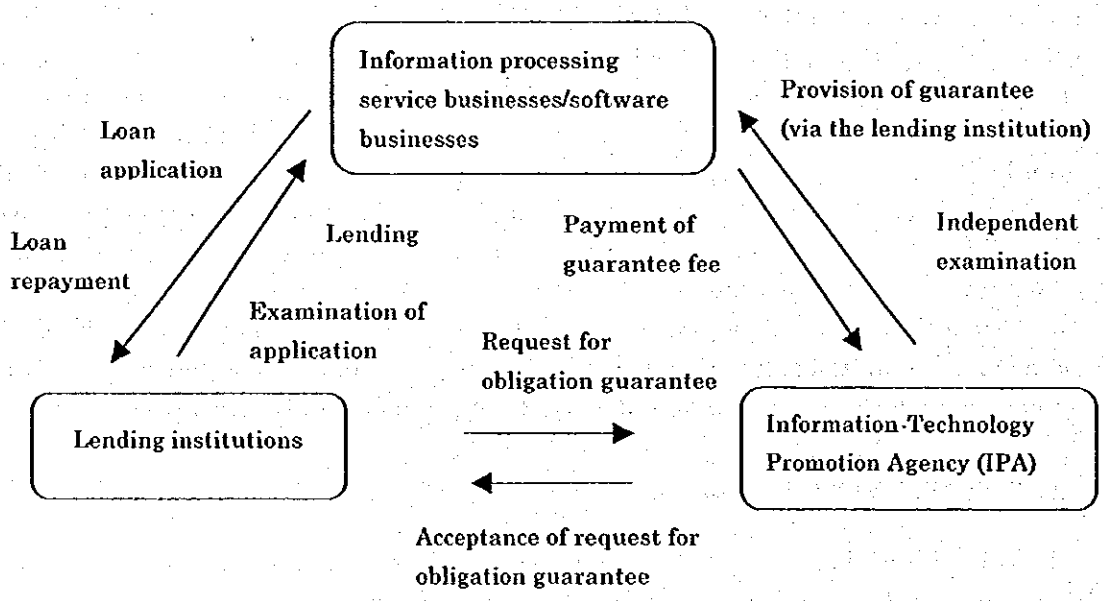
The major types of IPA assistance for SMEs in the industry are lending/obligation guarantees, special program development support, and human resource development. Unlike the case in the United States, venture capital is underdeveloped in Japan, and financial institutions tend not to accept the software engineers and PCs and other facilities needed for software development as security. Coupled with the increase in investment for information systems by ordinary companies, the financing and obligation guarantees furnished by the IPA as described

below helped to drive the growth of information processing businesses inclusive of SME software houses.

A. Lending/obligation guarantees

Business in software development and sales is suited to SMEs, because the minimum requirements are development personnel and personal computers or other systems. Japan's financial institutions have traditionally accepted mainly real estate and production facilities as security, but have not recognized the security value of the engineers (i.e., software developers) and PCs and other facilities needed to develop software. This made it difficult for SME software houses to raise funds.

Figure 2-3-2 Framework of obligation guarantees for software development businesses



Source: IPA data

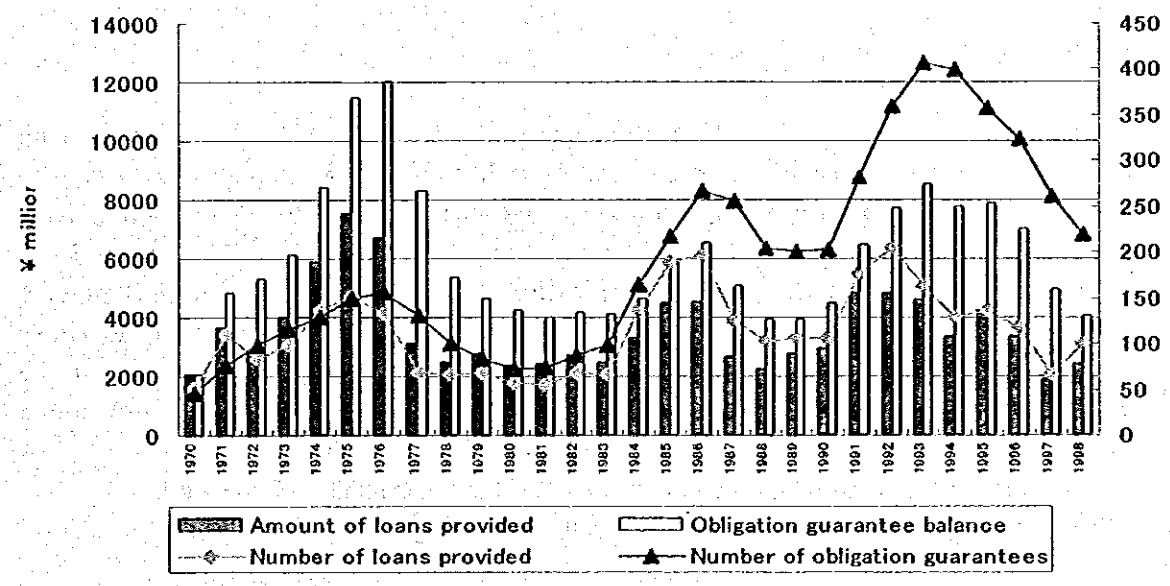
Software development differs from hardware production, and financial institutions ought to accord a security value to human resources and promising technology. For this reason, the IPA has made arrangements to assess, from an expert's perspective, the degree of promise of software products of SMEs desiring funding, and furnishes support in the form of direct financing at low interest rates or with simplified procedures, or guarantee of obligations in receipt of loans from financial institutions. For the SMEs, the arrangement provides "stopgap" funding needed for development. Figure 2-3-3 presents actual cases of its utilization.

Figure 2-3-3 IPA obligation guarantees for software development firms

Scheme	Eligible firms	Use of funds	Terms	Interest rate, loan ceiling, repayment term, repayment method, guarantee limitation, guarantee fee
General obligation guarantee	Information processing service businesses, software businesses	Computer installation, program development, program purchase, training of information processing engineers	In business for at least 2 years	-Interest rate prescribed by the lending institution -No more than 80% of the value of own funds -No more than 3 years -Repayment in equal installments every 3 months beginning no more than 6 months after the term of deferment -95% of the loan amount -0.5% of the guarantee balance
Obligation guarantee for new technology	Companies of the aforementioned type intending to develop programs utilizing new technology	Funding of the type noted above needed for development of programs utilizing advanced, original technology	None in particular	-Interest rate prescribed by the lending institution -No more than 100% of the value of own funds -No more than 5 years -Repayment in equal installments every 3 months beginning no more than 6 months after the term of deferment -95% of the loan amount -0.5% of the guarantee balance

Note: General firms are also eligible for application of the general obligation guarantees.
Source: IPA

Figure 2-3-4 Trend of loans and obligation guarantees for software development businesses



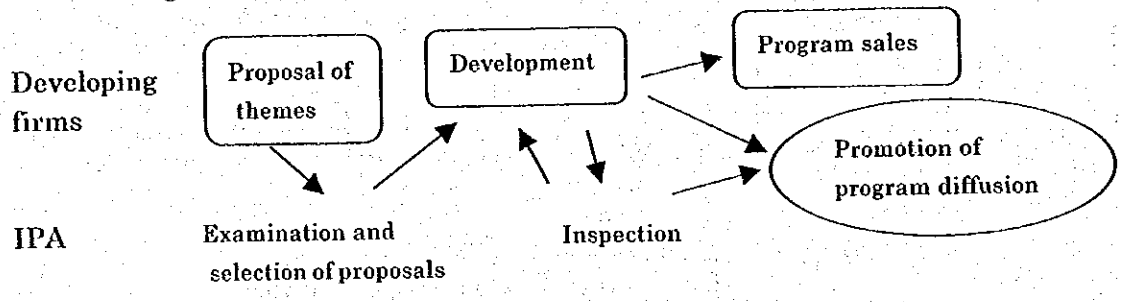
Source: IPA

B. Specified program development firms

The IPA invites submission of development themes and projects for general-purpose programs and microcomputer systems as part of its efforts to promote the development and diffusion of certain types of programs. The rights to the programs so developed are shared by the developing firm and the IPA. As compensation for this sharing of rights, the IPA pays the developing firm an amount equivalent to 80 percent of the development cost (70 percent in some cases) in equal installments beginning five years after the completion of the development. For its part, the developing firm pays a royalty corresponding to actual sales.

To promote the diffusion of the programs, the IPA makes its software plaza available for use by the developing firm for demonstrations and seminars. In addition, it collaborates by participating in various exhibitions, provides support for publicity in magazines and other media, and otherwise assists the development of business by information processing firms, which include many SMEs engaged in software development.

Figure 2-3-5 Provisions for specified program development firms



Source: IPA

C. Human resource development

Since last year, the MITI and Ministry of Labor have been supporting programs for the cultivation of personnel with knowledge and skills related to advanced information processing, in accordance with the Law for Promotion of New Business Generation. These programs are conducted by local governments, and the support is offered through ad-hoc organizations (instituted for the support of new types of business). The IPA, too, engages in activities for direct support of these organizations. It has also been involved in the development of CAI programs for the education of information processing engineers. In this area, it has developed systematic educational materials of the sort needed for this purpose.

(3) Keys for SME success and public support

The standard development process in the software industry is as follows.

A. Planning, investigation, and analysis

Investigation and analysis of the work to be systematized, and clarification of the planning framework, including systematization aims, anticipated effects, and requisite amount of investment

B. System design

Determination of the system prerequisites and design of both the overall configuration of the software to meet those prerequisites and the external program specifications of the program as the elements of that configuration

C. Programming

Computerized preparation of the program

D. Comprehensive testing

Examination to ensure that the program functions correctly as a whole

E. Hand-over and inspection

Preparation of operating instructions and user manuals, and attendance at inspection (including education and training for users)

Of these steps, an especially high level of technical expertise is required for that of planning, investigation, and analysis, which is also a high-VA procedure. In contrast, that of programming does not require very sophisticated technical capabilities and has a low VA. For this reason, it is customary for systems engineers (SEs), who are in possession of sophisticated technical skills and a wealth of experience, to be in charge of the other steps (i.e., planning, investigation, and analysis; system design; comprehensive testing, and hand-over and inspection), and for programmers to handle the programming, which is said to require tactics of the "human wave" type. There is not a large supply of first-rate SEs, and all entrants face the task of developing more of them, also in order to broaden their involvement in high-VA business.

In light of the above, the following may be cited as the key factors for success in the software development industry (in addition to those for SMEs in general).

- It is vital for firms to develop SEs who both are versed in applications and have extensive experience, and to raise the technical level of the entire organization by recruiting such personnel.
- Firms without any distinguishing capabilities are apt to be shunned by users and contractors. It is becoming imperative for all entrants, both large and small, to build a particular field (or type of work) into a unique core competence.

- Companies must incorporate types of technology that are liable to become mainstream in the future, such as network technology and parallel processing technology, which is now coming to the fore as a means of collaboration among computers.
- In the growth phase, software houses could expect parent companies and manufacturers to come to them with job requests. Recently, however, software houses cannot afford to wait for orders; it has become necessary for them to cultivate a wider customer stratum by reinforcing their capabilities for proposing system architectures and providing research and consultation services to meet the needs of the client in question.

In the software industry, many firms rapidly grew into big operations, as represented by the cases of "Just System" and "Konami" as leading Japanese firms in the area of the software industry. They were able to do so for a number of reasons, including the technical prowess needed to stay abreast and take full advantage of the actualization of the market, the successful forging of transaction ties with the leading hardware manufacturers, the backup of private financial institutions, and the raising of funds by direct financing.

As such, official aid has not necessarily been a vital key for success in each case. In the aspect of funding needed for development of business, however, SMEs encountered difficulties due to the stance of Japanese financial institutions, which were slow to recognize the assets value of software engineers, facilities, and the software technology as the fruits of development. Under these circumstances, the system of lending and obligation guarantee by the IPA served to meet the funding needs of individual SMEs and may also be said to have made a great contribution to raising the level of software development capabilities, at least in the industry as a whole.

3. Application in developing countries and points to consider

(1) SMEs in developing countries - current status and issues

This section presents a summary account of the current status of and issues related to SMEs in the electric/electronics industry in developing countries. It concerns only those that are owned by indigenous capital in the ASEAN countries of Malaysia, Thailand, the Philippines, Indonesia, and Vietnam.

Numerous Japanese and Western firms have sited in the ASEAN region, which has consequently become a center for assembly-base production of various types of electric/electronic equipment and components. Most of the finished products are exported mainly to developed countries in other parts of the world, and most of the supply of components required for their assembly depends on import from developed countries and the local (offshore) productions of Japanese and other developed-country firms that have sited in the country in question. Similarly, the circle of sources for molded plastic, stamped metal, and other types of processed components and materials needed for equipment and component assembly is essentially confined to

in-house divisions, local Japanese operations (wholly Japanese-owned or joint ventures with local capital), and indigenous firms that are receiving management or technical instruction from developed-country firms. Conversely, local SMEs that have not received such instruction have only a few supply opportunities. Moreover, these opportunities are limited to the field of devices that do not have high quality requirements and are directed to the domestic market for sales to the low-income segment (such as electric fans) and components for the same (such as switches and cords). Even this market is shrinking due to inroads by low-price, mass-produced goods supplied by Japanese-affiliated and other developed-country manufacturers.

In Malaysia and Thailand, the use of local energies for component processing holds great cost benefits for many of the Japanese and other developed-country firms with productions there. Partly in response to strong requests from the host-country governments, the big developed-country companies are providing on-going management and technical instruction to select local firms that are soundly run and eager to upgrade their level of management and technology while also gradually expanding transactions with them. While the firms receiving such assistance are still small in number, this assistance through the medium of actual business (i.e., linkage between foreign and domestic firms) is gradually elevating the management and technical capabilities of the indigenous SMEs. In Malaysia, for example, some of the firms dealing with a U.S. HDD manufacturer in the Pinang area have acquired an advanced level of precision processing technology and are succeeding in building up their transactions with developed-country companies.

In Indonesia, the Philippines, and Vietnam, the level of SME management and technology is generally lower than in Thailand and Malaysia. Except for a very few, such as some of the joint ventures with developed-country capital, almost none are internationally competitive. The resident operations of Japanese firms make almost no use of the energies of local firms other than those receiving continuous instruction in management and technology.

The activities of SMEs in the electric/electronics industry in ASEAN countries center around plastic molding, metal stamping, and other types of machine processing. In this domain, the local firms are still small in number and low in level of quality, but some are slowly acquiring the capability for transactions with developed-country firms thanks to the aforementioned management and technical instruction. In other domains, however, there are almost no SMEs owned by wholly local capital that have achieved international levels of technology in processing required by the electric/electronics industry, e.g., printed circuit fabrication, plating, coating, and other surface processing technology in the broad sense. In contrast, the spread of personal computers is being reflected in rapid growth in business (albeit mainly sales) by software firms, which require little investment for facilities and can readily develop business once they recruit the right engineering talent.

(2) Pointers in application of official aid schemes to developing countries

The study and analysis of the cases in Japan indicate that the following types of official aid were effective for promotion of the growth of SMEs.

A. Aid in the financial aspect

* Reduction of/exemptions from taxes on sale and acquisition of land for plants
* Acceleration of depreciation accompanying investment
* Provision of financing (including low-interest loans) for capital investment and operating funds through public financial institutions

B. Aid in the aspect of technology and human resource development

* Provision of management and technical guidance by public institutions
* Joint use of public laboratory facilities
* National examination system for certification of technical skills

C. Aid in the management and business environment aspects

* Preparation of industrial parks (including apartment-type housing)
* Support for participation in trade fairs and preparation of PR materials
* Ordering information provision services (to match SME suppliers with buyers)

As might be gathered from the case of Japan, official aid is clearly not the only key for SME success, and this observation also applies to developing countries. First and foremost, SME executives must clearly define the company's management stance on the manufacturing industry, and then persevere in the hard task of obtaining the requisite capabilities in the areas of management skills, production control, sales, technology, and human resources. The various types of official aid described above can demonstrate their effectiveness in various ways as management goes about the job of promoting such activity.

The following points must be borne in mind if the official aid in developing countries is to be effective.

- Planning for official aid in the electric/electronics industry must be preceded by preparation of an environment conducive to manufacturing by SMEs. To put it concretely, the government must formulate solid industrial policy, including measures for attraction of foreign capital and promotion of export that are in conformance with the country's stage of development and the international business climate. This must be joined by the promotion of user industries to set up the right conditions for SME business and to expand SME opportunities.
- In Japan, measures of the A and B types noted above were especially effective in the initial phase of SME growth (i.e., high-order economic growth). Once SME management and technology have reached a certain level, however, it would be advisable to provide aid of the C type, and particularly assistance for participation in trade fairs and order information services to support actual business. As this implies, the advisable type of official aid may vary depending on the stage of the development of the beneficiary industries and companies.

- However well-formulated, aid schemes may fail to function sufficiently if they are not accompanied by institutions that stand intermediate to the public sector (national/local government, etc.) and SMEs, and act in place of SMEs in performing various tasks related to the receipt of all kinds of official aid. In other words, official aid could be made more effective if extended through industrial associations or cooperatives that play a coordinating role for the recipient SMEs and tailor the aid to their needs.
- To make official aid more effective, it is also important to devise schemes in which aid is extended in return for business improvement. This can be done by, for example, offering official financing or other privileges only to companies that have made efforts to raise their management and technical capabilities or productivity. The provision of benefits without setting such targets could possibly amount to a mere waste of public funds.