Chapter 1 Introducing the pivotal technology concept — verification and analysis in terms of trade

1.1 The concept of pivotal technology

1) Objectives of the pivotal technology concept

It is often said that Japan's machine industry is being hollowed out due to a decline in international competitiveness and the resultant relocation of plants to foreign countries, which has led to a loss of industrial vitality and decrease in job opportunities. To the extent that we rely on foreign trade statistics, we cannot deny that the machine industry is losing its competitive edge in the international marketplace. Exports are also sluggish.

Despite these facts, if some sectors begin to boost exports to offset the decline, this can be regarded as the metabolism of the machine industry as a whole. From a more microscopic viewpoint, some products may be affected by the hollowing out, but the emergence of new products to supplant the exports can be considered the metabolism of the industry.

This idea poses two challenges. First, we need to determine whether there are sectors with expanding exports. Second, we must make sure that these sectors yield products that are fit for domestic production, at least under current conditions. In other words, we need to identify sectors or products that have a competitive edge and that resist hollowing. We can meet the first challenge by analyzing foreign trade statistics. The second challenge can be met to some extent by analyzing the characteristics of the competitive sectors.

If the machine industry is losing its competitive edge and being hollowed out, this must be accompanied by declining competitiveness and a hollowing out of technology (production facilities that embody technology by means of investment). Thus, we will focus on the aspect of technology in discussing the above-mentioned challenges. Let us assume that these are sectors with a competitive edge and growing exports. If we can identify the technological characteristics of these sectors, it will help us determine which sectors offer advantages for domestic production and resistance to hollowing out of technology.

Needless to say, the factors that provide advantages in terms of domestic production or that restrain overseas transfer are not limited to technology. There also must be various resource factors and circumstances, including levels of social infrastructure, education, consumption culture, research and development, skills and markets. By focusing solely on the technological aspect, however, we can identify the technology that gives a sector advantages in terms of domestic production. Let us call this the "pivotal technology" for the sector. The term "pivotal" derives from the fact that such technology serves as the foundation and pivot for advantages in the sector. In other words, pivotal technology is found in sectors for which domestic production remains advantageous, serving as the source of competitiveness for competitive sectors.

2) Characteristics of pivotal technology

When pivotal technology is defined as above, the depth and scope of such technology may depend on the size of the sector. The concept of pivotal technology may also change depending on the categorization and combination of sectors. In addition, it is possible to frame an abstract concept of pivotal technology for the machine industry as a whole. For convenience sake, however, we will divide the machine industry into different sectors in accordance with HS 4-digit classifications.

If it is to augment the advantages for domestic production, pivotal technology should have the following characteristics:

(1) Peculiarity

The special nature of the technologies and products that are inherent to Japanese companies and industries implies a distinctive quality of technologies and products stemming from the social and cultural characteristics of Japan. In some cases, such technologies and products are protected in the framework of intellectual property rights. Other examples include video game products (software and hardware) that originate from the animated film culture of Japan, or products that are developed out of necessity based on Japan's limited resources (energy- and resource-saving and recycling).

(2) Integration

Domestic production offers advantages and transfer of production is not easy when capital (e.g. equipment, technology development, human capital, social infrastructure) is highly accumulated or integrated. Industrial integration is one example of factors that restrain overseas transfer, although such integration does not necessarily provide immunity from hollowing out. Rather, pivotal technology is the fundamental technological factor that prevents hollowing out in cases of industrial integration.

Based on the above characteristics, it is possible to consider technology (integration) that entails social and cultural factors peculiar to Japan. As we have seen, the concept of pivotal technology used in this chapter is related to the integration (scheme) of technology. In this sense, pivotal technology is not a concept that focuses on the position of technology in the technological scheme (e.g. conventional "core technology" and "fundamental technology"). Rather, it is a concept centered on the relationships among technologies present in an industry, company or region in the form of integration and strata.

3) The pivotal technology concept in an industry or company

The concept of pivotal technology is not as popular as the conventional concepts of component technology, foundation technology, basic technology, core technology, key technology or fundamental technology. Let us take a look at some usage examples for this concept: "Creation of a natural gas- and hydrogen-driven society using fuel cells as pivotal technology" (the policy committee of a political party); "(In terms of chip components of the future) 'integration' is the pivotal technology for enhancing packaging density" (Nikkei Electronics); "Microfilming

(micro-processing technology) is our pivotal technology" (small and medium-sized firms specializing in plastics molding). Pivotal technology seems to refer to a technology scheme that serves as the pivot and entails integration in creating an industrial society or project.

One example takes the fuel cell-powered vehicle as a pivotal technology. Let us have a look at a fundamental technology that is similar to, but different from, pivotal technology.

In today's automobile industry, the fuel cell is a "fundamental technology." The "fundamental" aspect of fuel cells is the system (fuel cell stack) that converts hydrogen-oxygen reaction into electric energy. "Fundamental fuel cell technology" ranges from electrolytes and fuel tanks for storing large quantities of fuel to extend the travel distance to reformers for generating hydrogen. In other words, the strata of the technology concept are manifest, and they shift when fundamental technology is established at a lower level to some extent. On the industrial level, fundamental technology in the example of developing a technology system such as "fuel cell vehicles" refers not just to the fuel cells themselves but also to the pending challenges. On the corporate level, meanwhile, fundamental technology refers to a "strategic" technology that serves as the core of competitiveness and is difficult for other companies to copy.

In any case, fundamental technology can be defined as strategic technology for the future that shifts and changes in the course of events, which is to say, a discrete breakthrough technology.

The concept of pivotal technology is different, however. Unlike the concept of fundamental technology, it is not discrete and does not arouse a specific image of a certain product. Production using such a fundamental technology can easily be transferred to other developed nations with equivalent industrial capabilities. Technology is one of our artificial economic resources, and pivotal technology refers to a technology category that systematically integrates industries, companies and universities as well as human resources (i.e. researchers and engineers) that are ubiquitous in Japan.

The competitiveness of an automobile, for example, lies in the reliability of its engine (including after-sale service), fuel efficiency (e.g. engine, lightweight), development speed (concurrent engineering), comfort and design. The most important factors must be the reliability and efficiency of the engine as well as the engine development capabilities and production technology. These technological factors supporting competitiveness and offering advantages for domestic production can be defined as pivotal technology.

Let us now sum up the relationship between pivotal technology and fundamental technology. Fundamental technology is the strategic target of technological development by an industry or company in a given phase. Pivotal technology, on the other hand, not only supports domestic production of fundamental technology products but also encompasses the typical technology integration (sector) that is accumulated through domestic production of fundamental technology products. Fundamental technology products

gain advantages for domestic production when they are based on current pivotal technology.

It should be noted, however, that the properties of pivotal technology, like those of fundamental technology, continue to change. We will therefore focus our discussion on current pivotal technologies from the viewpoint of transitions in trade.

4) The significance of pivotal technology

As the example of fuel cells indicates, the pivotal technology scheme is expanded by fundamental technology that continues to develop in accordance with technology innovation, namely, changes in the external environment. Rooted in Japan's social infrastructure, social climate, education, culture, research and development and skills, pivotal technology offers advantages for domestic production, creating a technology scheme that is difficult to transfer to other nations.

Pivotal technology must be observed in the product sectors below:

(1) Sectors that keep up (are expected to keep up) production activities in Japan

(2) Sectors that contribute (are expected to contribute) to machine industry exports from Japan

(3) Sectors that upgrade (are expected to upgrade) the horizontal labor division structure (export/import price ratio) of the machine industry in Japan

Conventionally, industrial technology has been discussed in terms of two aspects. One might be called the "groundwork" aspect, including component technology, foundation technology and basic technology. The other is the high-technology aspect, including core technology, key technology and fundamental technology. "Pivotal technology", on the other hand, is a concept for understanding the technology integration scheme. An effort to grasp the technology scheme that develops and supports industry may provide a new strategic advantage for industrial technology policy.

1.2 Transitions in trade and pivotal technology

As we have seen in Chapter 1.1, the trade structure is undergoing a rapid change today. Here, we review the transitions in trade for a decade from 1991 to 2001 on the assumption that pivotal technology can be seen in sectors that have the following characteristics:

(1) Production is sustained in Japan.

(2) Export competitiveness is maintained and growing.

(3) Products and industrial activities continue to evolve and to acquire higher added value.

To this end, we have extracted the four types of sectors (products) itemized below based on the transitions over the 10 years in export unit prices (weight unit prices of products) and export volume.

(1) The export unit price is going up and the export volume is also increasing.

This is the most competitive sector, where products continue to acquire added value and enhanced price competitiveness. Pivotal technology should be observed.

(2) The export unit price is going up and the export volume is decreasing.

Horizontal division of labor has allowed an advanced sector to survive, and pivotal technology may have been created.

(3) The export unit price is going down and the export volume is increasing.

This is a sector that sustains price competitiveness. Pivotal technology may be found.

(4) The export unit price is going down and the export volume is also decreasing.

This is a sector that has lost competitiveness. Pivotal technology should not be found.

1) Classifications of the machine industry

Next, we will select some major product sectors based on the above classifications.

(1) General machines

• Prices up/exports increasing

・ Internal combustion engines (and their components) ・ Gas turbines, etc.

• Prices down/exports increasing

・ Construction machines ・ Machine tools and their components

• Prices up/exports decreasing

・ Computers

(2) Electrical machinery and apparatuses

• Prices up/exports increasing

Devices such as the following:

・ Spark plugs ・ Magnets ・ Batteries ・TV monitors ・ Printed circuits ・ Semiconductors

(Imports are also growing in these sectors. Low-grade products are imported while high-grade products are exported.)

• Prices down/exports increasing

・ Pre-recorded storage media (e.g. game software)

• Prices down/exports decreasing

・ Motors ・ Electrical household machinery and equipment

(3) Transportation equipment

• Prices up/exports increasing

・ Rolling stock ・ Passenger cars and their components ・ Motorcycles ・ Light plane components

(As regards automobile components and motorcycles, imports are also growing. Low-grade products are imported while high-grade products are exported.)

• Prices down/exports increasing

・ Rolling stock components

(These seem to be repair components accompanying exports of rolling stock cars.)

(4) Precision equipment

• Prices up/exports increasing

・ Wearable optical devices ・ Development machines ・ LCDs ・ Inspection equipment

(As regards optical devices and LCDs, imports are also growing. Low-grade products are imported while high-grade products are exported.)

• Prices down/exports increasing

・ Stationary optical devices ・ On-board clocks

• Prices down/exports decreasing

・ Watch movements

2) Discussion including technological aspects

(1) Overview

As we have seen in Chapter 1.1, competitiveness is not declining throughout the entire machine industry. Rather, it is diminishing in specific sectors. The decline is significant for assembly-type products (except

for automobiles), especially for electrical machinery and apparatuses. In the midst of the overall stagnation, however, not a few sectors are doing fairly well. Exports are increasing rapidly in some product categories. In fact, prices are increasing and exports are growing for some products such as internal combustion engines, electronic components and optical components. We can see that high-function components and materials enjoy advantages.

As regards construction machines and machine tools, exports are expanding although prices are going down, which leads us to conclude that these products retain competitiveness. This is contrary to the general view that the competitiveness of such products is diminishing, which may very likely reflect aggravation of the management of companies in the sector. Construction machines have unique competitiveness because they have been developed in accordance with Japan's geographical features. Machine tools still retain the competitiveness attained by the ME (microelectronics) revolution in the 1980s, although this competitiveness is gradually diminishing. To be sure, the management environment is severe in this industry due to the fierce price competition. It is hard to say, however, that the technological competitiveness is declining.

As regards electronic devices such as semiconductors, competitiveness is declining although prices (weight unit prices of the products) are going up and exports are growing. This may very likely be the result of difficulties in management and DRAM projects at major semiconductor manufacturers that have created an image of declining competitiveness throughout the industry. It may be necessary to avoid paying too much attention to Japan's economic conditions and difficulties in management in specific business categories. In general, we can say that the electronic device sector continues to retain and enhance its competitiveness due to demand for new devices such as cell phones and the development of custom-made products. As we have seen in Chapter 1.1, however, Japan's semiconductor industry is losing its leadership in the international market, which can be considered a problem.

In the optical device sector, the same applies to LCDs. Although the general perception holds that LCDs are losing their competitive edge, we can observe the LCD sector as a whole as enhancing its added value and competitiveness.

To sum up the technological features above, we can assume that the integration of technologies, such as electronic (material) technologies, optical (material) technologies and precision/micro-processing technologies, serves as an advantage. In the framework of regional industrial integration, an example can be found in the Suwa region.

(2) Competitiveness and technological combination

The machine industry is characterized by strong interconnection within the industry. The electrical machinery and apparatus sector indicates, however, that such interconnection does not necessarily enhance the technological connections (technology combinations) that

would offer advantages for domestic production. The phenomenon of hollowing out is particularly severe in the fields of white goods and audio-visual equipment. The myth of *keiretsu* production did not even work in these sectors. In the automobile sector, it is believed that today's greatest competitiveness (i.e. development speed) is created by *keiretsu* production. We can say, however, that a *keiretsu* type technology combination was not the source of competitiveness in the electrical machinery and apparatus sector in the past.

Meanwhile, in the electrical machinery and apparatus sector, components that are combined with materials continue to retain and reinforce their competitiveness. This may give us a clue to technology integration for sustaining competitiveness and domestic production.

The technology combination sustaining the competitive edge in the case of automobiles (including engines and components) takes the form of *keiretsu*. We cannot generalize about the effectiveness of *keiretsu* as exemplified by electrical household machinery and equipment. *Keiretsu* is still considered effective in the automobile industry, however, because it is designed to enhance competitiveness in terms of development speed and to embody the technology concept of concurrent engineering (vehicle design/development in concurrence and in combination with other processes), which may be referred to as a "parallel method". It is not appropriate, however, to focus solely on technology combination in connection with the automobile industry's *keiretsu*. Rather, the essence lies in the system of cooperation (coordination) and alliances (collaboration) that reinforces concurrent engineering beyond companies.

The automobile industry is characterized by "vertical technology combination" based on material technologies. Examples include the engines that serve as the core for reliability and fuel efficiency as well as the electronic control systems that might be called clusters of devices. In this regard, the automobile industry has technological characteristics that are similar to those of other competitive product sectors (e.g. batteries, electronic devices, optical devices, LCDs), although these sectors do not appear to share features in common with the automobile industry. White goods and audio-visual equipment seem to feature an assembly-type technology combination that differs from that in the automobile industry.

In other words, the *keiretsu* in the automobile industry is designed to fulfill the vertical technology combination or technology integration in connection with the vertical division of labor. The engine and electronic control systems that serve as the core product functions are also the fruits of this vertical technology combination. In this scheme, horizontally distributed processing technologies (e.g. machining, grinding) as well as machine elements and components are upgraded and combined; in addition, diverse and different technologies that are vertically distributed are integrated hierarchically and schematically to exert competitiveness. This should be applicable to other competitive components and devices, although they may not be associated with an

industrial system as gigantic as the automobile industry.

(4) Pivotal technology and vertical technology combination

The above discussion leads to the conclusion that vertical combination of technologies throughout the industry (combined technology or composite technology) is the source of competitiveness for pivotal technology in a machine industry sector that sustains and reinforces competitiveness in domestic production. Characterized by vertical technology combination throughout the industry, such sectors also cope with short product or technology life cycles. For many products of the machine industry, the decisive factor for competitiveness is a development speed consistent with the product or technology life cycle. Today, competitive sectors such as automobiles and electric/electronic components require coordination and collaboration to attain complicated vertical technology combination throughout the industry. It is therefore possible to think that these sectors manufacture products domestically because they need this kind of coordination and collaboration. In other words, domestic production offers advantages for a technology combination that requires close coordination and collaboration. Overseas production, on the other hand, offers advantages for technology that does not require this type of cooperation and alliances (the so-called horizontally accumulated technology).

So far, we have defined the essence of pivotal technology not as mere technology integration but as "schematic technology integration that requires strong vertical combination (cooperation and alliances) through industry to accelerate the development speed of products and technologies." Based on this definition, we can point out the following:

- Precise, accurate understanding of the scheme and structure of pivotal technology in the machine industry is required.
- It is necessary to recognize (abandon the myth) and take quick measures against the fragility and breakdown speed of mere industrial integration and *keiretsu* that lack pivotal technology.
- As regards fundamental technology products such as fuel cells, we require a vision to improve the technology scheme for recognizing the gap between the existing pivotal technology and the pivotal technology necessary to sustain the advantage of domestic production (a need to recognize the strong and weak points of Japan's technology integration).
- Support should be extended to improve the technology scheme in line with the vision. In particular, support should be mobilized to establish the framework for coordination and collaboration needed to accelerate the development speed of products and technologies by means of vertical technology combination.

1.3 Challenges for the machine industry from the pivotal technology perspective

In this section, we would like to review the major industries and examine the challenges facing them based on the characteristics of pivotal technology.

1) Electrical household machinery and equipment

The electrical household machinery and equipment industry is the largest sector responsible for the machine industry's stagnation today. One of the reasons may be the fact that it was too slow to shift from a technology combination that has lost competitiveness to a pivotal technology scheme that retains competitiveness and advantages for domestic production, or the fact that adjustment of the industrial structure was too slow.

In the electrical household machinery and equipment sector, high-function materials and components that are necessary to fulfill the crucial functions of various products still retain their competitiveness today. In light of this fact, we can say that the competitive edge is lost only in the development of products that are dependent on other horizontally distributed technology combinations (e.g. white goods). This phenomenon is occurring for many reasons, including rapid generalization of products (except for high-function materials and components) and open transactions with the advancement of IT. It is true that technology integration (*keiretsu*) no longer leads to competitiveness in product development and advantages for domestic production. We should keep in mind, however, that technology integration also propels the international division of labor in the form of high-grade products and low-grade products. It is believed that competitiveness in this division of labor comes from high-function materials and components, which can be regarded as the driving force of today's pivotal technology. Resources should have been shifted from white goods and audio-visual equipment to sectors that are based on high-function materials/components with advantages for domestic production. It took time, however, to bring about a shift. This seems to be the cause of stagnation in the industry.

As we have seen in the example of fuel cells for automobiles, constant shifting accompanies high-function materials and components that require vertical technology combination. This necessitates not only metabolism of a technology scheme consistent with the transition but also metabolism of coordination and collaboration functions. The electrical household machinery and equipment industry has failed in its restructuring efforts due partly to excessive competition in the process of metabolism.

Metabolism requires vertical technology combination among industries with different pivotal technologies. Metabolism also requires coordination and collaboration of the vertical division of labor. It therefore necessitates enormous cost. Let us assume that such metabolism is to be achieved under conditions of severe competition in the industry. The entire industrial structure that should attain vertical technology combination would be engulfed in violent competition, and a huge amount of resources would be wasted until an optimal system is created.

A situation of this type is most likely to be observed in competition over de facto standards. In many cases, the struggle for a de facto standard is equal to the struggle over

fundamental technology. It is true, however, that such struggles also connote competition that decides the future of an entire pivotal technology that should serve as the bedrock for the fundamental technology. The life cycles of electrical household machinery and equipment are particularly short. This sector also demands speed for development of products and technologies. There have, however, been a number of struggles over de facto standards. The "unproductive" struggle for a de facto standard that unfolded over DVD players is one example. From the viewpoint of the industry as a whole, such struggles may have hindered the shift from a technology combination that had lost competitiveness to a competitive pivotal technology. We consider such struggles to be "unproductive" because they should be settled promptly allow the market players to compete in terms of development speed in the international arena. In most cases, it is not the de facto standard that should be determined in free competition. The de facto standard is seldom determined through free competition. It has been taken for granted, however, that such standards should be determined through free competition, which has led to wars of attrition. The battle over operating systems for domestic PCs is also considered to have been an unproductive struggle for a de facto standard.

In other words, a struggle over a de facto standard for fundamental technology may break out due to a lack of coordination and collaboration functions for promoting metabolism of pivotal technology (including coordination and collaboration functions for vertical technology combination) and for shifting the whole machine industry to sectors with advantages. One of the challenges facing the electrical household machinery and equipment industry is to improve such functions, which may be widely applicable to other sectors in the machine industry that are forced into stagnation. Although the general view considers "concentration and selection" necessary in the machine industry, such concentration and selection may have been delayed in part by a lack of coordination and collaboration functions.

2) Automobiles and high-function materials/components

As we have seen, automobiles and high-function materials/components are retaining and reinforcing their competitiveness in domestic production. For the future, it will be necessary to check whether a vertically combined technology scheme (which supports competitiveness in domestic production) is sustained and whether coordination and collaboration functions work properly in the vertical division of labor. Of particular importance will be systems for accelerating the development speed of technologies and products. It will be also necessary to sustain and improve the technology schemes required for these systems. Sectors that are currently enjoying a competitive edge will enter into a more critical phase.

In the automobile industry today, the fuel cell vehicle is a strategic "fundamental technology." Research and development of fuel cell vehicles require various "sub" fundamental technologies,

ranging from fuel cell stacks (electrolytes, power generation/combustion control system) and fuel reformers to fuel tanks. Various technologies that are developed under the technology development initiative should be turned into advantages for domestic production. To this end, it will be necessary to digest new fundamental technologies while making use of current pivotal technology in the machine industry. At the same time, it will also be necessary to metabolize the pivotal technology itself in the process. In this context, technology sectors that are vertically distributed in various industries and that originate from Japan's limited resources and natural environment (e.g. energy- and resource-saving and micro-processing technologies) will acquire the uniqueness and attain the technology integration required for domestic production.

It seems at present that the technology scheme has improved quite smoothly in these sectors, involving the resource/energy industries and electric machine industry. The automobile industry is less likely to lose its competitiveness. In short, competition is currently unfolding over a vision for a technology scheme. More specifically, it is a competition over development speed. In other words, the competition is being contested in the realm of coordination and collaboration effects between the industries/companies involved and the technology integration required by these industries/companies. We need to check these points thoroughly, and the same is fully applicable to high-function materials/components.

Companies in the electronic product sector have transferred their plants overseas in the past. In recent years, however, some of these companies have relocated their plants to Japan in an effort to shorten the delivery period and speed up product development. These examples seem to demonstrate the validity of the above discussion and to indicate the measures that are needed to ensure advantages in competitiveness and domestic production for the machine industry. In other words, it is important to take advantage of technology integration that requires reduced delivery time and enhanced development speed through coordination and collaboration in product and technology development. It is also crucial to form technology integration that attains reduced delivery time and enhanced development speed through coordination and collaboration. At present, Mie Prefecture is undertaking technology integration for the manufacture of LCDs. This is different from the so-called "business-castle-town" type industrial integration or integration of small and medium-sized firms in Ota-ku. Mie Prefecture's approach features integration of technology (big business) that is widely distributed in the prefecture. This integration involves not just companies that supply capital goods and high-function materials (e.g. production goods) but also suppliers of the semiconductor devices required for LCDs. Some of these companies have been newly located in the region; others have been promoting a technology shift from existing projects. These companies are contributing to the attainment of vertical

technology combination as well as coordination and collaboration functions and to ensuring competitiveness and advantages in domestic production. This new type of technology integration was created when the prefecture gave incentives to an LCD manufacturer (that serves as the mainstay) and invited to locate a plant there. As we have seen in this example, for technology integration to be metabolized to ensure advantages in domestic production, it will be necessary to identify what is missing and take measures to spur metabolism.

3) Molds

The mold industry (which has supported the machine industry) has been considered to be in a crisis for a long time. In fact, the mold industry is rapidly transforming itself into an import industry. Imports of molds as well as of other products with low unit prices are increasing, while not a few sectors (e.g. motorbikes, cameras) are sustaining exports of products with high unit prices.

As we have seen in reviewing the characteristics of pivotal technology, it is possible to generalize and conclude that domestic production can be sustained in sectors that have turned into import industries, and horizontal division of labor can be expanded through the development of products by taking advantage of a vertical technology combination from materials to processing. One example is the new integration of vertical technology combination in Mie Prefecture mentioned above. This may provide the mold industry with a model for development.

4) Policy challenges

Today, pivotal technology is created in the machine industry through the integration of electronic (material) technology, optical (material) technology and precision/micro-processing technology. This pivotal technology supports such competitive sectors as automobiles, electronic components and optical devices. If the status of the machine industry is not sufficiently high in the national economy, it should be useful to study the measures below in addition to the commitment made by private enterprises.

(1) Development of a vision to improve the technology scheme

- To develop a precise, accurate understanding of the pivotal technology scheme and structure in the machine industry.
- To create a vision for improving the technology scheme recognizing the gap between the existing pivotal technology and the pivotal technology that is necessary to sustain the advantages of domestic production for fundamental technology products such as fuel cells (recognizing the strong and weak points of Japan's technology integration).
- To review technology development initiatives (e.g. in fuel cells) taking into account improvements in pivotal technology for sustaining the advantages of domestic production.

(2) Support for coordination and collaboration by private enterprises

- To extend support for improving the technology scheme in line with the above vision. In particular, to provide support for establishing

a framework for coordination and collaboration required to accelerate the development speed of products and technologies through a vertical technology combination. Among other things, to coordinate competition over de facto standards and change the intellectual property framework and competition policy (e.g. relaxation of Anti-Monopoly Law application).

(3) Support for creation/shifting of technology integration

- To understand and take quick measures in regard to industrial integration and *keiretsu* systems that do not have pivotal technology.
- To study measures to sustain technologies that have accumulated in the declining industry sector and that are necessary to improve the technology scheme.
- To take the initiative and provide incentives for creating (shifting) technology integration as seen in the case of Mie Prefecture.