Chapter 1. Challenges and prospects for Japan’s monodzukuri - Toward strengthening supply chains and improving the reliability of monodzukuri -

(The Japanese manufacturing industry’s general business conditions)
- Japan’s manufacturing industry expanding production and increased the number of production sites as the economy bottomed out and started to recover in 2002. However, uncertainty over its future is increasing due to soaring resource prices and other factors (Chart 1-1).

(The current state and challenges of manufacturers’ supply chains expanding throughout Asia)
- Japanese manufacturers are expanding production in Asia, driven by intensifying global competition and the growth of Asian supply chains. As their supply chains (chains of companies involved in a sequence of activities from raw material procurement through to the delivery of products to consumers) expand throughout Asia, exports of intermediary goods from Japan to other parts of Asia have increased (Chart 1-2).

- Fundamental industries for monodzukuri are also exposed to competition with Asian contenders. Since this competition is expected to intensify (Chart 1-3), consolidating their management foundations is essential from the viewpoint of strengthening the competitiveness of Japan’s entire monodzukuri industry. This requires (1) promoting fair subcontracting practices in order to create an environment in which basic monodzukuri industries can secure reasonable profits (Chart 1-4), (2) fostering innovations that meet the needs of downstream companies, and (3) consolidating the management foundations of Japanese companies by allowing them to absorb the vitality of growing Asian economies through exports and overseas operations.

- Expansion of supply chains and improvement of efficiency (e.g., reduced inventories) increase competitiveness. However, an important perspective is to strengthen the entire supply chain, in consideration of (1) Impacts of potential disruption in supplies in the event of disaster and other reason (Chart 1-5); (2) Risk of leakage of technical information from customers (e.g., suppliers), and (3) Importance of securing quality human resources and preserving skills and expertise for the company itself as well as its suppliers.

Companies should counter the risk of disruption in supplies in a way that does not hinder their competitiveness and that takes account of the degree of its potential impact and their own supply chains’ strengths and weaknesses (Chart 1-6).

Restoring confidence in monodzukuri
- When companies are involved in intensifying competition and increasingly advanced and complex monodzukuri processes, rare metal use and waste management problems and fraud cases one after another have undermined consumer confidence in monodzukuri (Chart 1-7).

Companies, including not only top management but even a worker, should renew their awareness of the value of safety and confidence and step up efforts to improve their design philosophy, organization and so on. On the other hand, to address the fear that counterfeit goods produced mainly in Asia may cause safety problems and harm confidence in Japanese monodzukuri, measures to combat counterfeiting are needed.

Adapting to resource and environmental constraints
- Resource and environmental constraints have become so severe that they affect the business viability of manufacturers. Relevant efforts should be accelerated. Rare metals are an important factor of industrial competitiveness. Their supply is also at risk due to soaring prices and a shift in the resource policy of producing countries. Japan urgently needs to make efforts to strengthen relationships with resource-producing countries and propel a shift to monodzukuri that uses less rare metal (e.g., by promoting the 3Rs and developing alternative resources or materials).

This should be done by furthering individual companies’ efforts as well as fostering collaborative efforts (e.g., resource savings through coordinated efforts by companies constituting a supply chain) (Chart 1-8). Japan’s manufacturing industry should also take advantage of its strength in the environmental field to enhance its international competitiveness.

[Chart 1-1 Japanese manufacturing industry’s production and business condition DI]
[Chart 1-2 Value of procurement from Japan by monodzukuri (FY95 vs. FY06)]
[Chart 1-3 Japanese basic industries’ competition with Asian counterparts]
[Chart 1-4 Improvements under the Guidelines for the Promotion of Fair Subcontracting Practices (machine parts and tooling industries)]
[Chart 1-5 Disruption in supplies from parts suppliers and its impact]
[Chart 1-6 Measures to counter the risk of disruption in supplies]
Chapter 2. Human resource development for consolidating the base for monodzukuri

Current state of employment and labour of monodzukuri-related industry workers

- The workforce in the manufacturing industry has been increasing since the second half of 2005. Workforce shortages remain high (Chart 2-1). The number of new graduates hired is still at a low level, although having increased. The stability of these new employees poses a problem, especially in small and medium enterprises.

Diversifying work style in the monodzukuri industry

- A major management challenge for monodzukuri organizations is to give high priority to “high quality and accuracy,” “short delivery times,” and “price competitiveness” in order to succeed in international competition. To meet this challenge, companies are changing and enhancing their human resources requirements. For example, engineers are expected to have broad expertise as well as creativity that enables improvements in production systems, while technicians are expected to be not only highly skilled and versatible but also capable of making proposals and executing them on the shop floor so that streamlined operations and high value creation can be fostered, thereby improving the company’s financial standing (Chart 2-2).

A recent trend is the diversification of working styles across all kinds of monodzukuri jobs. For example, the number of dispatched workers has increased as companies try to cope with variations in demand, competition with Asian rivals and price competition, but there has been no significant change in the percentage of regular employees and that of non-regular employees (including part-timers) in the entire workforce (Chart 2-3).

Among this diversification of work styles, non-regular employees and outsourced workers undertake not only jobs that require only minimum experience, but also jobs that involve qualification or skills that take several years or more to acquire. Nowadays, non-regular employees are engaged even in areas that call for expertise and adaptability to change and that determine the quality of the product.

Challenges and keys to developing human resources

- For developing regular employees’ job skills, nearly 80% of companies provide Off-JT and about 50% of companies provide OJT based on programs in place. On the other hand, non-regular employees are given fewer opportunities to develop their job skills than are regular ones (Chart 2-4).

These fundamental challenges increase the need to:

- Help regular employees to gain job experience through OJT, acquire expertise through Off-JT, and share knowledge and values through active networking with other people;
- Raise the level of education and training for non-regular workers, as well as the level of their skills, and clarify career prospects for them;
- Improve the safety and other basic training programs and the skills evaluation criteria for both regular and non-regular employees.

Shop floor staff view the effects of using non-regular workers as follows: While non-regular workers bring benefits such as allowing the shop floor to adapt to variations in workload and enabling regular employees to focus on more sophisticated jobs, they increase the personnel management workload and the need to take action to ensure accumulation and preservation of know-how (Chart 2-5).

The establishment of a personnel management system should be promoted with a view to contributing to consolidating the base for the entire range and diversity of monodzukuri activities.

Promotion of policies for human resource development

- To nurture technicians with advanced skills, the government will support programs for current employees, including the provision of vocational training and the means to preserve corporate know-how and skills.

To develop practical human resources that can play central roles on the shop floor, the “practical human resource development system,” a vocational training program that combines internships and lectures, will be promoted. For “freeters” (job hoppers), the job card system will be promoted in order to help them find worthwhile jobs by increasing job opportunities for them as regular employees. This system will also be used in monodzukuri industries.

Based on the results of the International Skills Festival for All, Japan 2007, the government will further the improvement of infrastructure to make Japan a monodzukuri-based nation (Chart 2-6).
Chapter 3. Promotion of education and R&D to underpin monodzukuri

**Monodzukuri education at technical colleges and vocational high schools**
- For the promotion of fundamental technologies for monodzukuri, it is essential to develop human resources to underpin them. In particular, technical colleges and vocational high schools are educational institutions central to monodzukuri education provided in cooperation with industry.
- Technical colleges, which are designed to nurture practical and creative monodzukuri engineers, should enhance and strengthen their roles in preserving and advancing monodzukuri technologies and producing innovations (Chart 3-1).
- Industrial and other vocational high schools, which are aimed at nurturing the next generation’s professionals who will play important roles in regional monodzukuri industries, should improve their hands-on vocational education programs and carry out initiatives involving long-term internship programs (the dual system) and engineers invited as instructors. There is a need to develop curricula in accordance with the characteristics of individual schools and to enhance collaboration with regional communities (Chart 3-2).

**Development of human resources for monodzukuri through school education**
- The amended Fundamental Law of Education stipulates that the relationship between education and career should be stressed as a new goal of education. The new government course guidelines stipulate hands-on career education as a new requirement.
- The government has expanded education in science, technology and mathematics by assigning new staff to assist scientific observations and experiments in elementary schools and by promoting the development of high school curricula that emphasize science and mathematics.
- Elementary, junior high and high school students learn about monodzukuri as part of their curricula. Schools have enhanced their career education by providing students with opportunities to experience monodzukuri in the real world. For example, some schools take students over to local company offices and plants to learn about careers, and some junior high schools provide students with five-day or longer internship programs.
- For universities, the government promotes monodzukuri education in accordance with the characteristics of individual schools, for example, by supporting educational programs aimed at nurturing monodzukuri engineers with advanced knowledge and skills and by fostering quality, long-term internship programs jointly provided by industry and academia. The government has created an environment conducive to the creation of fundamental technologies for monodzukuri (Chart 3-4).
- Vocational schools are used for offering practical vocational education in cooperation with industry, while museums and universities are used for providing extensions aimed at deepening people’s understanding of monodzukuri.

MEXT is supporting a wide range of activities that many different organizations conduct with the aim of fostering education on monodzukuri (Chart 3-4).

**Promotion of R&D to enhance Japan’s industrial capacity**
- The government is promoting R&D of fundamental technologies for monodzukuri based on science, with an eye toward increasing the Japanese manufacturing industry’s international competitiveness and allowing Japan to lead the world in monodzukuri technology even with the decline in the workforce for monodzukuri (Chart 3-5).
- Monodzukuri technology comprises technology that materializes product innovation in the remaining seven fields listed in the Third Science and Technology Basic Plan. Since monodzukuri is inseparable from these remaining fields, initiatives to promote monodzukuri are in progress in coordination with these fields.
- The government is creating an environment that fosters the creation of fundamental technologies for monodzukuri by allowing R&D results to be returned to society. Efforts toward this include promoting joint research by universities and companies, strengthening intellectual property strategies (e.g., expanding the Intellectual Property Policy Headquarters, collaborating with TLOs), supporting the creation of university ventures, and consolidating regional innovation systems (Charts 3-6 & 3-7).

**Data and Illustrations**
- **Chart 3-1 Jobs chosen by technical college graduates, by industry** (Monodzukuri Monodzukuri Other engineers 6.3% Transport/communications jobs 3.2% Industrial engineer 50.1% Professional/technical jobs 90.8% Clerical jobs 1.6% Other professional jobs 11.6% Service/maintenance jobs 2.7% Transport/communications jobs 3.2% Categorical jobs 1.6% and career should be stressed as a new goal of education. The new government course guidelines stipulate hands-on career education as a new requirement.
- **Chart 3-2 An example of education on monodzukuri at vocational high schools**
- **Chart 3-3 Internship programs offered at universities**
- **Chart 3-4 Diverse initiatives for education on monodzukuri**
- **Chart 3-5 Examples of R&D projects on fundamental technologies for monodzukuri**
- **Chart 3-6 Number of joint research projects conducted by universities**
- **Chart 3-7 Number of patents licensed by universities**