

FY2012

Summary of the White Paper on
Manufacturing Industries
(Monodzukuri)

June 2013

Ministry of Economy, Trade and Industry (METI)

Ministry of Health, Labour and Welfare (MHLW)

Ministry of Education, Culture, Sports, Science and Technology (MEXT)

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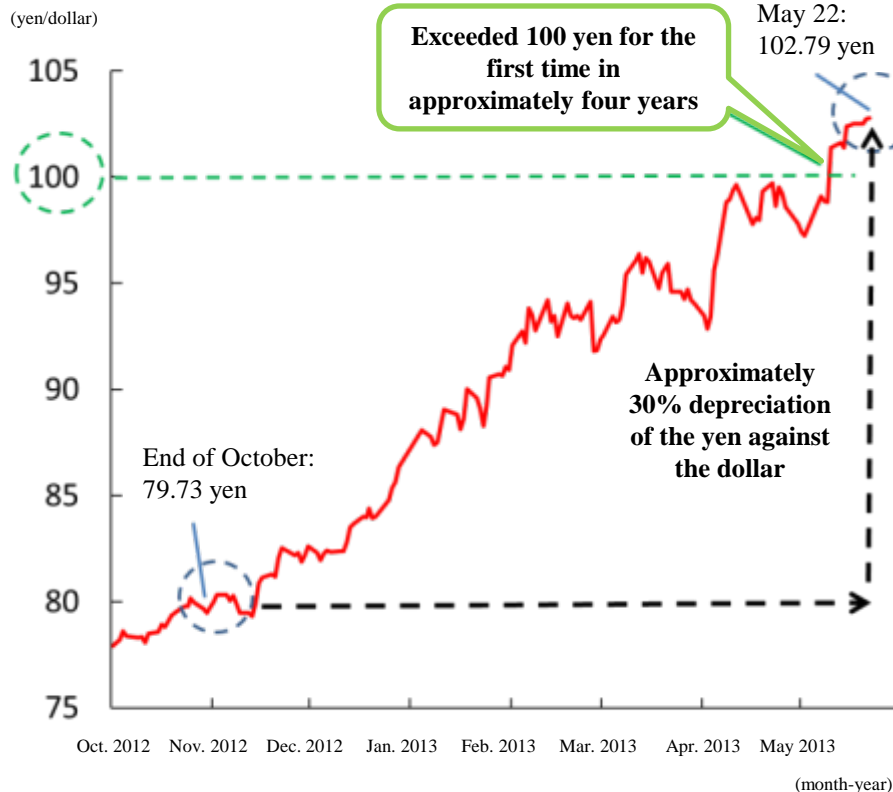
Chapter 1 Challenges Facing Japan's Manufacturing Industries and their Future

[Recognition of the Current Situation] Fluctuations in the Manufacturing Industries that Have Supported the Japanese Economy

(Business conditions have been improving recently, but there is concern over medium- and long-term deterioration in competitiveness.)

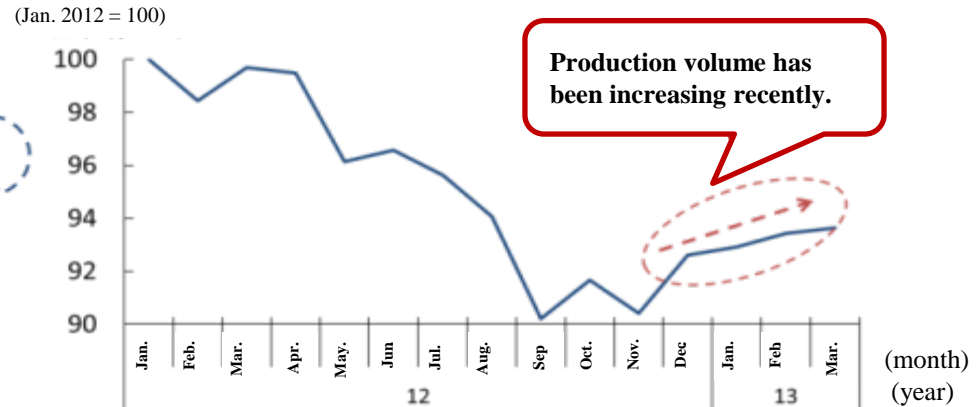
- Manufacturing industries have been Japan's key industries, maintaining domestic employment and supporting trade.
- Although business conditions are improving at present, backed by the correction of the yen's appreciation and expectations for an exit from deflation, there is concern over medium- and long-term deterioration in the competitiveness of Japan's manufacturing industries, which has historically been rooted in the strength of the workforce.

【Chart 1: Changes in Exchange Rates】

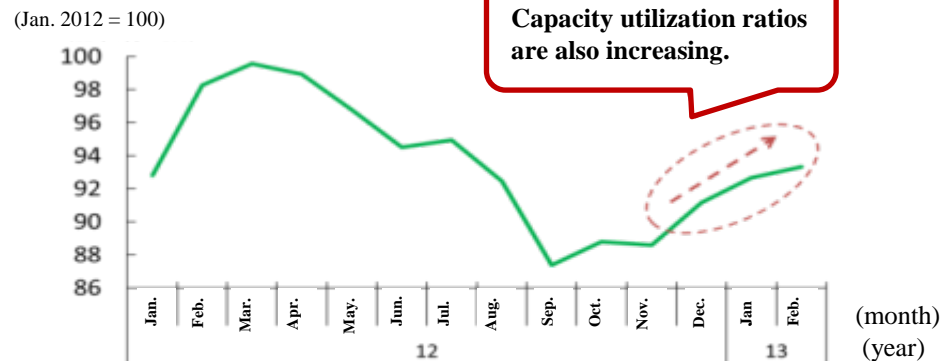


Source: Bank of Japan

【Chart 2: Changes in Industrial Production】



【Chart 3: Changes in Capacity Utilization Ratios】

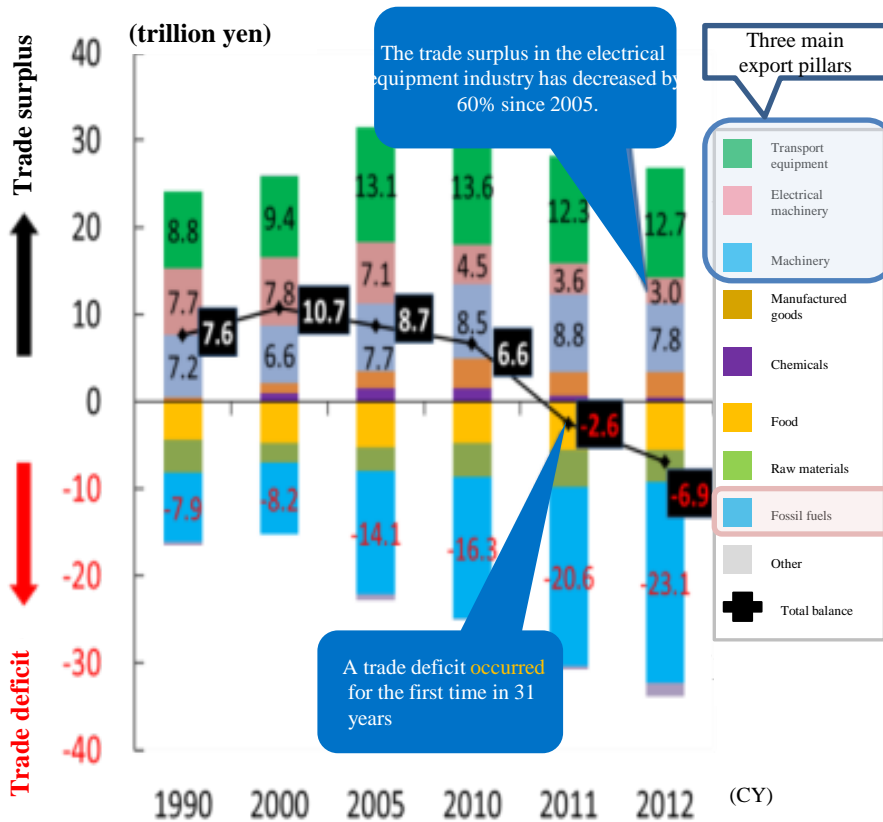


Source: "Industrial Production Index" (METI)

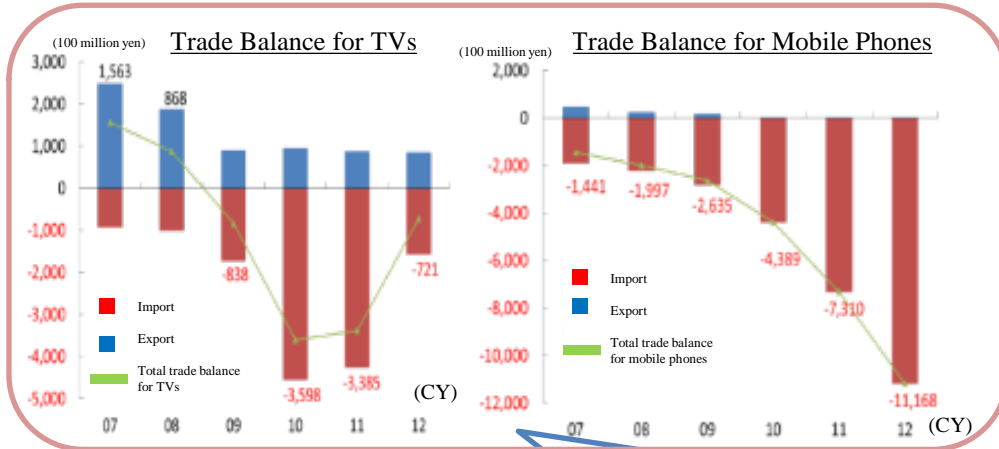
(Earning power is deteriorating in the exports of major industries)

- Japan recorded its largest ever trade deficit of 6.9 trillion yen in 2012, due to such reasons as an increase in imports of mineral fuels (natural gas and crude oil, etc.) and deterioration in the competitiveness of major industries, including the electronics (electrical machinery and consumer electronics) sector.
- The automobile (transportation equipment) industry has maintained a large trade surplus, but this may diminish due to the acceleration of local production for local consumption and an increase in the use of imported parts.

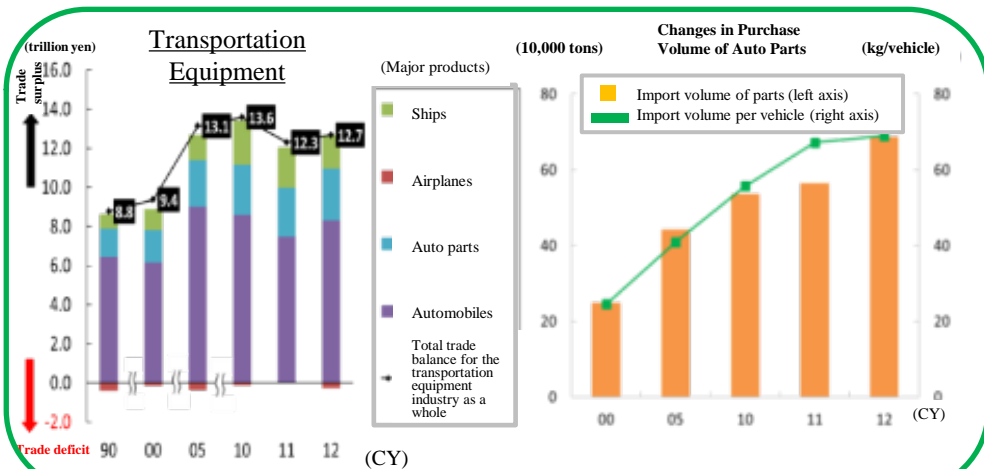
【Chart 1: Changes in Japan's Trade Balance】



【Chart 2: Structure of the Trade Balance for Major Products】



The total trade deficit for TVs and mobile phones exceed 1 trillion yen.

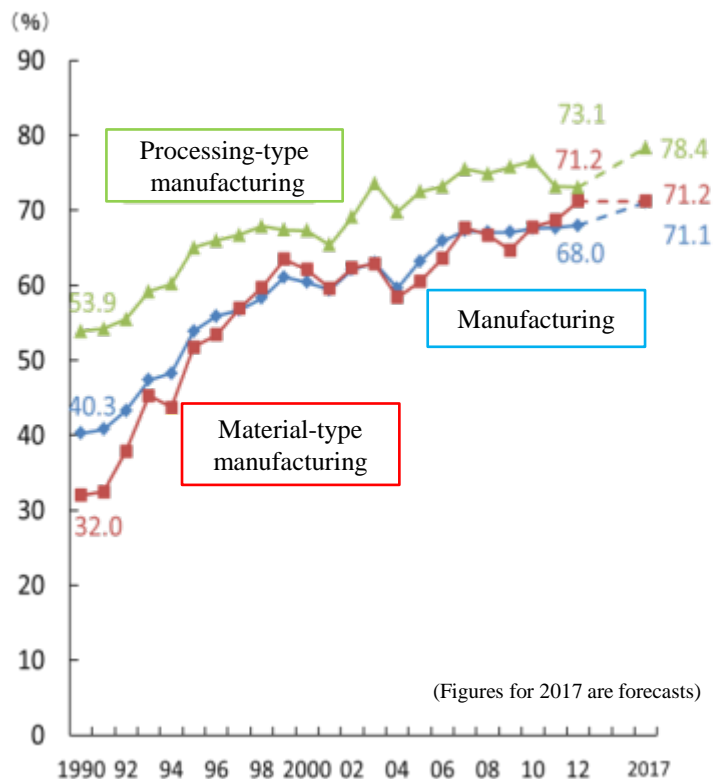


Source: "Trade Statistics of Japan" (Ministry of Finance)

(Overseas investment has been expanding in the automobile industry but has been sluggish in the electronics industry)

- An increasing number of companies have commenced overseas production and approximately 70% of listed companies are now manufacturing products overseas. Overseas production has been expanding mainly in the automobile industry, while domestic production has leveled off.
- Capital investment has been and will remain sluggish in the electronics industry both within and outside of Japan. It is highly likely that the electronics industry has little remaining strength to increase its competitiveness domestically and internationally.

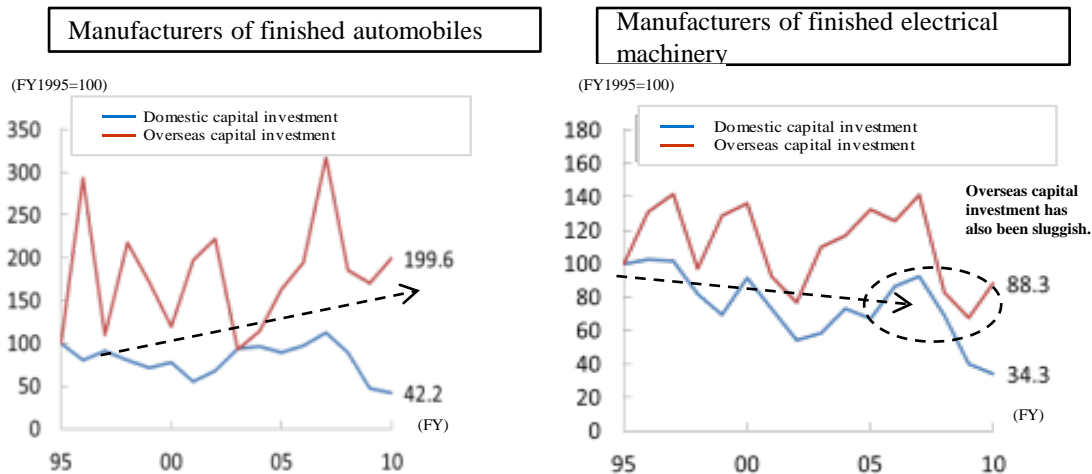
【Chart 1: Percentage of Companies Manufacturing Products Overseas】



Source: “FY2012 Annual Corporate Behavior Survey” (Cabinet Office)

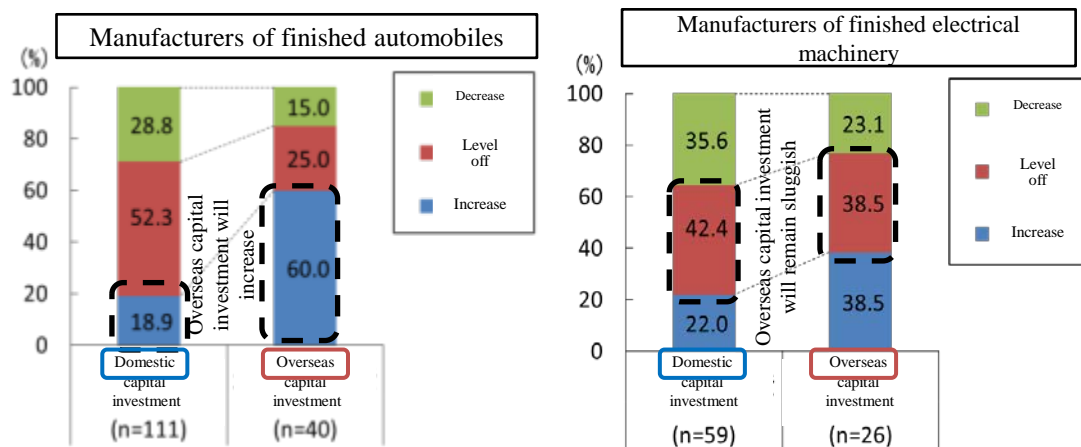
Remarks: Percentage of companies manufacturing products overseas among those that provided valid answers

【Chart 2: Changes in Domestic and Overseas Capital Investment】



Source: Created based on “Basic Survey of Japanese Business Structures and Activities” and “Basic Trend Survey of Overseas Business Activities” (METI)

【Chart 3: Three Year Domestic and Overseas Capital Investment Forecast】

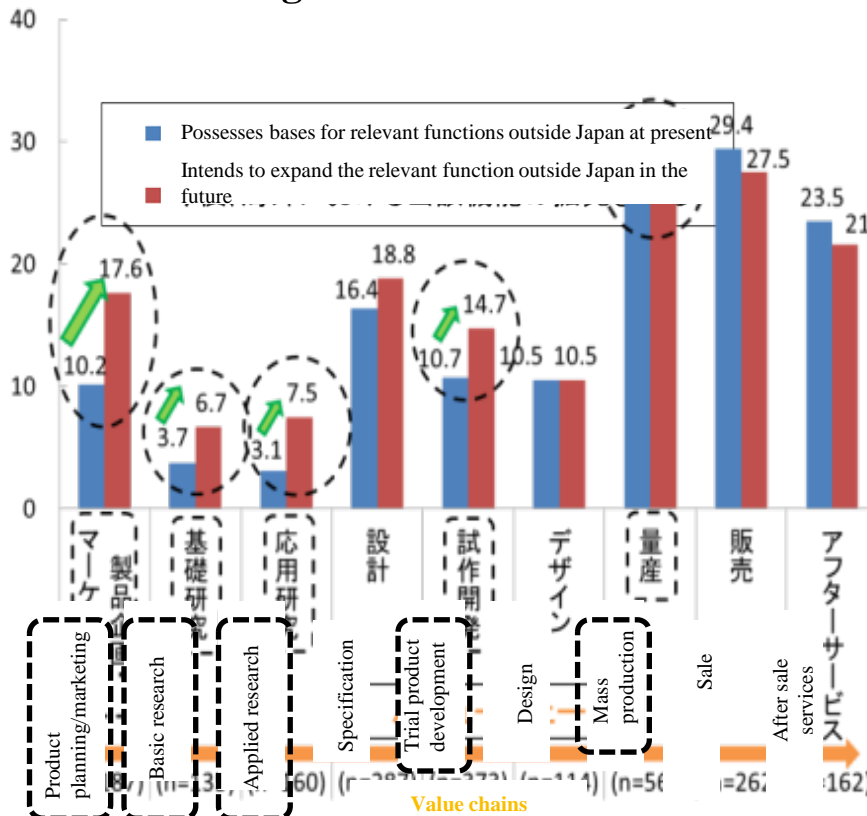


Source: Surveyed by METI (December 2012)

(Increase in the added value of the functions of overseas bases)

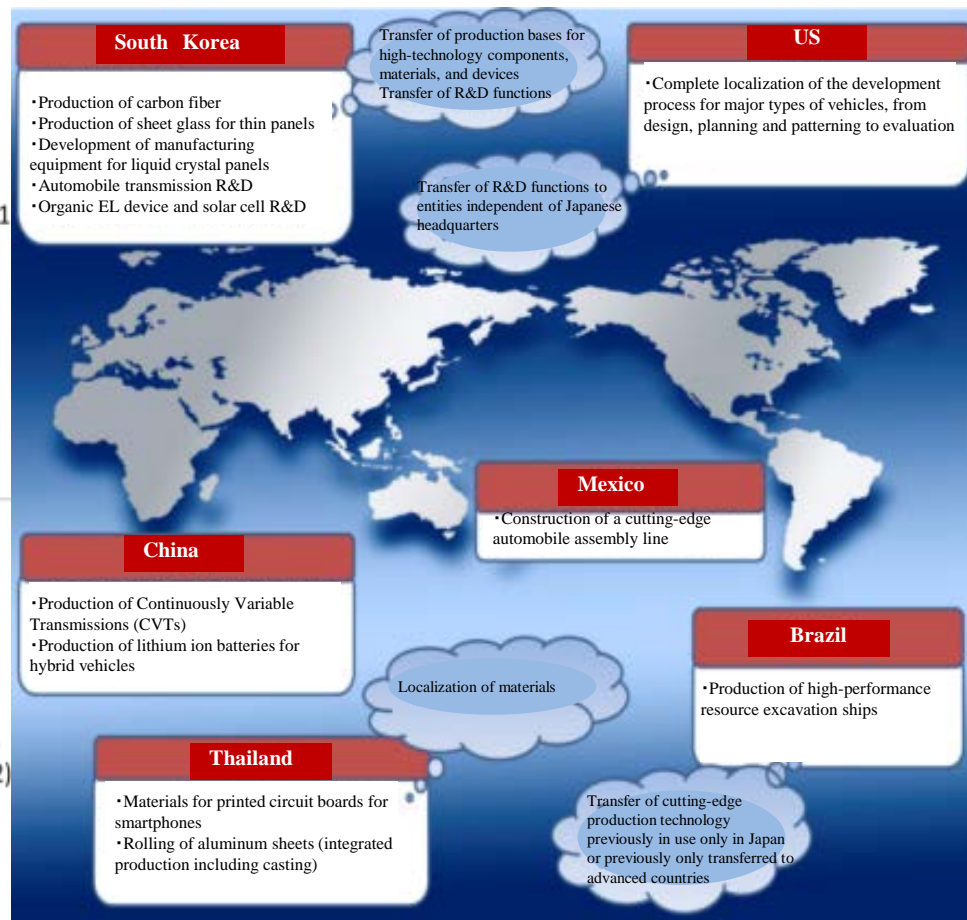
- Overseas business expansion has diversified, and overseas expansion may be accelerated with regard not only to mass production but also design, R&D and other key functions of Japanese companies – the source of their competitiveness.

【Chart 1: Overseas Business Expansion Forecasts according to Value Chain Function】



Source: Surveyed by METI (December 2012)

【Chart 2: Cases of Overseas Transfer of Non-Mass Production Functions】



Source: Created by METI based on released data

(Changing Trends for the World's Manufacturing Industries)

- Japan's manufacturing industries face a turning point on both the supply and market sides.
- On the supply side, competition with companies from emerging countries has intensified as a result of the digitalization of products and manufacturing processes, making it easier for companies to begin manufacturing. When 3D printers and other new manufacturing devices become prevalent, anyone will be able to begin manufacturing without an accumulation of manufacturing technology.
- On the market side, the domestic market is stagnating due to changes in consumer preferences and the population decrease coupled with the low birth rate and longevity, while emerging markets are growing rapidly. Companies need to respond to changes in market environments.

【“3D printers” attracting the attention of manufacturing industries worldwide】

3D printers are formally called additive manufacturing technologies, and form three-dimensional objects by continuously accreting layers of various materials, such as plastic, resin, and metal. These technologies have attracted the world's attention for their potential to bring about a revolution in conventional manufacturing, as highly accurate three-dimensional products can be created only by using 3D data.

At present, 3D printers are only used for small-lot production, such as the making of trial models or custom-made goods, and are not available for mass production.

However, when price reduction accelerates the diffusion of these technologies, they may drastically change manufacturing methods in the future, as the highly advanced processing techniques of skilled workers become unnecessary. We should monitor these technologies to ascertain whether they will pose a threat to Japan's manufacturing industries or a chance for them to enhance their competitiveness.



【Target emerging markets as a platform to disseminate electric motorbikes】

Terra Motors Corp., an electric motorbike manufacturer, has been strategically promoting overseas business expansion in the belief that Asia is a very promising market for electric motorbikes, in light of environmental problems due to increased gas emissions and traffic jams in Asian urban areas.

In 2012, the company established overseas subsidiaries and plants in Vietnam and the Philippines. In the Philippines, the company participated in a government-led three wheeled electric taxi project, built a system to locally produce 10,000 units annually and established a full-fledged sales system. It is expected that the company will capture Asian markets in the field of electric motorbikes.



【Problems and Future Direction (i)】Need to “develop a location environment” to bring out the maximum competitiveness

(Weaknesses in industrial infrastructure and other location environment factors)

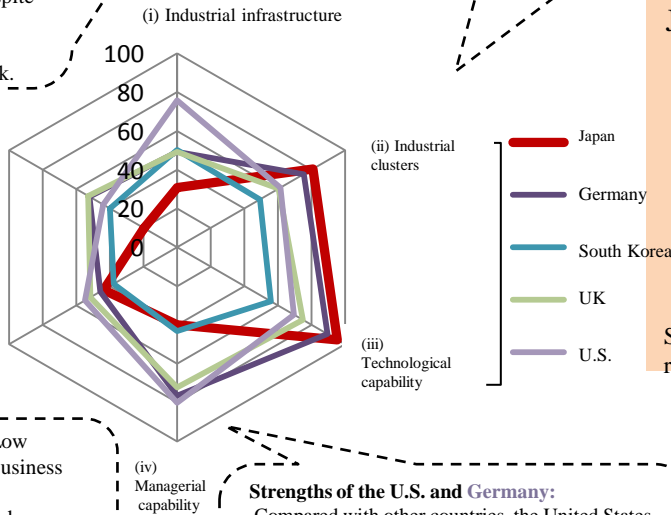
- Japanese manufacturing is rather expensive compared to other countries due to the effect of exchange rates, energy constraints, delays in concluding economic partnerships, and regulations that have become a hindrance in business location. Japan is superior to other major countries in terms of its industrial clusters, but has location environment weaknesses, such as an inferior industrial infrastructure and labor force.
- There is an urgent need in correcting this high-cost structure, review the regulations inside Japan and form economic partnerships, such as the TPP, the ASEAN Framework for Regional Comprehensive Economic Partnership (RCEP), and the Japan - China - Republic of Korea Free Trade Agreement (FTA). Through the drastic improvement of a location environment, Japan should aim at the country where companies are able to engage in business most actively in the world.

【Chart: Comparison of the Competitiveness of Manufacturing Industries of Major Countries】

Strengths of the U.S.: Large GDP, enhanced legislation concerning scientific research and innovation, and low industrial electricity cost

Weaknesses of Japan: Despite high quality industrial infrastructure, industrial electricity cost, etc. are weak.

Strengths of Japan and Germany: Japan and Germany have strength in technology and integration of manufacturing general.



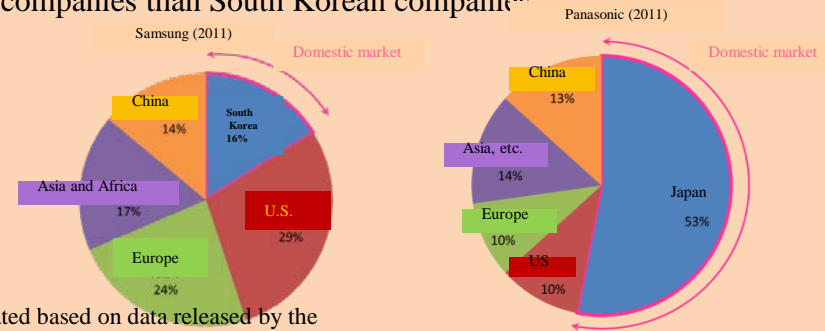
Weaknesses of Japan: Low motivation for overseas business expansion, low ratios of international trade (dependence on domestic markets), unwillingness to globalize, and low trade value of goods against GDP

Strengths of the U.S. and Germany: Compared with other countries, the United States is generally strong and balanced, and takes advantage of companies' capacity to adapt to changes in markets, active industry-academia collaboration and technology transfer, as well as proactive utilization of marketing technology and high quality business management education.

Source: Created by METI

<Break away from dependence on the domestic market to promote globalization>

Japan is also significantly inferior to other major countries in globalization, one of the indicators of competitiveness. A great dependence on the domestic market is considered to be one of the causes. For example, in the electronics industry, overseas sales ratios are lower for Japanese companies than South Korean companies.



Source: Created based on data released by the respective companies

【Urgent need to improve the location environment via the TPP and other economic partnerships】

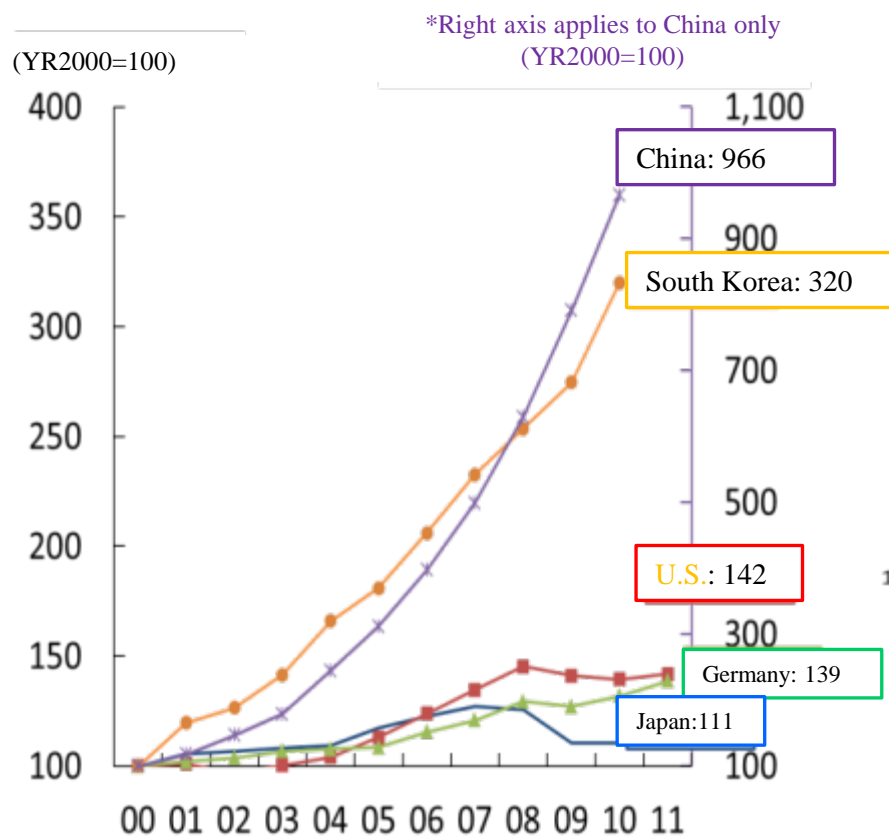
Economic partnerships are indispensable to strengthening the competitiveness of Japan's exports through such means as the elimination of tariffs. Broad-based economic partnerships are particularly important amid the formation of global supply chains. Japan expressed its intention to participate in TPP negotiations in March 2013. By proactively participating in the rulemaking process, it is expected that Japan will successfully enhance its brand power through measures with regard to tariffs and a stricter crackdown on counterfeit goods and illegal copying, and will create easy-to-use place of origin regulations.

【Problems and Future Direction (ii)】Need to strengthen and maintain technology and facilities which are the source of companies' potential competitiveness

(R&D activities, the source of new technology, have been sluggish both quantitatively and qualitatively)

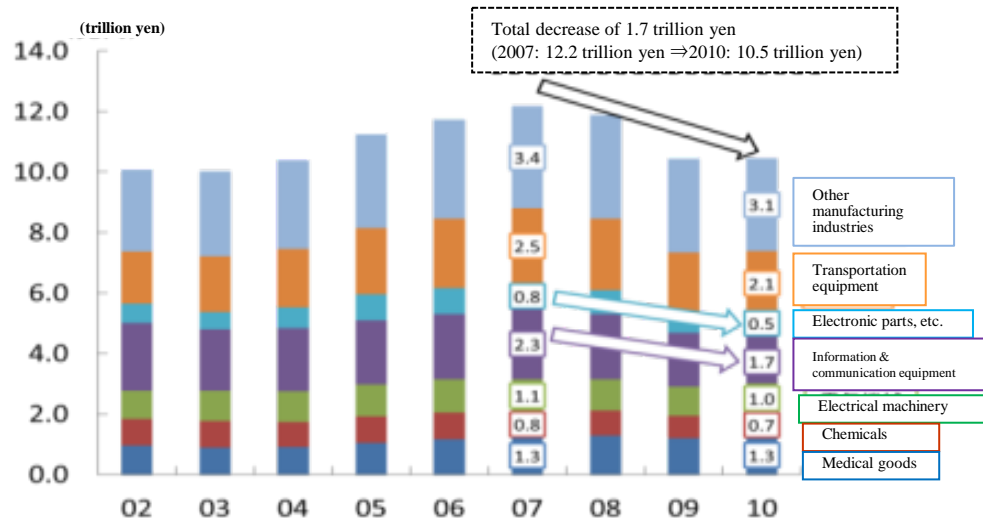
- R&D spending by Japanese companies is leveling off (quantitative stagnation) across almost every industry, while R&D spending is significantly increasing in China and South Korea.
- Japanese companies have an increasing tendency to seek short-term outcomes from R&D activities (qualitative stagnation).

【Chart 1: R&D Spending by Companies in Major Countries】



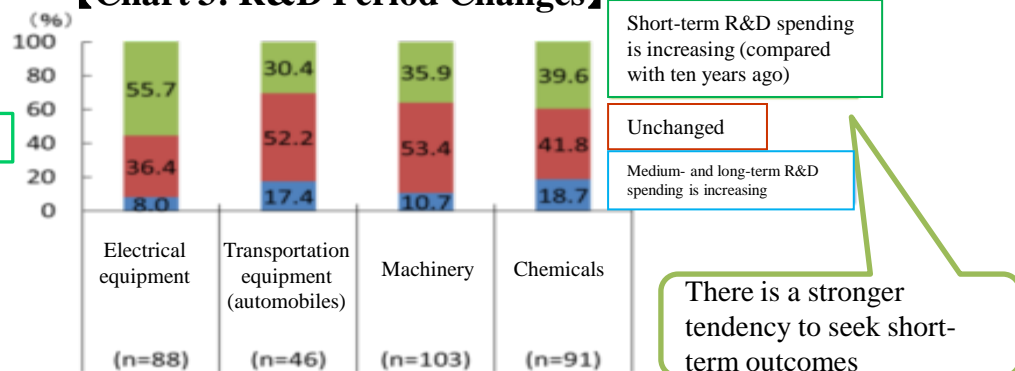
Source: OECD

【Chart 2: Changes in R&D Expenses by Industry】



Source: "Science and Technology Indicators 2012" (National Institute of Science and Technology Policy)

【Chart 3: R&D Period Changes】

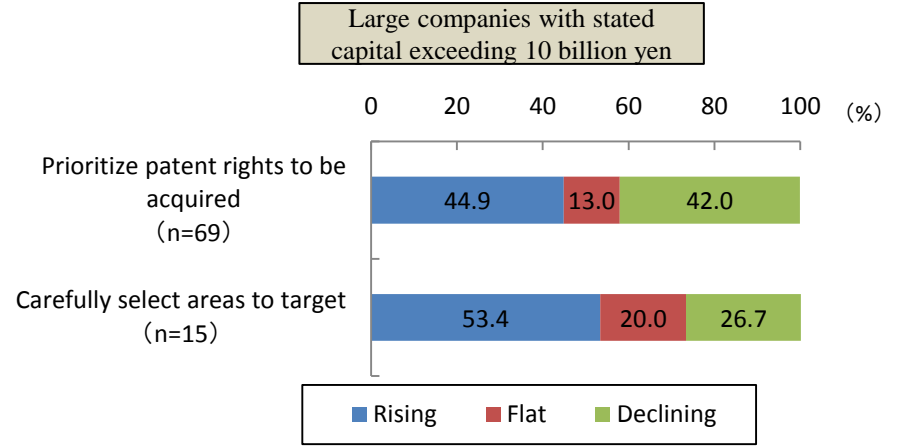


Source: Surveyed by METI (December 2012)

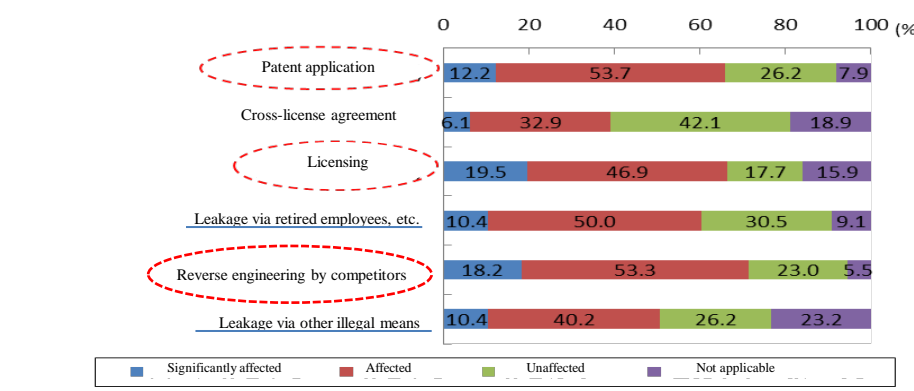
(Strategic acquisition and exercise of patent rights is required)

- The acquisition of patent rights in order to preserve the profitability of technology is important. However, the acquisition of a large number of patent rights does not necessarily equate to increased profits. Emphasis should be placed not only on the number but also on the quality of patent rights acquired, thereby expanding corporate earnings.
- Unless patent rights are strategically utilized, patent registration may end up merely disclosing novel technology. Furthermore, only a small percentage of Japanese companies file suit or have licensing negotiations even when they discover patent infringement. Strategic acquisition and exercise of patent rights is required.

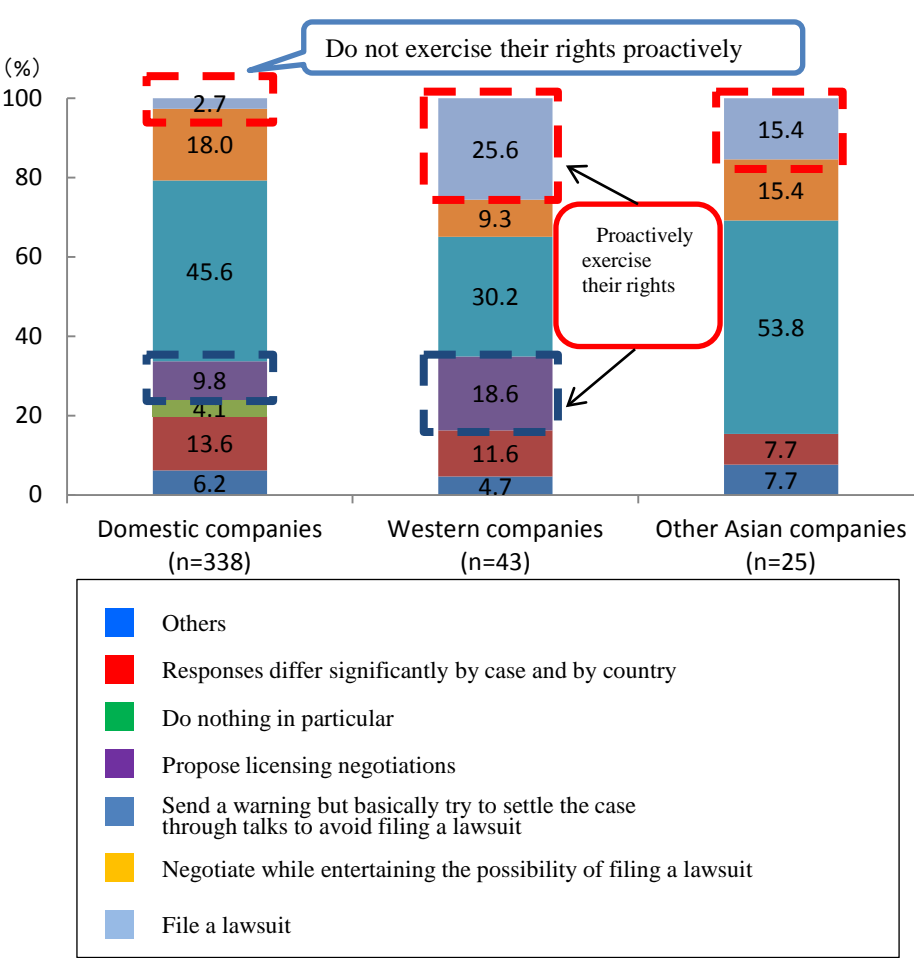
【Chart 1: Patent Acquisition Strategies and Business Profits】



【Chart 2: Influential Technology Transmission Routes】



【Chart 3: Responses upon Discovering Patent Infringement】



Source: Surveyed by METI (February 2013)

Source: "FY2012 IP Internationalization Strategy Promotion Project" (Japan Patent Office)

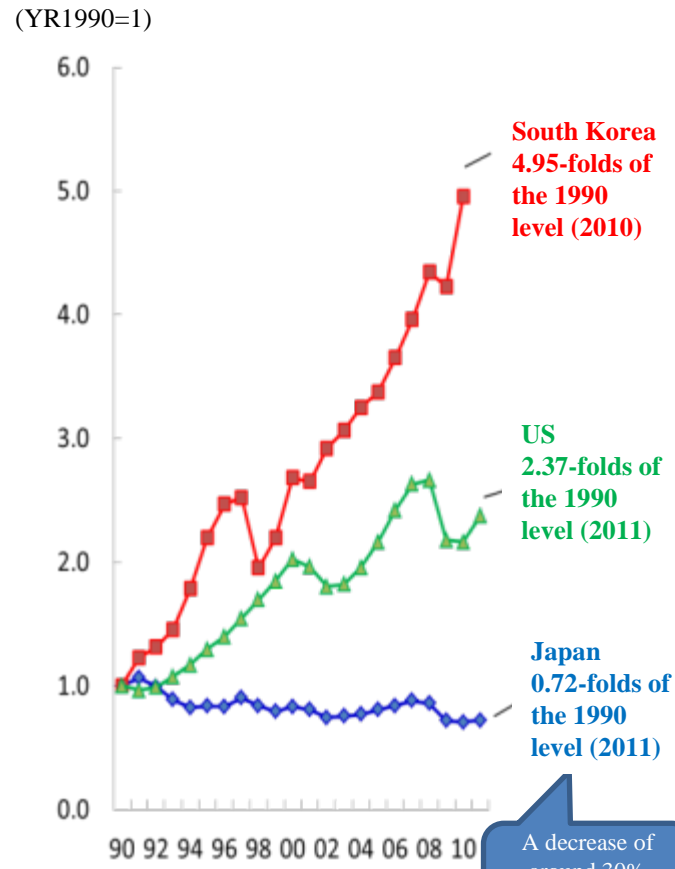
(Sluggish domestic capital investment and the aging of facilities)

- Capital investment decreased by approximately 30% over the two lost decades, and facilities aged by approximately six years over the same 20 year period.
- Free cash flow (business profits + depreciation allowance) affects capital investment significantly. Unless profit ratios improve, further capital investment is difficult.

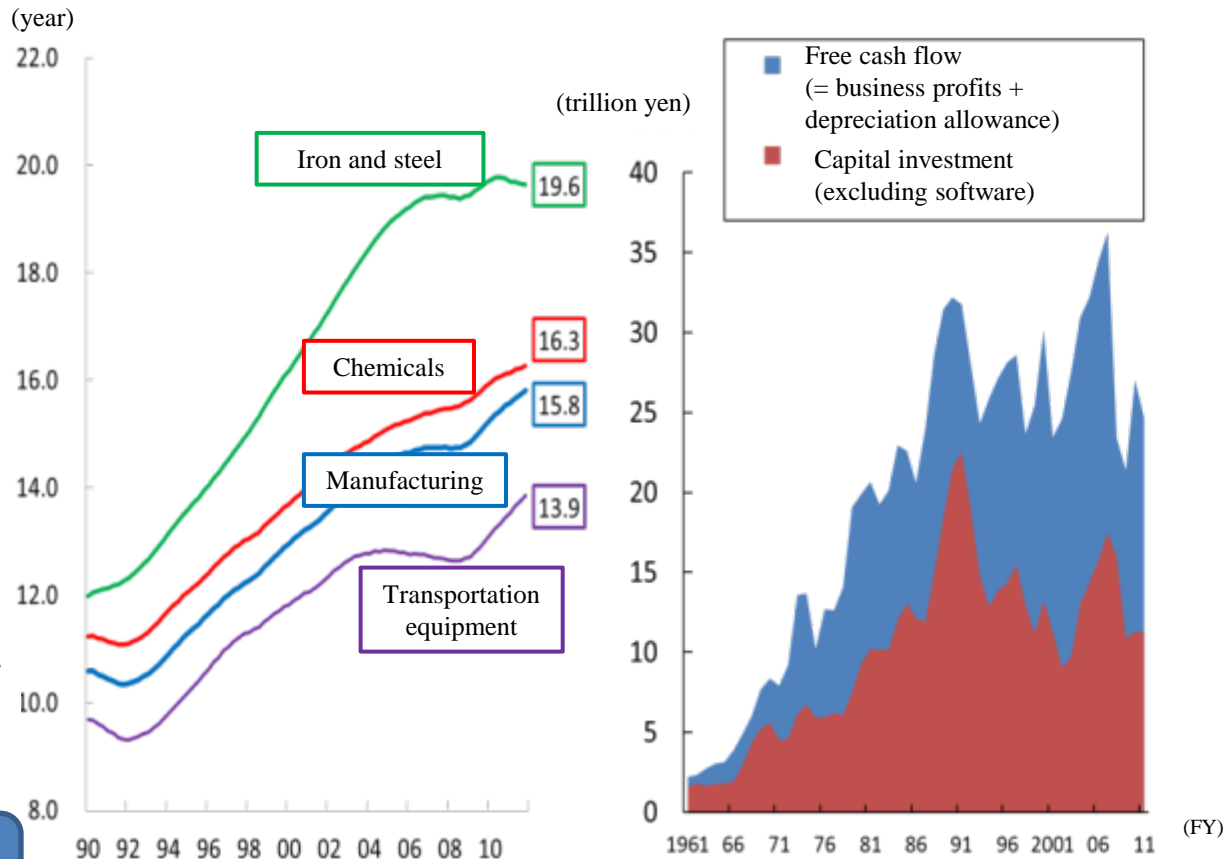
【Chart 1: Changes in Companies' Capital Investments】

【Chart 2: Changes in the Age of Facilities】

【Chart 3: Cash Flow and Capital Investment】



Source: OECD



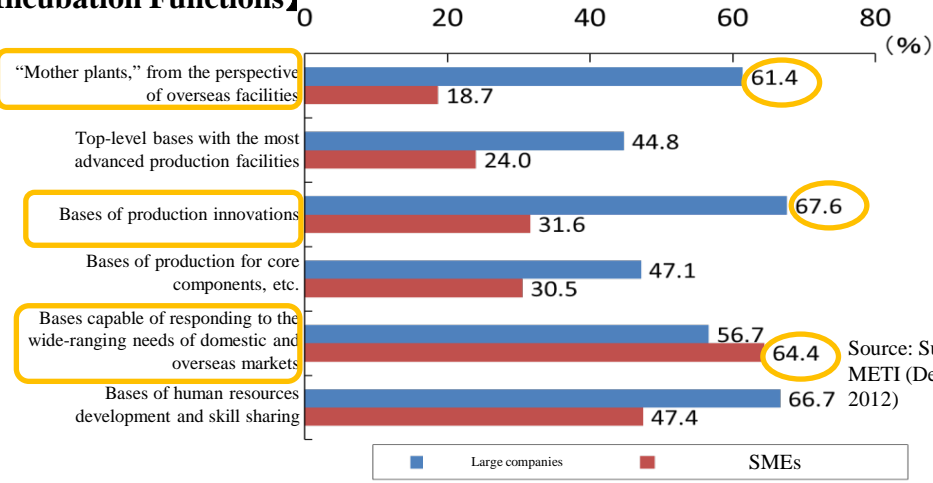
Source: Created based on “Gross Capital Stock of Private Enterprises” and “National Wealth Survey” (Cabinet Office)

Source: “Financial Statements Statistics of Corporations by Industry” (Ministry of Finance)

(It is important to streamline, and to develop an environment that encourages investment leading to enhanced competitiveness)

- There is a need to develop an environment that encourages R&D and capital investment leading to enhanced competitiveness (in particular, strengthening and maintenance of the incubation functions of domestic facilities as production bases for global business expansion).
- Furthermore, it is important to promote research and product development fully based on the needs of customers and society, as well as to streamline, and prepare regulations that will enable prominent technologies to lead to new businesses.

【Chart: The Role Domestic Production Bases Play in Terms of Incubation Functions】



【Domestic production bases capable of responding to various customer needs (example of incubation functions)】

At NEC Personal Computers Ltd., the Yonezawa Plant (Yonezawa City, Yamagata) fulfills an incubation function for NEC's entire PC business at group companies. The plant has the strength of being able to respond to the need for variable-quantity, multi-product production with a short delivery time, which is unrivaled by any of its overseas production bases.

The plant outstrips overseas production bases in its per capita output, under a mixed production system with a small number of multi-skilled workers and through steady improvements. These constant efforts and thorough commitment to manufacturing have led to the renown of the "Yonezawa production method" both in and outside of Japan.



< Cases requiring streamlining and preparation of regulations >

【Fields related to advanced medical care and drug development】

Regenerative medical treatments such as those using iPS cells and the development of biological drugs require highly advanced technology and are fields in which Japan can have a strong presence. New regulations and rules need to be prepared in order to promote technology development and commercialization in an effective manner.

【Fields related to medical care and nursing care】

It is expected that robotics technology and other advanced manufacturing technology will be used in fields related to medical care and nursing care, which have a growing variety of needs. It is necessary to clarify the provisions of the Long-Term Care Insurance Act in order to improve predictability of development.

【Commercialization of leading-edge robotics technology in medical equipment】

CYBERDYNE Inc. has developed a robot suit to be worn on the body, which assists, expands, and improves body functions.

【Fields related to automobiles】

In order to promote the popularization of electric vehicles and vehicles with advanced safety technology which represent the crystallization of Japan's advanced manufacturing technology, there is a need to develop a mechanism and infrastructure to ensure the safety of such vehicles.

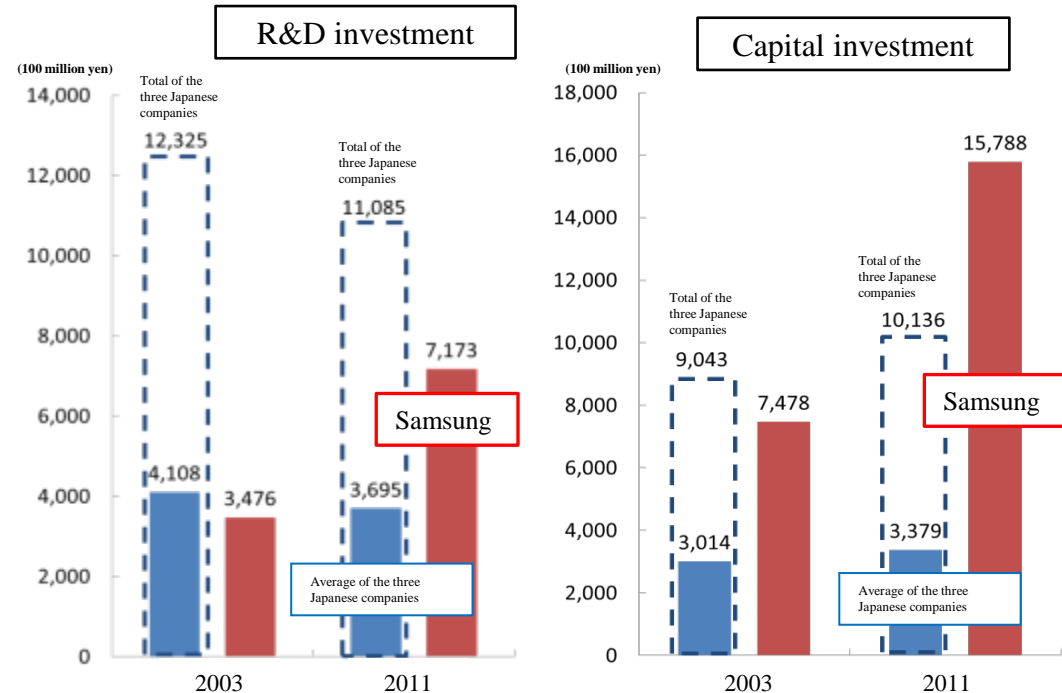
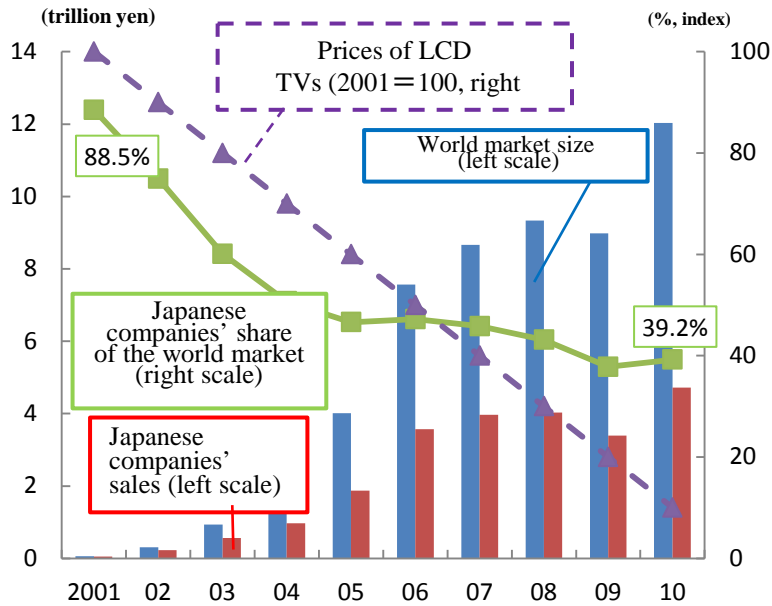
【Problems and Future Direction (iii)】A business model transformation is needed to allow companies to demonstrate their competitiveness

(Shifting Japan’s traditional business model, which rests on the belief that high-performance, high-quality products sell well)

- In commoditized product fields, such as televisions, companies have found themselves in price competitions and are losing their market share. In such fields, companies should shift to new business models which proactively utilize outsourcing rather than adhering to self-sufficient policies.
- Furthermore, a large number of Japanese companies operate within the same industry and their competitiveness is dispersed. It is possible that the scale of individual investments has been insufficient or redundant. Japanese companies should seek to become major, global companies through business restructuring, etc. to ensure globally competitive business.

【 Chart 1: TV (liquid-crystal (LCD) and plasma) Market Size and Market Share】

【 Chart 2: Comparison of Capital Investment by Japanese and South Korean Electronics Companies】



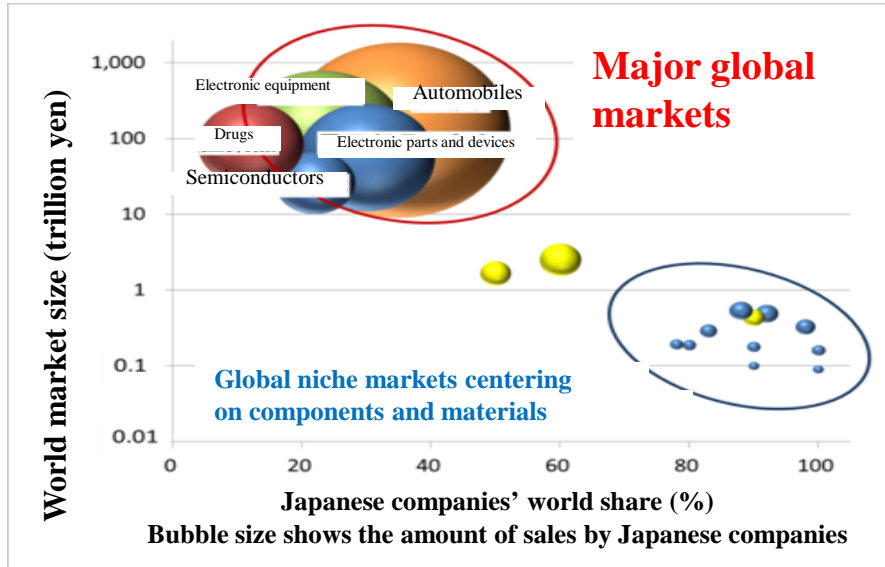
Remarks: Changes in the price of LCD TVs are represented by an image.
Sources: Based on the “Quantitative Survey of Japanese Companies’ Competitive Position in the World” (FY2008-2011 Industrial Technology Survey Commissioned by METI) and “Production Forecasts for the Global Electronics and Information Technology Industries (JEITA).”

Remarks: The three Japanese companies refers to Panasonic, Sony, and Sharp.
Source: Created by METI based on data released by the respective companies

(It is important to create and foster highly competitive, global companies at the top of the niche markets)

- A select group of Japanese companies maintains large market shares and is recognized as indispensable throughout the world.
- It is important to create and foster highly competitive global companies at the top of the niche markets, by properly selecting business fields in which their technology can be employed to the best advantage, while avoiding falling into a competition based on scale.

【Chart 1: Japanese Companies' Competitive Position in the World】



【Business expansion centering on a company's own technology and materials】

Daicel Corporation has a top-level share in the world market in the niche field of inflators for automobile air bags. Inflators start working within just a few milliseconds of a collision to open the air bags. The company has accumulated know-how in the handling of explosives, and its ability to meet difficult requests from auto manufacturers to ensure the safety and reliability of inflators, as well as to save weight and reduce costs, has allowed it to successfully acquire a market share.



【Chart 2: Goods for which Japanese Companies Have a Large Market Share】

	Goods	Share
Automobiles	Vehicle glass	75%
	Wire harness	58%
	Air bags	30%
Electric and electronic items	Liquid crystal polarizing plate protective films	100%
	Glass for liquid crystal displays	50%
	Electronic compasses (for GPS)	82%
	Fluorescent substances (LED)	60%
Semiconductors	Semiconductor sealing	91%
	Photoresists (UV) (sensitive material)	77%
Machinery	Ball bearings	98%
	Numerical control (NC) devices	72%
Iron	Hypertonic steel	80%
	Magnetic steel sheets	47%
Others	Rare earth magnets	96%
	Carbon fiber	68%

【A company manufacturing small bearings boasts a share at the top of the global market】

The small bearings from Minebea Co., Ltd. have a share at the top of the global market. The company specializes in small bearings, instead of the large ones whose market is dominated by western companies, and has accumulated technological capabilities.

The company maintains strong competitiveness against other Asian companies with its unequaled technology.



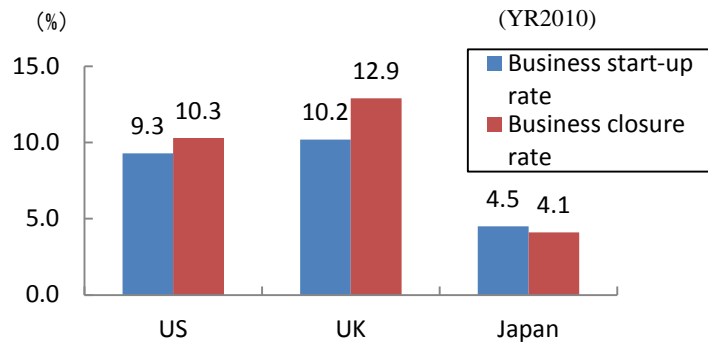
Source: "Quantitative Survey of Japanese Companies' Competitive Position in the World" (FY2010 Industrial Technology Survey Commissioned by METI)

【Problems and Future Direction (iv)】It is necessary to facilitate the renovation of industry to promote more effective utilization of inefficiently employed management resources and strengthen competitiveness

(It is necessary to develop an environment that facilitates the renovation of industry)

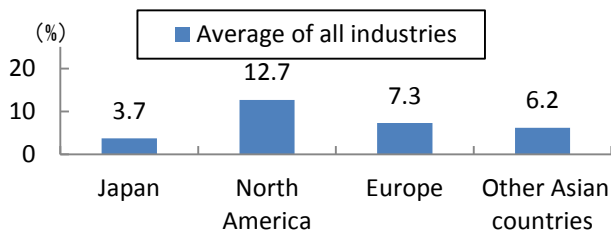
- Japan’s business start-up and closure rates are lower than those of western countries, and the profitability ratio is also low in Japan. Many Japanese companies are holding on to inefficient business undertakings and don’t make use of their human resources, facilities, and other management resources. Industrial renovation has not made progress.
- Development of the business environment is needed to encourage companies to transform their business by effectively utilizing management resources in the unprofitable sectors, or by entering new fields (such as renewable energy and collaborative areas between agriculture, commerce, and industry), and to promote collaboration among SMEs (effective use of regional resources, etc.).

【Chart 1: Comparison of Business Start-up and Closure Rates in Japan, the U.S., and the UK】



Source: Japan “Annual Report on Employment Insurance Services FY2011” (MHLW)
 US: “The Small Business Economy: A Report to the President (2012)” (U.S. Small Business Administration)
 UK: “Business Demography (2010)” (Office for National Statistics)

【Chart 2: International Comparison of Profitability Ratios】



Source: “Current International Competitiveness of the Machinery Industry in America, Europe, Japan, and Other Asian Countries (FY2011)” (Japan Machinery Center for Trade and Investment)

【Business expansion in the environmental field through a company’s use of its existing technologies】

Daiwa Chemical Industries Co., Ltd., an Osaka-based manufacturer of environment-preservation equipment, had previously engaged in the development of dry cleaning units but predicted future stagnation of the laundry business. Therefore, the company started a new business undertaking in the environmental field while fully utilizing the existing technologies that it had previously employed for dry cleaning units, in ways such as applying its gas recovery technology to the treatment of volatile organic compounds (VOC), and using its distillation technology to treat sewage. The company continues to cultivate new customers.



【Effective use of idle plants and new challenges in the field of agriculture】

Nisshinbo Holdings Inc. suspended operation of its denim plant in Tokushima prefecture as a result of production system reforms, but decided to utilize it as a plant factory and has been trying its hand at a new business field. The company started growing strawberries, for which demand can be expected throughout the year from pastry shops and confectioners. The company plans to utilize its Fujieda plant and others for commencing new types of business undertakings in a similar manner.



(It is necessary to strengthen competitiveness by utilizing potential management resources)

- It is necessary to strengthen the competitiveness of the manufacturing industries by encouraging companies to effectively utilize their potential management resources such as by establishing well-designed business strategies, utilizing the female workforce, and creating mascots associated with local industry.

【Utilization of external consultants to supplement corporate management capabilities】

Fuji-shi Industry Support Center (f-Biz) provides various types of business support to SMEs. Through consultations with companies, the center discovers selling points of the companies that they themselves are not aware of; works with them in finding a way to present such selling points, sell products, and find business partners with the goal of creating new business; and supports their efforts continuously. Systems for producing the kind of highly competent consultants and business support seen at this Center need to be developed in order to explore companies' potential and allow them to succeed in business.



【A foundry aiming to make it easier for women to work there】

In general, women working at foundries tend to work in the office, in fields such as design, testing, and analysis. However, at Sasaki Chukosho, K.K., many female workers work in metal casting. Aiming to make the foundry safer and more comfortable, the company has instituted safety measures and labor-saving efforts, as well as supporting women's participation in the labor force, providing a dressing room equipped with shower rooms and dressers for its female workers, and in other ways.



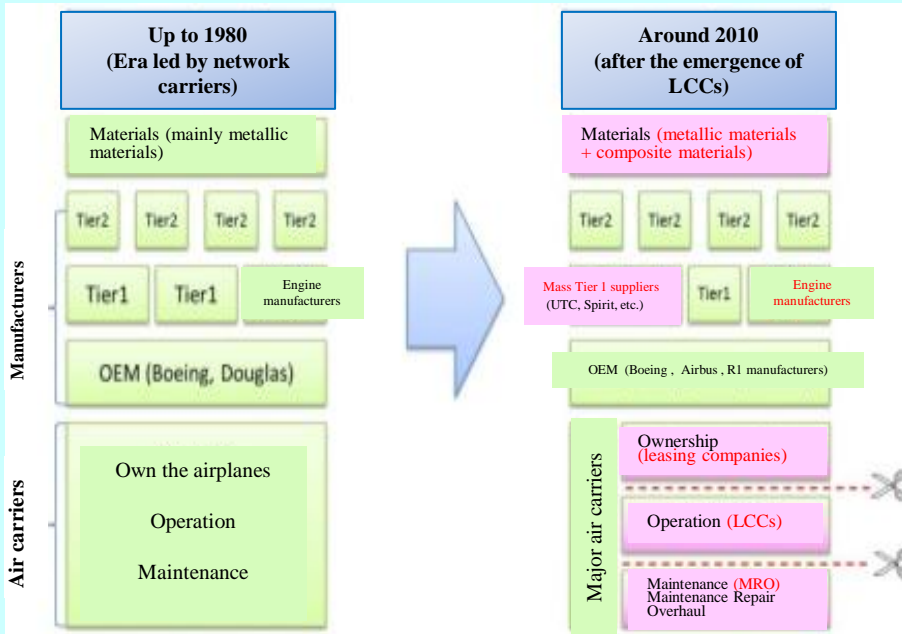
【Introduction of the local manufacturing industry using a strange but lovable yuru-kyara mascot】

Bally-san, the Tourism Ambassador of Imabari City, is a mascot that wears a belly-warmer made of an Imabari towel, epitomizing and symbolizing the charm and characteristics of the city. The character actively engages in PR activities promoting the Imabari towel and other manufacturing industries of the city, and is expected to bring about a favorable effect in terms of regional development and industrial promotion. Utilization of such strange but lovable mascots is one of the means that can be employed to introduce people to local manufacturing industries and establish a brand image.

【Structural changes in the world aircraft industry】

The easing of regulations in the aircraft industry brought about a new business model under which multiple companies horizontally divide labor, i.e., leasing companies purchase airplanes, low-cost carriers (LCC) operate flights, and special companies called MRO (maintenance, repair and overhaul) do maintenance work, in addition to the conventional business model of major air carriers where they vertically integrate everything from purchase to operation and maintenance of the airplanes. In the meantime, company reorganization led by tier-one suppliers has progressed in the aircraft manufacturing industry, and massive tier-one suppliers with the capacity to develop and manufacture wide-ranging aircraft components have emerged.

The Japanese aircraft industry also needs to develop into an industry that can provide comprehensive added value, covering materials and components to assembly, operation, and maintenance of airplanes.



【Creation of innovation through industrial clustering, in tandem with recovery from the Great East Japan Earthquake】

The Miyagi Reconstruction Park is the base for the renting of plants and facilities to companies and organizations that sustained damage in the Great East Japan Earthquake, using idle facilities at the Sony Corporation Sendai Technology Center, in Tagajo City, Miyagi for the purpose.

People aiming to get back into their existing business undertakings faster, SMEs trying to expand into new business areas, and universities, research institutes, and companies engaging in research and development under industry-university collaboration with the aim of achieving the practical use and commercialization of new technology, are eligible to rent such facilities. The ultimate goal is not only to repair the damage from the earthquake, but to create a series of innovative moves for manufacturing and the improvement of local companies' technological capabilities through collaboration among industry, academia and government,

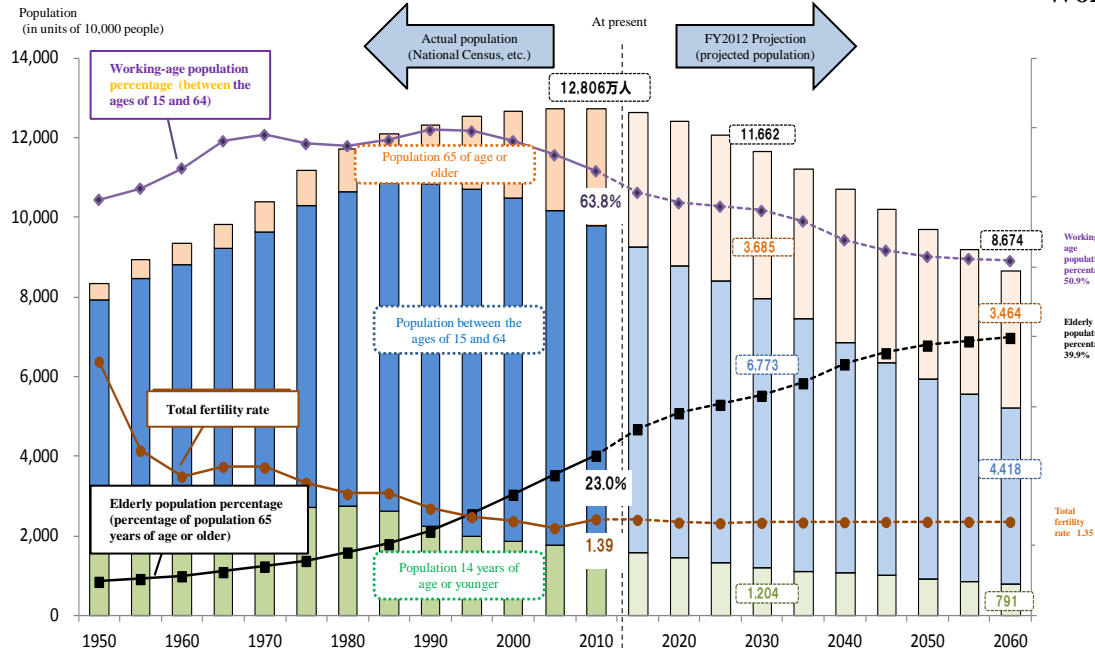


Section 1: Current Status and Problems at Manufacturing Sites

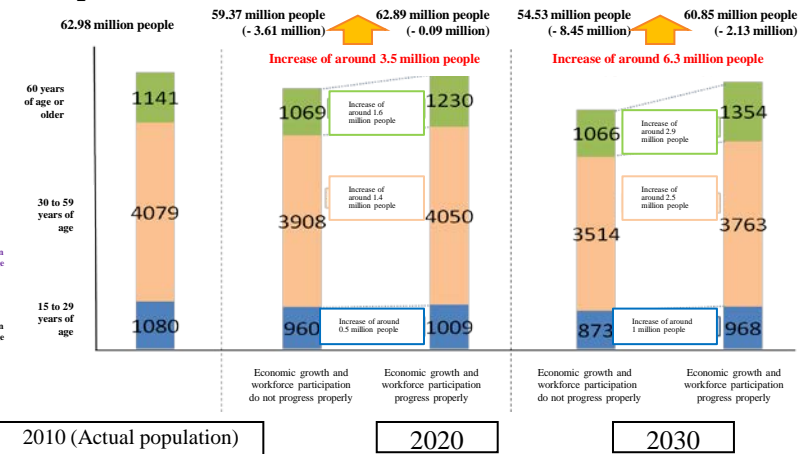
1. Future of the Manufacturing Industry in a Society with a Declining Population

- As depopulation and the aging of the population are expected to progress in the future, it is important to build a fully participatory society and further enhance per capita labor productivity in order to ensure economic growth in Japan.
- * A report compiled by the Study Group on Employment Policy estimates that it would be possible to avoid a significant decline in the number of workers even as late as 2030, when the total population is expected to have decreased by 10 million people, if economic growth and workforce participation progress properly.
- The manufacturing industries remain major export industries and play a significant role in the Japanese economy. Fostering human resources in manufacturing to support these industries is of great importance.
- * A report compiled by the Study Group on Employment Policy estimates that the number of workers in the manufacturing sector can remain at the level of 9.87 million in 2030 if economic growth and workforce participation progress properly.

【Chart 2-1: Changes in the Population of Japan】



【Chart 2-2: Simulation of Changes in the Number of Workers up to 2030 (Total Number of Male and Female Workers)】



Source: "National Census" (Ministry of Internal Affairs and Communications), "Population Projection for Japan (Jan. 2012): Medium-Mortality Assumption" (Population as of October 1 every year) (National Institute of Population and Social Security Research), "Vital Statistics of Japan" (MHLW)

Remarks: 1. The projection was made by the Japan Institute for Labour Policy and Training, based on the "Population Projection for Japan (Jan. 2012)" issued by the National Institute of Population and Social Security Research.
 2. Economic growth and workforce participation progress properly: assumes that high economic growth is achieved and that participation in the labor market progresses
 3. Economic growth and workforce participation do not progress properly: assumes that reconstruction demand will maintain economic growth at a level similar to that in which economic growth progresses to some extent until 2015, but that thereafter the economic growth rate and the price change rate both remain at zero and that participation in the labor market does not progress (assumes that the labor force participation rate with regard to gender and age remain unchanged (presumption in 2010))

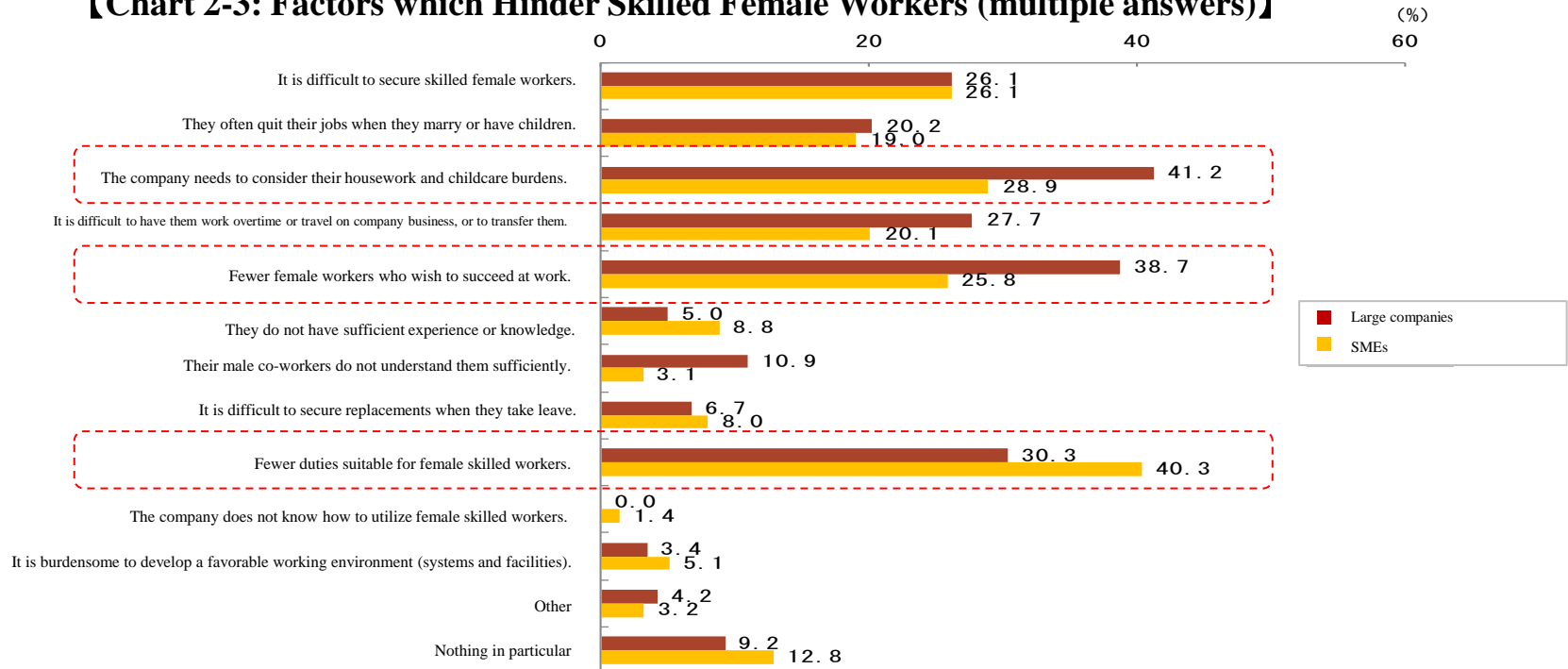
Source: Actual population for 2010: "Labor Force Survey" (Ministry of Internal Affairs and Communications) (interpolated values based on the 2010 (new) standard population); Projected population in 2020 and 2030: "Projection of Labor Demand and Supply - Policy Simulation based on the 2012 Labor Demand and Supply Model (2013)" (projection by the Japan Institute for Labour Policy and Training)

2. Skilled Female Workers

(Utilization and fostering of skilled female workers and future challenges)

- Females account for approximately 30% of workers in manufacturing, lower by around 10% than the ratio across all industries.
- More than 90% of companies provide their skilled female workers with the same training that is provided to skilled male workers.
- Factors that hinder the activities of skilled female workers could be the “need to consider the burdens of housework and childcare” and “fewer female workers who wish to succeed at work” at large companies, together with “fewer duties suitable for female skilled workers” at SMEs.
- Most companies provide their skilled female workers with the same training that is provided to skilled male workers. There seems no specific bottleneck for skilled female workers, and manufacturing industries could provide women with better working environments. However, SMEs seem particularly unwilling to hire female workers.

【Chart 2-3: Factors which Hinder Skilled Female Workers (multiple answers)】



【Column: Skilled female workers playing active roles】

Company M in Kanagawa prefecture is an electric equipment manufacturer with around 60 employees. The majority of its employees, including part-timers, are female, and 40% of its full-time skilled workers are female. The company is very active in utilizing skilled female workers.

Representative Director A says, “Gender and age mean nothing. I want all employees to perform their duties while fully employing their own characteristics and abilities.” According to him, the same duties are assigned to all employees at Company M, irrespective of gender.

Furthermore, Mr. A says, “Recently women have ceased resigning upon marrying and an increasing number of women study hard in university. Therefore, it has become easier for us to secure female workers.”

Company M started to promote female workers to managerial positions three years ago, and there are three female managers/supervisors at present. One of them was initially hired as a part-timer, but subsequently attained full-time status and was later promoted to supervisor. “I want female workers to be managers/supervisors as well, and have them actively participate in municipally-organized management seminars targeting women,” says Mr. A.

Mr. A often encourages female workers to exercise their abilities on such occasions as in-house meetings and gatherings. His daily communications with female workers may also create an atmosphere where skilled female workers can be active in their duties.

Ms. B, who is in her 40s, initially started working for Company M as a part-timer seven years ago and became a full-time worker a year and a half ago. She is now engaged in assembly work.

Ms. B, who is working in manufacturing for the first time, says, “Electrical equipment mechanisms are very difficult, and I was confused at first. Although the task required attention to detail, I recognized that I would be able to handle it once I got used to it. After around a year, I had acquired a knack for the work and became confident after around three years.” She seems to be playing an active role as a skilled female worker.

Ms. B also says, “Plant operation hours are fixed and all workers finish work at the same time, and we seldom work overtime. The plant is closed on weekends and we can be certain of having days off, enabling us to more easily balance work and family.”

In response to a question as to whether there were any changes after she became a full-time worker, Ms. B says, “When I became a full-time worker, the president told me how I should be prepared as a member of the company and this changed my awareness. I sometimes feel pressure but I find my job very rewarding.”



A skilled female worker doing assembly work

(Future direction for further utilization of skilled female workers)

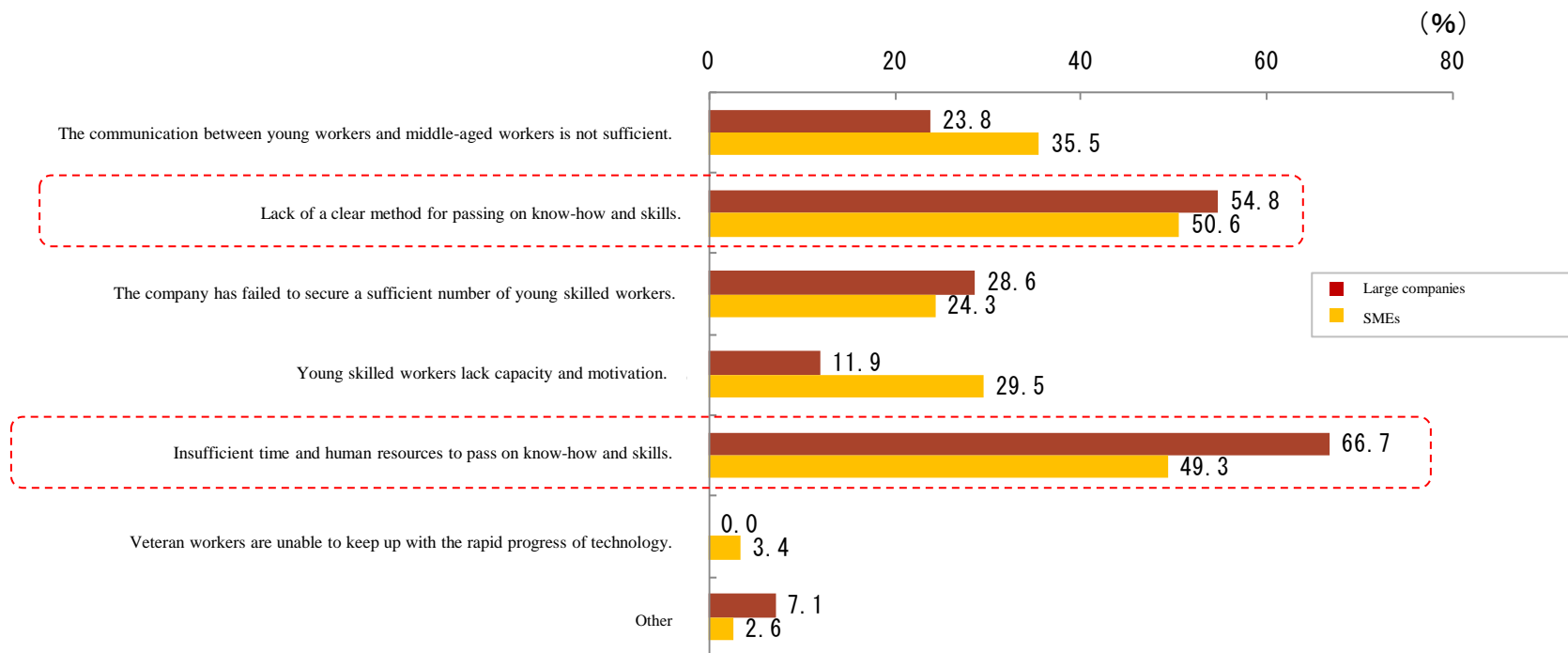
- In order to encourage women to find jobs in the manufacturing industries, where the ratio of female employees to male employees is lower at present, it is important to develop working environments comfortable for women and to make efforts to progress in building the capacities of skilled female workers.
- Measures to support childrearing, measures to achieve a work-life balance, and positive action need to be promoted on an ongoing basis.
- As SMEs seem unwilling to hire skilled female workers, it is also important to make efforts to raise the awareness of business operators to encourage them to actively employ female workers.

3. Skilled Elderly Workers

(Utilization of skilled elderly workers and transfer of skills to skilled young workers)

- While the total number of workers in the manufacturing industries declined by approximately two million over the last ten years, the number of those aged 60 or older has increased by 200,000 or more, with their percentage of the total increasing from approximately 11% in 2002 to approximately 15% in 2012.
- More than 90% of companies have been making efforts to facilitate the transfer of skills from skilled elderly workers.
- Nearly 40% of companies have failed to facilitate the transfer of skills from older to younger workers, often due to such reasons as “lack of a clear method for passing on know-how and skills” and “insufficient time and human resources to pass on know-how and skills.”

【Chart 2-4: Reasons for Failure to Transfer Skills (multiple answers)】



Source: “Survey on Securing and Fostering Skilled Workers to Achieve a Fully Participatory Society (2012),” (Japan Institute for Labour Policy and Training)

【Column: Roles expected of skilled elderly workers】

Company W in Gifu prefecture is a company with around 80 employees that manufactures electric machine components by metal stamping. The company has obtained an ISO9001 certificate and invests a great deal of effort in quality improvement. Company W has a cooperative relationship with a major electrical machinery manufacturer and is also making efforts to cultivate other business partners.

The company is willing to hire elderly workers. Although its official retirement age is 60, some time ago the company introduced a system to rehire all employees who want to continue working up to the age of 65, and their employment may be extended until age 70 or even older on a case-by-case basis.

At present, there are 13 workers over 60 years of age, and their duties and working hours are determined based on their individual circumstances. One of these workers serves as a section chief and is expected to provide proper advice and guidance to young workers in the event of unexpected troubles at the workplace and thereby manage the situation. The administration division chief of Company W says, “Manufacturing sites depend completely on highly skilled workers with many years of experience, and they are challenging for companies to retain. It is very important that skilled elderly workers play active roles in the workplace.”



A skilled elderly worker instructing a young staff member because a problem has occurred

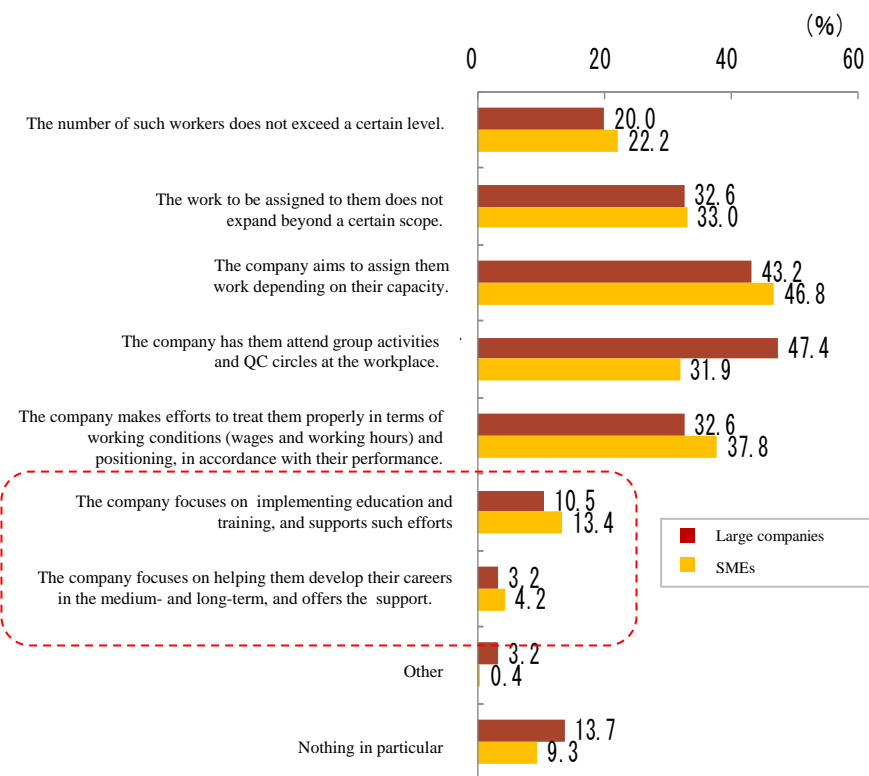
(Future direction for further utilization of skilled elderly workers)

- Amid a decline in the working-age population, elderly people over 60 years of age are also required to play a role as a key labor force. Elderly people with rich knowledge and experience are major players in the manufacturing industries, and it is increasingly important for them to develop their own capacities by further advancing their careers and assuming leadership, while organizing the knowledge and skills they have already acquired as necessary.
- Companies should proactively provide training to existing workers to enable them to adapt their skills to technological innovation so that the skills of elderly skilled workers do not become obsolete.
- Skill transfer – an objective in the utilization of elderly workers – is often unsuccessful. Support is needed to facilitate the transfer of skills to younger people via the National Trade Skill Test system and the *Monodzukuri* (Manufacturing Industry) Meister System, which debuted in FY2013 and gives skilled workers the chance to provide practical instruction to younger people. At the same time, companies should make greater efforts to utilize the skills elderly workers have amassed.

4. Non-permanent Skilled Workers (Status of utilization and human resources development)

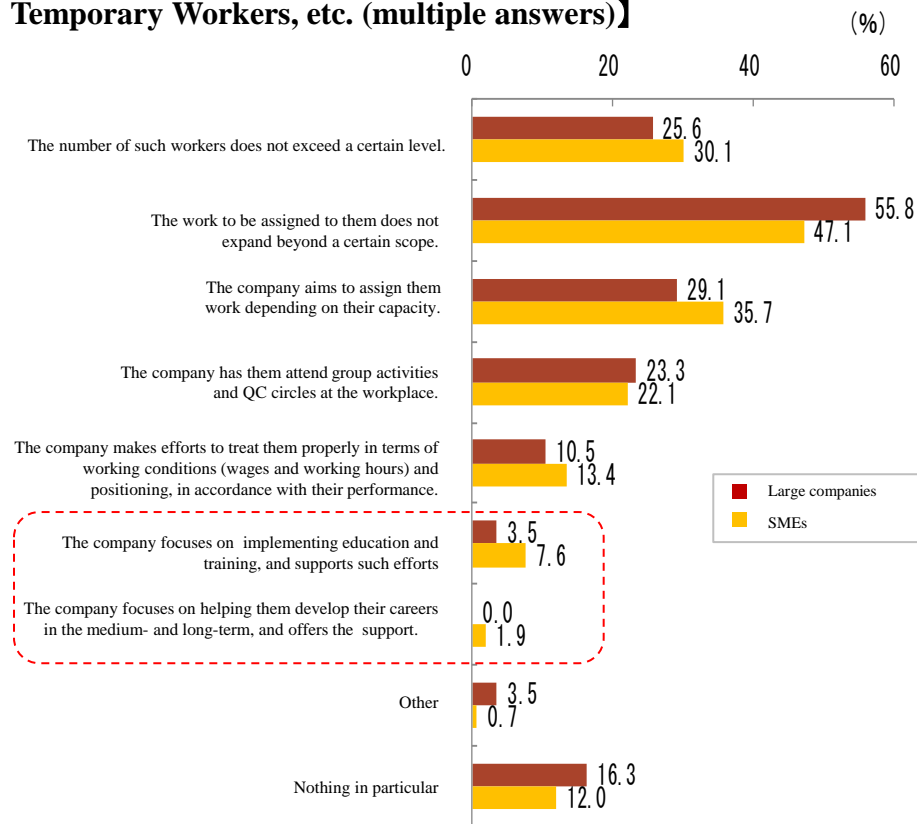
- The number of non-permanent workers is increasing, and they now account for one-third of all employees and approximately 20% of employees in the manufacturing industries.
- Only a small number of companies answered that they are “focusing on implementing education and training, and support such efforts” or “focusing on career development in the medium- and long-term, and offer support” with regard to all of their part-timers, contract workers, and dispatched workers.
- Compared to part-timers and contract workers, dispatched workers have even fewer chances to receive education and training or career development support.

【Chart 2-5: Matters to Take into Consideration in Utilizing Part-Timers and Contract Workers, etc. (multiple answers)】



Source: “Survey on Securing and Fostering Skilled Workers to Achieve a Fully Participatory Society (2012),” (Japan Institute for Labour Policy and Training)

【Chart 2-6: Matters to Take into Consideration in Utilizing Temporary Workers, etc. (multiple answers)】



Source: “Survey on Securing and Fostering Skilled Workers to Achieve a Fully Participatory Society (2012),” (Japan Institute for Labour Policy and Training)

(Future direction for further utilizing non-permanent skilled workers)

- **The education, training and career development support offered by companies to non-permanent workers is generally insufficient. It is important to encourage workers to utilize career consulting services to enable them to build their capacities.**
- **It is also important to provide know-how to help each company create training curricula, to offer comprehensive assistance to their systematic career progression efforts, including the cultivation of in-house human resources (Career Progression Subsidy), and to support business operators who provide vocational training to non-permanent young workers or who try to employ and retain them as permanent workers after such training (Grant for Fostering and Retaining Young Workers (Youth Challenge Grant)).**

5. Measures to be Taken in the Future to Achieve a Fully Participatory Society

- **In order for the Japanese economy to maintain its vitality and achieve further development, it is indispensable to create a society where all willing and able people can work. In particular, the national government must offer strong support for capacity development with the aim of increasing labor productivity.**
- **The capacities obtained by workers through vocational training and daily work should be properly evaluated not only within their respective companies but also beyond them, and lead them to find proper jobs. The Job Card system and Vocational Ability Evaluation Standards need to be reviewed as necessary.**
- **It is important to ensure that every person has the opportunity to develop and enhance his/her vocational abilities and career at any time. Therefore, efforts should be made to provide people with opportunities to receive necessary vocational training in their local communities and to prepare training courses based on local personnel needs in close cooperation with public vocational training organizations, private training institutions, and economic associations in the respective regions. It is also necessary to improve access to career consulting services.**
- **Labor movement is expected to increase, particularly among female workers and non-permanent workers, amid expected future changes in industrial and employment structures. Therefore, the various retraining support measures need to be enhanced to ensure the existence of opportunities for necessary capacity development.**

Section 2: Government Measures to Promote and Support the Fostering of Human Resources in Manufacturing to Achieve a Fully Participatory Society

1. Measures to Foster Manufacturing Workers (Public vocational training)

- The national government and prefectures will establish public vocational training centers where workers can acquire the skills necessary for their vocations in a phased, systematic manner, and will provide the following three types of training.
 - (i) Training for displaced workers: Targeting displaced workers with the goal of easing their transitions to new jobs through the acquisition of necessary vocational skills and knowledge
 - (ii) Training for incumbents: Targeting incumbents with the goal of enabling them to acquire advanced skills and knowledge to help them respond to technological innovation and changes in industrial structures
 - (iii) Training for school graduates: Targeting graduates from junior or senior high schools with the goal of enabling them to acquire necessary vocational skills and knowledge over a relatively long period of time

【Column: Fresh start beyond 50 years of age】

“I learned various welding technologies and knowledge of construction management through vocational training at the Shiga Polytechnic Center. As the training courses offered many opportunities for hands-on skills-building practice, I was able to become accustomed to fieldwork quickly. The courses mostly consisted of work within a plant and the safety education was also very helpful,” said Mr. A.



Training for the technical metalwork course

Because he needed to change jobs at the age of 52, Mr. A received vocational training at the Shiga Polytechnic Center. He chose the technical metalworking course, a training course which offered the chance to learn various welding technologies and non-destructive inspection techniques, etc. with the aim of helping students find new jobs in such industries as the metal component manufacturing industry.

After finishing the training course in October 2011, Mr. A was employed by a manufacturer of agricultural machinery and various types of storage tanks for agricultural equipment. He is mainly in charge of the final finishing of the products and hydraulic pressure tests, and says that the training he received on the entire process, from welding and preparation of construction management plans to final testing, is of great help in his present job.

He is now trying to acquire brazing techniques to enhance his skills. It is expected that Mr. A, who continues his efforts to pursue growth even in his 50s, will be increasingly active in his new field.

(Career development support)

- The Career Development Subsidy and the Career Progression Subsidy are granted to support the employee career development efforts made by business operators.
- The Job Card system is utilized to provide practical vocational training by combining internships and classroom lectures to help participants find stable employment.
- A system to promote career consulting services will be developed to enable individuals to make their own vocational life plans in accordance with their competence and vocational experience, and to select jobs or receive vocational training to develop their vocational abilities in an effective manner based on such plans.

2. Promotion of Human Resources Development for Younger People (Measures under the FY2012 supplementary budget)

- In order to promote employment and retention of young people as permanent workers, support is offered to business operators who provide vocational training to non-permanent young workers. Furthermore, the Youth Challenge Grant was created to support business operators who further try to employ and retain such young workers as permanent workers after the training.
- In collaboration with local governments, the national government has built networks consisting of local organizations supporting young people and bases such networks around Local Young People Support Stations to provide support for employment or other career decisions for so-called NEETs and other young people. Under the FY2012 supplemental budget, the national government increased the number of such bases and has implemented a project to promote collaboration between support stations and schools and an intensive training program for jobless young people.

3. National Trade Skill Tests and Other Skill Evaluation Measures

(National Trade Skill Tests)

- This is a system to evaluate and authenticate the skills of workers based on certain criteria.
- The system plays an important role in encouraging workers, including manufacturing workers, to acquire skills and enhances their position in society.
- Skill tests are available for 128 job categories as of April 1, 2013, and there are now approximately 4.9 million Certified Skilled Workers.

4. Infrastructure Development to Become a *Monodzukuri* (manufacturing)-based Nation

(Awards for Outstandingly Skilled Workers)

- Awards are given to extremely skilled workers (Outstandingly Skilled Workers) with the aim of fostering a skill-oriented mindset widely in society, thereby enhancing the status and skill levels of skilled workers and at the same time encouraging young people to choose to be skilled workers with pride and hope in accordance with their competence and to devote themselves to jobs of their choice.

【Column: Contribute to the streamlining of operations through an excellent blowing technique used when transferring molten pig iron to a converter】

Mr. Kazuo Nishino (aged 61), steel making engineer, Kashima Works, Nippon Steel & Sumitomo Metal Corporation

Mr. Nishino has a thorough knowledge of manufacturing techniques used in steel making processes.

His particular excellence lies in his ability to ascertain the status of a reaction in a furnace based on the status of the flames at the converter throat and information on the pressures within the furnace, which he then uses to properly operate the furnace.

These skills significantly contributed to the subsequent development of a high-performance lance pipe (note: a pipe to blow high pressure oxygen into a furnace), and Mr. Nishino has received various awards within and outside the company as a leading expert in the industry. Furthermore, he has achieved a great deal by fostering the skills of his junior co-workers.



Mr. Nishino on duty



Converter managed by Mr. Nishino

(National Skills Competition)

- The National Skills Competition has been held every year since 1963 with the aim of motivating skilled young Japanese workers by challenging them compete on the basis of skill, and of providing the general public with an opportunity to closely watch refined skills in practice, thereby emphasizing the significance and importance of skills and fostering a skill-oriented mindset.

【Column: Reaffirm the advantages of the National Skills Competition】

Toshiba Corporation encouraged its young employees to actively participate in the National Skills Competition from its inception. These young employees performed admirably: Sixty four out of 1,000 Toshiba Corporation entrants won first prize (337 have won other prizes). However, the company considered it more important to raise the level of all workers rather than fostering a limited number of top-level skilled workers, and stopped participating in the late 1980s, enhancing in-house training as an alternative.

However, as Japan's manufacturing industry requires outstanding skills and technological sensibilities, the company resumed participation in the National Skills Competition in 2010. The company considers the following to be the advantages of participating in the competition: (i) the company can establish a benchmark with its competitors and enhance its skill potential, which may lead to greater innovation; (ii) participation improves the motivation and work ethic of younger workers; (iii) the company can enhance its corporate image (brand strength); and (iv) the company can improve its skills and exchange information with other leading companies in Japan.

【Column: Interview with the winner of the 50th National Skills Competition】

Furniture Making: Ms. Kaoru Hayashi (CONDE HOUSE Co., Ltd.)

Q: What motivated you to participate in the National Skills Competition?

A: I saw senior staff members devoting themselves to the competition and was inspired to take on the challenge myself.

Q: What exercises (training) did you do prior to the competition?

A: I timed each process to figure out where I was spending too much time, and practiced gradually reducing this wasted time.

Q: What did you find to be gratifying, and what discouraged you during the process of preparing for the competition?

A: It made me happy to receive so many words of encouragement from people at the company and my friends. What frustrated me was that I was unable to reduce wasted time easily.

Q: What was significant for you about your participation in the competition?

A: I could feel that my skills were improving every day, albeit gradually.

Q: How do you intend to make use of your experience of winning the competition?

A: With the belief that my efforts will surely bear fruit in the future, I would like to utilize my experience in my future manufacturing work.



Ms. Hayashi tackling the task of furniture making

Chapter 3 Education, Research and Development to Support the Foundations of Japan's Manufacturing Industries

Section 1 Efforts by Universities (Engineering), Colleges of Technology, Specialized Upper Secondary Schools, and Specialized Training Colleges to Foster Manufacturing Human Resources

- Universities (engineering) provide practical engineering education in collaboration with industries. Colleges of technology provide experience-oriented specialized education with a focus on experiments and practical training sessions. Specialized Upper Secondary schools work on unique projects to foster future specialists in collaboration with local companies, universities or research institutes. Specialized training colleges make efforts to enhance practical and professional knowledge and technology in collaboration with local industries. The unique vocational education provided at each type of school has thus played a significant role.

【Efforts at a university —Saitama University—】

The faculty of engineering of Saitama University promotes close collaboration between university teaching staff and skilled engineers at companies, and employs a new education method integrating virtual training and practical work to foster manufacturing engineers with knowledge of fundamental manufacturing technology and the means to pass on their techniques and skills.

Specifically, the faculty has built an interactive network for technology/skill exchange between Saitama University's knowledge and technological resources and the technological resources of local companies. Saitama University has also been providing manufacturing education on machining technology, material process technology, and means of transferring techniques and skills by way of an interactive skill tradition and training system that integrates novel virtual reality and information-communication technology and through internships at local companies, such as casting companies in Kawaguchi City.

Saitama University's efforts to educate engineers and skilled workers using virtual reality technology earned it the "Japanese Society for Engineering Education Award (Outstanding Performance Award)" in FY2007.

【Efforts at colleges of technology — Colleges of technology Design Competition—】

The Design Competition aims to develop the abilities of its participants (mainly civil engineering students at colleges of technology) to propose better living space through competition in various living environment-related tasks, under a new concept which expands the scope of design to include all of the technology that forms people's living environments. Creatively competing to create work using their acquired academic skill and design abilities offers participants a precious opportunity to work under incentives unavailable in ordinary class activities at colleges of technology.

Furthermore, by hosting the Design Competition, regions can increase local people's interest in manufacturing, science and technology. The competition highlights the impressive abilities of students at colleges of technology and offers a valuable opportunity for such schools to demonstrate the results of their human resource development efforts.

【Chart 3-1: Durability determination Underway (Colleges of technology Design Competition)】



【Local efforts to foster manufacturing human resources—Yamanashi Prefecture—】

Since FY2010, Yamanashi Prefecture has been cooperating with local companies and carrying out the “Project to Foster Manufacturing Human Resources through Regional Cooperation” with the aim of fostering key workers at local companies. The project has established objectives such as the development of educational programs targeting the training of technical upper secondary school students in fundamental technology concerning semiconductor manufacturing equipment and industrial robots, and the fostering of human resources with the ability to solve problems through close collaboration between technical upper secondary schools and companies of the district.

In this project, students visit companies to undergo hands-on training in technological knowledge and skills and receive practical classroom lessons from a team consisting of school teachers and highly-skilled workers. Teachers also receive training at companies to enhance their technical capability and leadership.

【Chart 3-2: Creation of a Machining Center Program at a Cooperative Company】



- Since FY2012, MEXT has supported efforts by universities to foster capabilities required for global human resources and educational collaboration with overseas universities. Colleges of technology are carrying out programs by dispatching their students to overseas companies to develop international sensibilities.
- Since FY2012, METI has been carrying out overseas internship programs to provide young people, including adults and students, with opportunities for internships lasting several months in developing countries to foster young global human resources and build an international network of human resources to facilitate overseas business expansion by Japanese companies, including SMEs, and the overseas expansion of infrastructure businesses.
- As measures to restore manufacturing industry in the areas affected by the Great East Japan Earthquake, MEXT supports the efforts to promote industrial recovery conducted by universities.

【Efforts at a specialized training college—Tohoku Computer College—】

In the Tohoku region, the college develops and implements educational programs and provides teachers with the necessary training to foster engineers specialized in embedding software systems in automobiles in response to advancements in electronic control technology using embedded software in collaboration with companies and municipalities in Miyagi Prefecture and professional training schools and companies in other prefectures. The college thus makes efforts to foster specialized human resources which will play a central role in the reconstruction of the automobile industry in the region.



【Chart 3-3: Class Activities】

Section 2: Educational/Cultural Capacity to Foster Manufacturing Human Resources

- Manufacturing education has been valued in the new Courses of Study (school curriculum guidelines), while substantial improvement was made in the teaching contents of technology and home economics. The government is endeavoring to foster future international personnel specialized in science and technology by such means as encouraging female junior and senior high school students to take science courses, thus comprehensively pushing ahead with enhancements in science and mathematics education that will underpin science and technology.
- The government prepares teaching materials for practical career education and has established a system which helps students to be independent socially and vocationally at the higher education phases. The government will further provide practical re-training opportunities at universities, etc., targeting adults seeking to enhance their careers or to find new jobs.
- The National Museum of Emerging Science and Innovation (*Miraikan*) holds various science experiment classes and events to convey the enjoyment of manufacturing, while endeavoring to increase people's understanding of advanced science and technology. The National Museum of Nature and Science, Tokyo, holds exhibitions and provides educational support activities to increase people's interest in manufacturing industries.
- Efforts to hand over manufacturing traditions to future generations are made by fostering successors of important intangible cultural properties and preserving selected conservation techniques.

【The symbol of Japan's manufacturing technology – The National Museum of Nature and Science, Tokyo –】

○Manufacturing Festival for Young People 2013 – Fly a Paper Plane!!!
Japan's first domestically-produced passenger plane, the YS-11, which is preserved in Hanger T101 at Tokyo International Airport, was Japan's first mass-production passenger plane and is a symbol of Japan's manufacturing technology. In a series of classes entitled "Manufacturing Festival for Young People," students from the elementary school to high school levels made a paper glider modeled on the YS-11 and learned the significance of using their inventiveness and of trial and error.

In the final class, a contest to comprehensively evaluate flying distance and flight control was held in Hanger T101, in front of the real YS-11, enabling the students to feel a connection with the YS-11 and the spirit of manufacturing.



【Chart 3-4: Participants Making a Paper Plane】

【Exhibition "Selected Conservation Techniques 2012 – Traditional Craftsmanship Supporting Cultural Properties"】

At the exhibition "Selected Conservation Techniques 2012 – Traditional Craftsmanship Supporting Cultural Properties," each 28 preservation groups of selected conservation techniques set up exhibition booths displaying panels introducing their activities and their product production processes such as making materials, exhibiting materials and tools used in traditional repair work, and offering hands-on demonstrations where visitors could make a roof tile, shingle a roof, shave wood, or make a rice paddle using a plane.



【Chart 3-5: Experience Making a Rice Paddle】

Section 3: Promotion of R&D to Enhance Japan's Industrial Strength

(i) Research and development in fundamental manufacturing industry technologies

- The development of measurement and analysis techniques/equipment is promoted, which are necessary for the success of R&D aiming to dramatically improve the performance and reduce the cost of fuel cells, etc.
- Joint use of the Super Photon ring-8GeV (SPring-8), the SPring-8 Angstrom Compact Free Electron Laser (SACLA), and the Japan Proton Accelerator Research Complex (J-PARC) are promoted to support research and development in manufacturing industries by utilizing quantum beam and photon science and technology.

【Chart 3-6: Birds-eye View of the SACLA】



【Chart 3-7: C-band Accelerator which Accelerates Electrons to the Speed of Light】



【Strongly support product development by private companies utilizing cutting-edge facilities — Japan Synchrotron Radiation Research Institute (JASRI) —】

The Japan Synchrotron Radiation Research Institute (JASRI) selects and offers support to users of SPring-8 in its capacity as a registered institution for facilities use promotion as prescribed in the Act on the Promotion of Public Utilization of the Specific Advanced Large Research Facilities. JASRI introduced a coordinator system in FY2000, established an Industrial Use Promotion Office in FY2005 and began actively holding training sessions to enable participants to acquire technological knowledge on the utilization of radiated light and workshops to introduce the use of radiated light by companies. JASRI has also built a system to offer advice on the evaluation of measurement data and the preparation of reports. All these activities mainly target corporate engineers with little experience using radiated light. The basic principle for the activities of the Industrial Use Promotion Office is to promote outcomes that can be fed back into manufacturing. Therefore, efforts have been made to share understanding of the demands of user companies and of experimental discoveries so that the institute can achieve outcomes that will satisfy user companies.



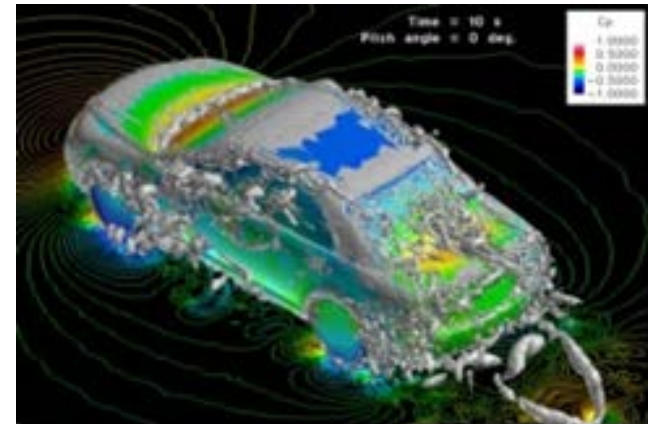
【Chart 3-8: Inside of the Experimental Hall of the SPring-8】 34

- The K computer, which boasts the world's highest level computational performance, was completed in June 2012, and began operating for the shared use of researchers and engineers from the end of September 2012. One of the results of research utilizing the K computer was awarded the Gordon Bell Prize in November 2012. Efforts to generate outcomes have been made steadily.

【Chart 3-9: The K Computer】



【Chart 3-10: Wind Tunnel Simulation for an Automobile】



- In response to societal needs, research and development on materials, including new nanoscale material creation and structural control, has been conducted.

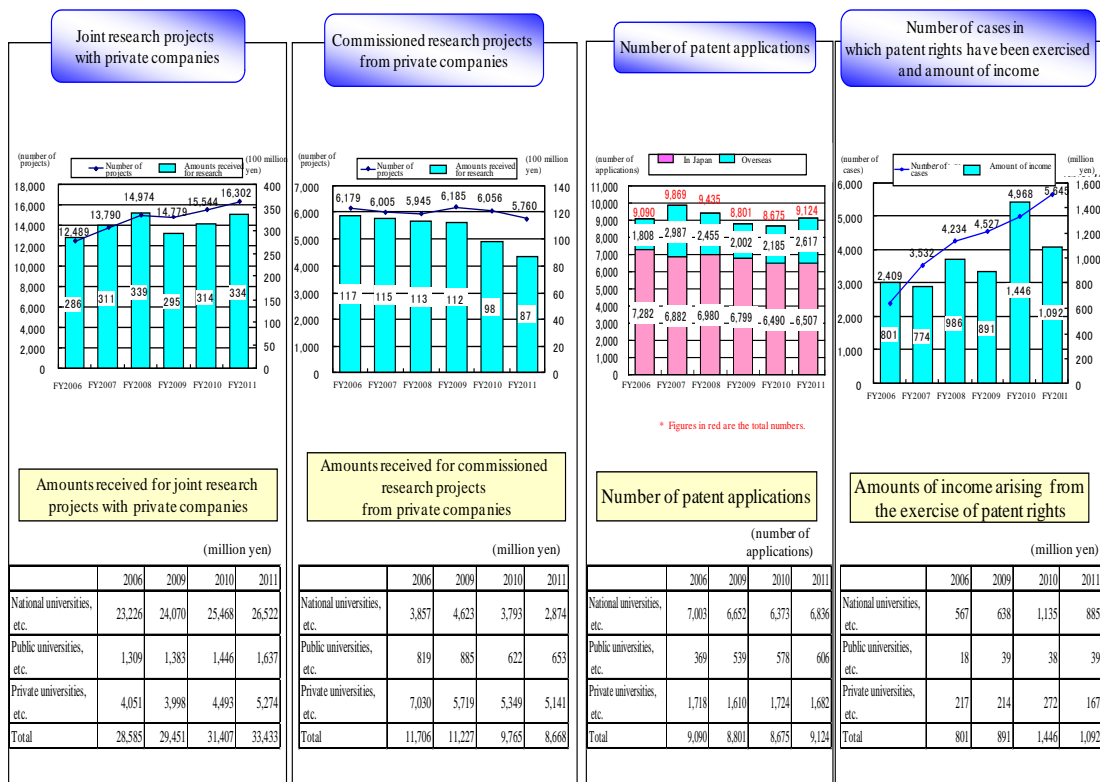
【Development of high-performance permanent magnet materials that do not use rare earths or other rare elements】

Japan depends completely on imports for rare earths and other rare elements (which are indispensable to components supporting cutting-edge industries, such as high-performance magnets used in the motors of hybrid cars, and for high-strength materials which support public infrastructure) and faces a serious supply deficiency due to the rapid increase in global demand and export controls by supplier countries. MEXT commenced the “Chemical Element Strategy Project <For Establishing Research Centers>” in FY2012, aiming to create innovative alternative materials that do not use rare earths or other rare elements, with the goal of overcoming resource constraints and strengthening Japan’s industrial competitiveness. This project covers the four material fields (magnetic materials, catalyst and cell materials, electronic materials, and structural materials) that directly relate to Japan’s industrial competitiveness. Under the strong leadership of the respective chief researchers, who have prominent views on materials, theoretical clarification of the roles of elements governing the functions of each material, the creation of new materials and assessment of their unique characteristics will be integrated and promoted with the close collaboration of joint research organizations with established research centers as their core.

(ii) Promotion of research and development based on collaboration between the government, industry, and academia

- The government promotes the development of a system to facilitate collaboration between universities, industry and the government, and research and development to commercialize research results, and offers support for the utilization of intellectual property, such as the filing of foreign patent applications.
- MEXT launched initiatives to create ventures from universities targeting the global market in FY2012.

【Chart 3-11: Changes in the Number of Joint Research Projects at Universities, etc.】



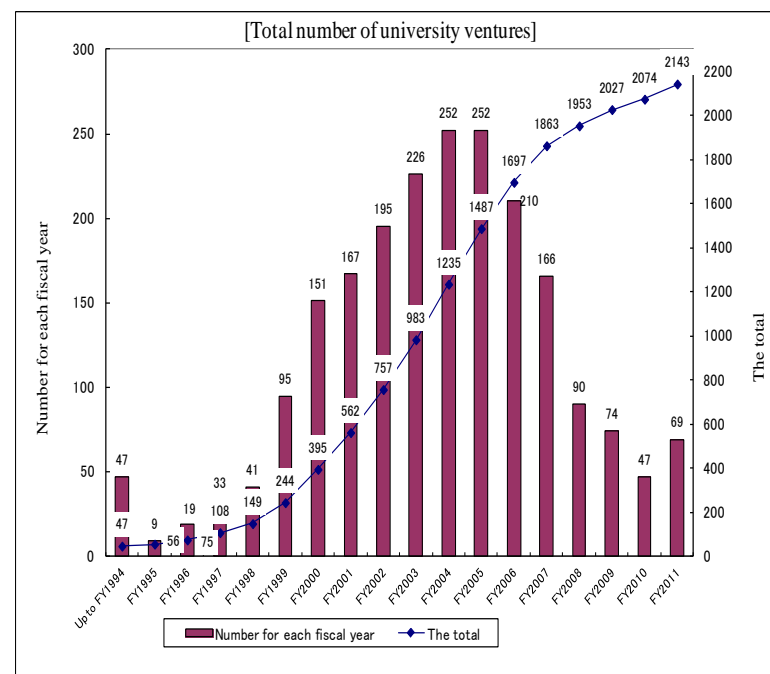
Source: Ministry of Education, Culture, Sports, Science and Technology "FY 2011 enforcement situation, such as industry-university cooperation in university etc." http://www.mext.go.jp/a_menu/shinkou/sangaku/1327174.htm

* National, public and private universities (junior colleges are included), national, public and private technical colleges, inter-university research institutes are objects.

* Since less than 1 million yen has been rounded off, the "total" and the "total of subtotals of national, public and private universities etc." may not be same number.

* The number of cases, such as patent-right enforcement, is the number of the transferred patent rights and the patent rights of which enforcement is consented (the stage of "the right to receive" is included)

【Chart 3-12: Total Number of University Ventures】

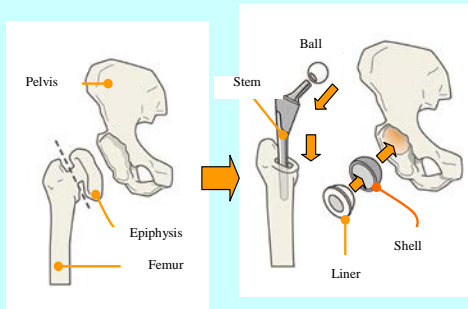


- The building of platforms where the government, industry and academia can share human resources, facilities, and intellectual property to engage in innovative R&D activities are being promoted. The development of commercialization by companies utilizing technology owned by universities is also being promoted.
- Support is provided for efforts to achieve novel concepts that contribute to the creation of regional innovations, including in the affected areas.

【Succeeded in the development of artificial hip prostheses that prevent abrasion of materials leading to long expected service lives】
 Based on the results of research by the University of Tokyo, Japan Medical Materials Corporation succeeded in developing highly abrasion-resistant artificial hip prostheses by covering the surface of the joints with a coating of an MPC polymer which is superior in biocompatibility on a nanometric scale (nano means one-billionth), and thereby successfully creating a biomimetic membrane around the joint. The company obtained production and marketing authorization for medical equipment in April 2011 and started to put the equipment into medical use in October of the same year (an outcome of the Outsourcing Project for Creative Seeds Development Business (now Research Results Development Project, Outsourcing Program to Support Optimal Development of Research Results (A-STEP))).
 Due to the aging of Japan's population, the number of people experiencing motor impairment and joint problems is increasing, and there are more than 40,000 joint replacement surgeries using artificial hip prostheses annually.



【Chart 3-13: Abrasion-resistant Artificial Hip Prosthesis (Outcome of A-STEP)】



【Chart 3-14: Regional Innovation Strategy Support Programs】

