Summary of the White Paper on Manufacturing Industry (Monodzukuri) 2012

June 2012
Ministry of Economy, Trade and Industry (METI)
Ministry of Health, Labour and Welfare (MHLW)
Ministry of Education, Culture, Sports, Science and Technology (MEXT)

Chapter 1: Status of Manufacturing Industry in Japan in Correlation with Changes in Domestic and Overseas Economies

(1) Production

- Despite some gaps between industrial sectors, production in manufacturing industry is recovering to the level it was before the Great East Japan Earthquake. In the transport machinery industry in particular, the current production exceeds the level seen immediately before the earthquake due in part to the effects of policies, including the Eco Car Subsidy Program (Chart 1-1).

(2) Trade

- Japan's trade balance in 2011 turned into a deficit due to a series of factors, such as production stagnation resulting from supply chain disruptions, a decrease in exports due to slowdown of the world economy, and an increase in imports in line with growing fuel demand (Chart 1-2).
- Meanwhile, the income balance including profit repatriation from overseas subsidiaries is on the increase, contrary to the trade balance.
- As for the exchange rate, the yen continues to be strong, falling below the breakeven rate for exporting companies (Chart 1-3). The domestic business environment still remains severe for companies.

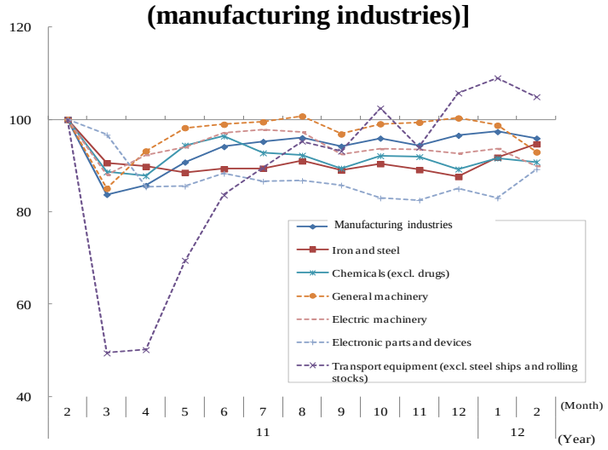
(3) Capital investment

- While many companies project their domestic capital investment over the next five years to "remain flat," many project that their overseas capital investment will "increase" or "slightly increase" (Chart 1-4). This trend is particularly notable for large companies.

(4) Employment

- The unemployment rate (seasonally adjusted) showed a downward trend from July 2009, but has been climbing again since October 2011 (Chart 1-5).
- The active job openings-to-applicants ratio (seasonally adjusted) marked 0.76 in March 2012, gradually rising after hitting a record low at 0.43 from July to September 2009. However, the employment situation still remains quite severe (Chart 1-5).
- The number of employed persons and the number of employees in the manufacturing industry has been on a long-term downtrend and though the number began to recover in 2005, it has been declining again since the second half of 2007.
- The number of new job openings in the manufacturing industries has been on the increase since June 2009, but began to fall since October 2011. However, the number turned to an increase in January 2012 (Chart 1-6).
- The proportion of establishments that had implemented some form of employment adjustment in the manufacturing industry had been decreasing after reaching 70% in the second quarter in 2009. The proportion increased in the first half of 2011, but turned to a decline.

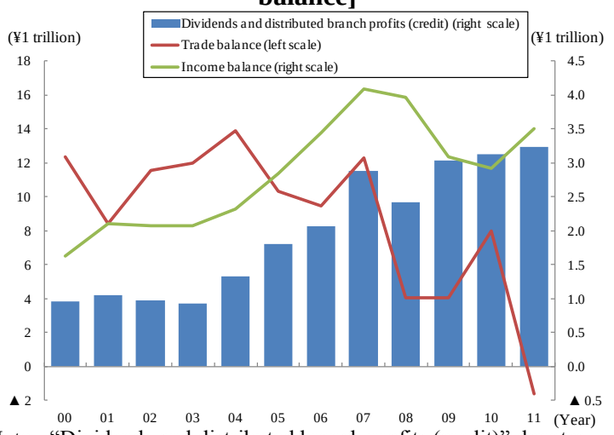
[Chart 1-1: Trend in indices of industrial production (manufacturing industries)]



Note: Seasonally adjusted, and indexed to 100 in February 2011 (immediately before the Great East Japan Earthquake).

Source: METI, "Indices of Industrial Production"

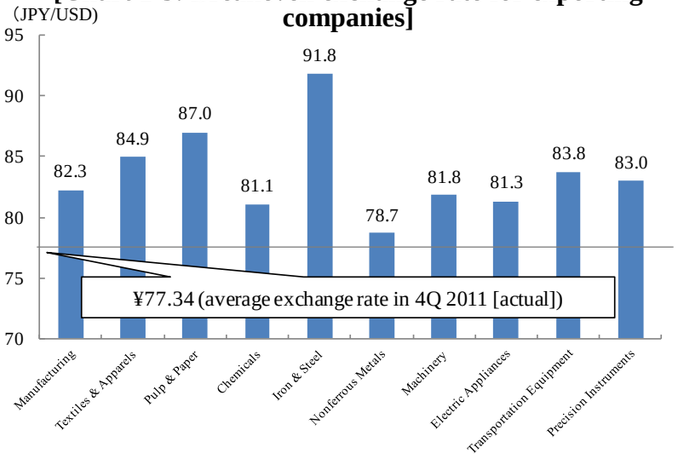
[Chart 1-2: Trend in income balance and trade balance]



Note: "Dividends and distributed branch profits (credit)" denotes the amount of profit repatriation from overseas subsidiaries to (parent companies in) Japan.

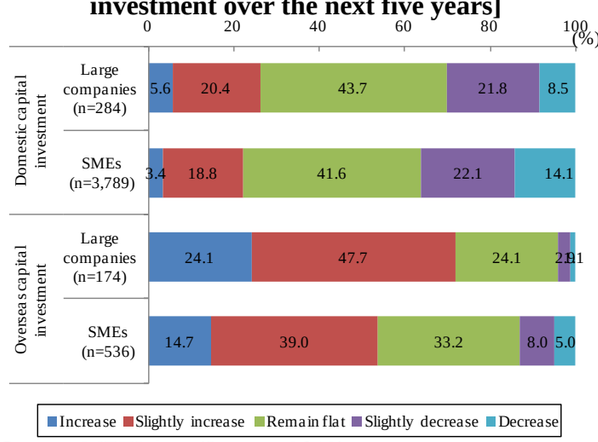
Source: Ministry of Finance, "Balance of Payments."

[Chart 1-3: Breakeven exchange rate for exporting companies]



Source: Cabinet Office, "Annual Survey of Corporate Behavior FY2011."

[Chart 1-4: Projected domestic and overseas capital investment over the next five years]

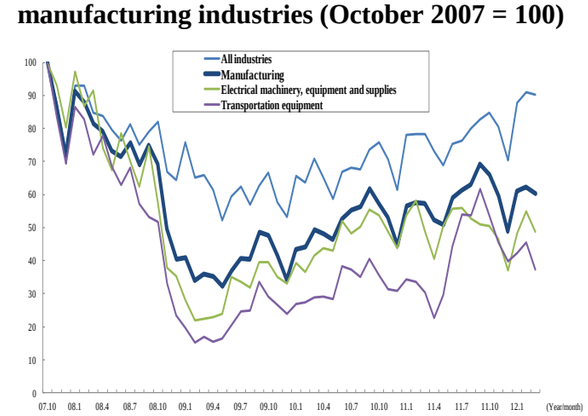


Source: METI data (January 2012).

[Chart 1-5: Trend of total unemployment rate and active job openings-to-applications ratio]

Source: Ministry of Internal Affairs and Communications, "Labour Force Survey" and Ministry of Health, Labour and Welfare, "Employment Statistics ."

Chart 1-6: Trend in new job openings in manufacturing industries (October 2007 = 100)



Source: Ministry of Health, Labour and Welfare, "Employment Statistics."

Chapter 2: Challenges and Prospects Facing Japan's Monodzukuri Industry

(1) Manufacturing industry in Japan facing structural changes in the global economy

- With the spread of such technology as CAD/CAM and NC, digitization has made progress in manufacturing industry. The introduction of high-performance production facilities has facilitated the manufacturing of products of a constant quality in emerging economies. In order to enjoy the merit of cost reduction through mass production in emerging economies, there has been an increase in product designs that require no tuning between components (modularization), which has led to a decline in the added value of the manufacturing/assembly process in manufacturing industry (Chart 2-1).
- There have been moves among European and U.S. manufacturers, such as Apple Inc., to specialize in the planning/development of products (and incidental services) and to create added value in processes other than the manufacturing process (Chart 2-2). In Asian emerging economies, many companies achieved rapid growth by specializing in mass, low-cost production through OEM/ODM from European and U.S. companies. On the other hand, Japanese companies saw a sharp drop in their world market share across the board, and faced difficulty securing sufficient profits even for products in which they have a technology edge (Chart 2-3). Japanese companies need to develop a new manufacturing strategy that gives consideration to global manufacturing trends.

(2) Growing need for the perspective of "who the product is for" and construction of an international role-sharing system

- As a result of an increase in the middle-income class in emerging economies, there is a growing need to provide products at low prices to consumers in those economies (Chart 2-4). Also, it has become increasingly important to respond to the diverse, country-specific needs, as well as to the rapid changes in income levels and multi-stratification of income classes. It is essential to build a business model from the perspective of "who the product is for" (product suitable for the target market).
- Amid the intensifying global competition, factors including the upward pressure on the yen have caused Japan's business environment to relatively deteriorate, making the acceleration of international role-sharing more inevitable than ever (Chart 2-5). As a result, Japanese companies' overseas operations could have a negative impact on domestic investment and employment, and could raise concerns about conflict between corporate profits and national interests (Chart 2-6).
- Meanwhile, the per-capita compensation of employees in manufacturing industry is higher than that in other industries (Chart 2-7). It is important, also for maintaining high-quality employment in Japan, that the government develops an appropriate business environment and companies undergo self-reformation.

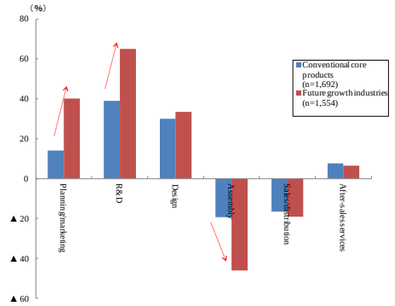
(3) Roles of Japan's manufacturing industry in the international role-sharing system

- Japan's manufacturing industry has accumulated *genbaryoku* (capabilities to find and solve problems in the field) (Chart 2-8), which made early restoration from the Great East Japan Earthquake possible. *Genbaryoku* is the source of strength of Japanese manufacturing. Japanese-style manufacturing, which has cultivated *genbaryoku*, contributes to raising the level of manufacture when transferred to overseas production bases (Chart 2-9).
- Some global companies oriented toward international role-sharing have taken such steps as training overseas workers in Japan, in order to communicate and use the *genbaryoku* of manufacturing industry that is rooted in Japan (Chart 2-10).The role of Japan's manufacturing industry in achieving optimum international role-sharing is to perform the "mother function," which is to actively collect information from overseas markets, reinterpret it, raise its added value through *genbaryoku*, and send it out to the world.

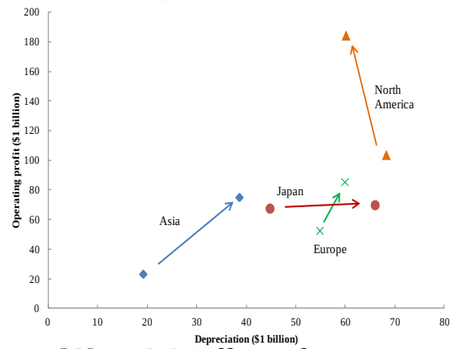
(4) Human resource development toward strengthening the competitiveness of Japan's manufacturing industry

- In recent years, there have been signs that the superiority of Japan's *genbaryoku* is at risk due to a decline of employment (regular employees) in Japan's manufacturing industry and to the growth of human resources in ASEAN and China (Chart 2-11). In the future, it is important to develop global human resources who are capable of solving the challenges they are confronted with, transferring *genbaryoku* to overseas, and identifying local needs (Chart 2-12). There are stronger calls than ever to achieve both corporate profits and national interests by promoting international role-sharing that embodies the mother function, and by establishing a business model by which Japan's manufacturing industry can secure added value.

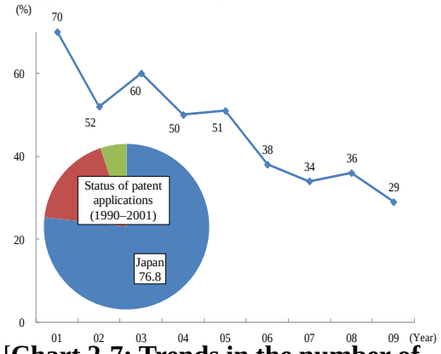
[Chart 2-1: Processes considered to have high/low added value]



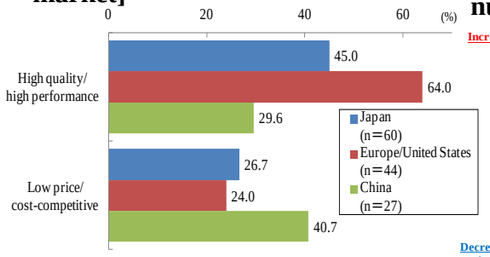
[Chart 2-2: Trends in efficiency of capital investment (operating profit/depreciation) (2005–2010)]



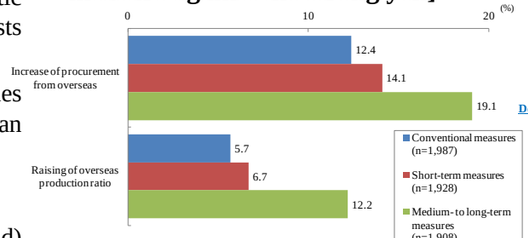
[Chart 2-3: Trends in the status of patent applications relating to semiconductor lithography apparatus and Japan's share]



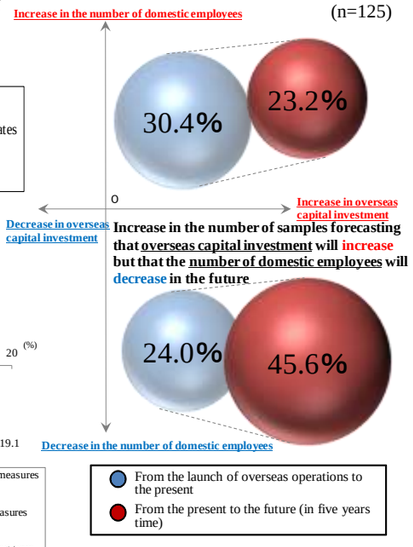
[Chart 2-4: Success factors for cultivating a middle-income-class market]



[Chart 2-5: Advancement of overseas operations as a measure against the strong yen]



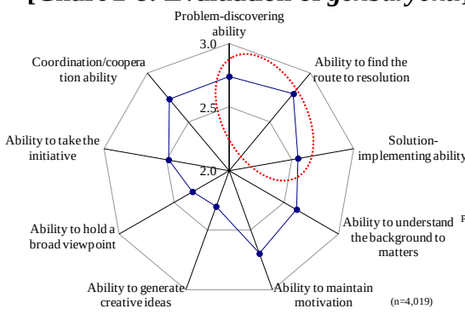
[Chart 2-6: Effects of overseas capital investment on the number of domestic employees]



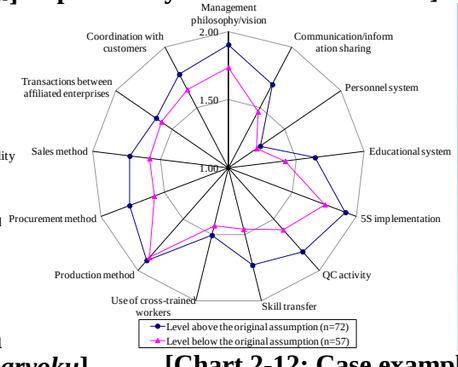
[Chart 2-7: Trends in the number of employed persons and per-capita compensation of employees in manufacturing industry, etc.]

	Number of employed persons (10,000 persons)	Increase/decrease from the number in 2000 (10,000 persons)	Per-capita compensation of employees (10,000 yen)
Manufacturing	1,032	▲217	466
(Motor vehicles, etc. in manufacturing)	120	14	581
Construction	510	▲131	421
Services	2,256	373	309

[Chart 2-8: Evaluation of *genbaryoku*]



[Chart 2-9: Status of transfer of Japanese-style methods in ASEAN]



[Chart 2-10: Examples of the mother function]

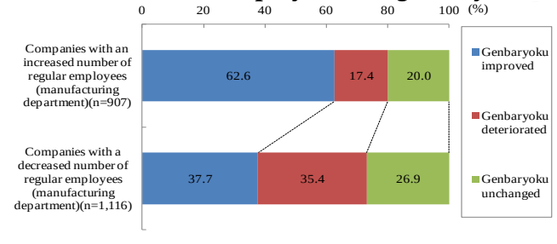
(1) Nissan Motor Co., Ltd.

➢Nissan gathers its employees from around the world to the Nissan Learning Center in order to teach them Nissan's manufacturing DNA by giving them training in personnel affairs.

(2) Bosch Corporation

➢The role of the Japanese subsidiary in the Bosch group is to communicate the QDC (quality, delivery, and cost) of manufacturing that has been cultivated in Japan.

[Chart 2-11: Relation between an increase/decrease of employees and *genbaryoku*]



[Chart 2-12: Case example of development/use of global human resources]

○ Akebono Brake Industry Co., Ltd.

➢In the company's eight to twelve weeks of overseas training, the trainees experience local production while leading local lifestyles, such as cooking their own meals. In the future, the company plans to conversely train overseas employees in Japan in order to diffuse its corporate philosophy which has been implemented at its domestic bases.

Chapter 3: Strengthening the Manufacturing Base Centering on Fostering of Human Resources as the Core for Monodzukuri

(1) Fostering/securing of core human resources at manufacturing sites

- The abilities sought in core human resources at manufacturing sites are the "ability to supervise production lines and instruct subordinates as a manufacturing site leader" and the "ability to handle multiple machines/processes" (Chart 3-1). The knowledge and know-how sought are “quality control” and “streamlining and improvement of production lines” (Chart 3-2).
- While more than 50% of companies mentioned a lack of core human resources, a higher percentage of SMEs responded that they were being unsuccessful in fostering core human resources compared to large companies (large companies: 49.0%; SMEs: 59.3%).
  Regardless of the company size, the notable causes for being unsuccessful in fostering core human resources are “insufficient numbers of employees to engage in the fostering of core human resources” and “insufficient know-how on effective educational training programs” (Chart 3-3).
- Compared to large companies, a smaller percentage of SMEs carry out systematic OJT as a measure to maintain/improve the skills of core human resources (large companies: 54.7%; SMEs: 29.6% [multiple answers]).
- Only a small percentage of companies use internal/external examinations, national qualifications, and national trade skill tests to identify the skill level of core human resources (Chart 3-4).

(2) Challenges and future measures concerning the fostering of core human resources for monodzukuri

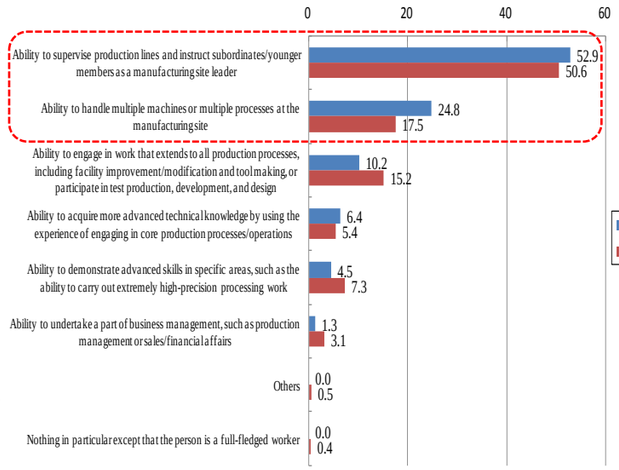
- It is necessary to promote the fostering of core human resources relating to such growth fields as the environment and energy, where employment expansion can be expected, and to manufacturing fields involving high skills in the domestic manufacturing sector.
- In order to support companies in fostering core human resources, it is necessary to achieve wider-spread recognition and promote the use of the various services provided by the Japan Organization for Employment of the Elderly, Persons with Disabilities and Job Seekers, including vocational training for employed workers, the dispatch of vocational training instructors, and consultation/support for carrying out vocational training
  In addition, in order to support companies’ human resource development when they expand business in such growth fields as the environment and energy, there is a need to strengthen measures to develop training curriculums for employed workers in coordination with local industry groups and to support individual companies in formulating a human resource development plan.
- To systematically promote human resource development, companies need to have personnel who can act as the core of such activity. An external consultation and support system should be improved so as to cater to the needs of companies that cannot develop such human resource development systems and employees seeking support for career formation.
- In fostering core human resources at manufacturing sites, it is necessary to use certified skilled workers, who are well-versed in manufacturing sites, and to further promote the use of national trade skill tests and vocational ability evaluation standards as tools for objectively identifying employees’ skill levels and for setting achievement targets.

(3) Government measures to support/promote the fostering of core human resources in manufacturing industry

The government currently implements the following measures for fostering core human resources in manufacturing industry.

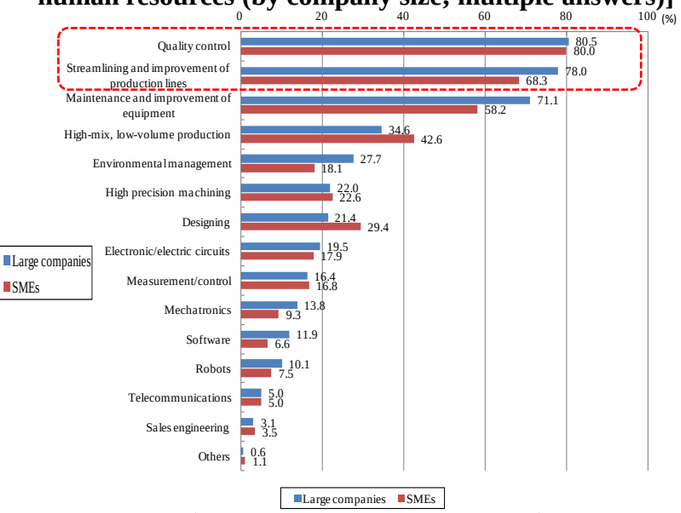
- Measures for fostering core human resources in manufacturing industry.
  (1) Implementation of advanced and diverse vocational training, including response to technology innovation, at public vocational training facilities
  (2) Support for career formation.
  * Promotion of career consulting, offer of a subsidy when an employer makes an employee receive vocational training for promotion of career formation, etc.
- Expansion of vocational training for responding to the Great East Japan Earthquake and the strong yen
- Measures for skill evaluation
  * National trade skill tests (skill tests are available for 129 job categories as of April 1, 2012; about 290,000 people passed the tests in FY2011; there is a total of about 4.59 million certified skilled workers)
- Enhancing occupational capabilities to become a manufacturing-based nation
  (1) Fostering a skill-oriented mindset by making honorable recognition of prominent craftsmen (Great Craftsmen in the Present World) (Chart 3-5)
  (2) Promotion of occupational skills through organizing various skill competitions (Chart 3-6)
  * In the 41st World Skills Competition held in the UK in 2011, Japanese competitors won gold medals in 11 skill categories, including mechatronics, CNC milling, and autobody repair, as well as four silver medals, four bronze medals, and nine medallions for fighting spirit.

[Chart 3-1: Types of abilities sought in core human resources (by company size)]



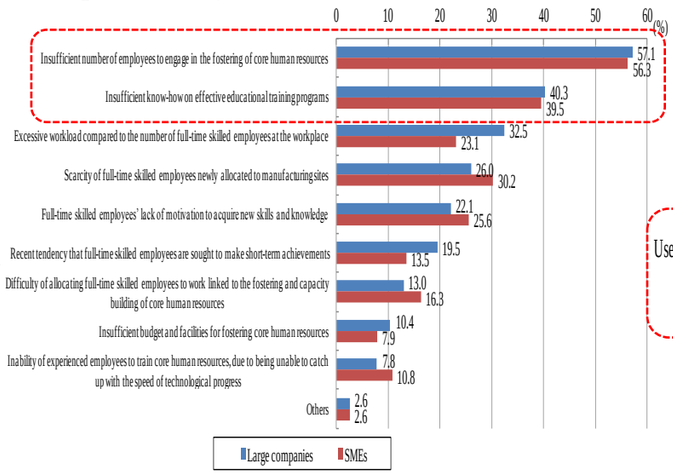
Source: The Japan Institute for Labour Policy and Training, "Survey on the current status of and problems in the fostering of skilled workers who serve as the core at manufacturing sites (2011)"

[Chart 3-2: Knowledge and know-how sought in core human resources (by company size; multiple answers)]



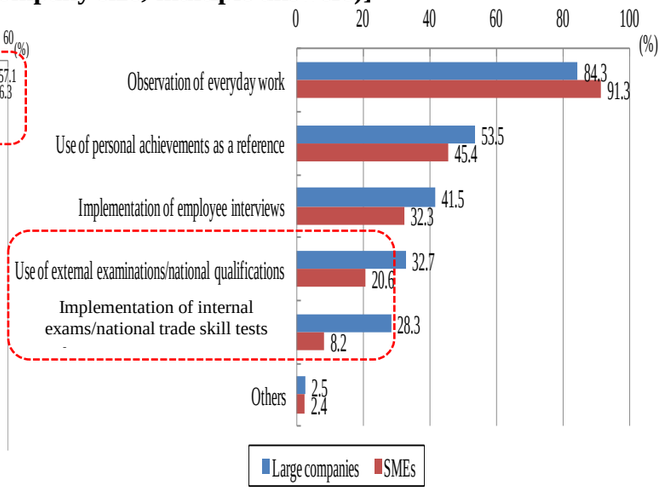
Source: The Japan Institute for Labour Policy and Training, "Survey on the current status of and problems in the fostering of skilled workers who serve as the core at manufacturing sites (2011)"

[Chart 3-3: Causes for being unsuccessful in fostering core human resources (by company size; multiple answers)]



Source: The Japan Institute for Labour Policy and Training, "Survey on the current status of and problems in the fostering of skilled workers who serve as the core at manufacturing sites (2011)"

[Chart 3-4: Method for identifying whether core human resources have the level of work skills being sought (by company size; multiple answers)]



Source: The Japan Institute for Labour Policy and Training, "Survey on the current status of and problems in the fostering of skilled workers who serve as the core at manufacturing sites (2011)"

[Chart 3-5: Great Craftsmen in the Present World]

Mr. Nishine served as a satellite mechanical system assembly leader and contributed to instructing and fostering younger workers.

[Chart 3-6: World Skills competition]

Mechatronics competition

Chapter 4: Education, Research and Development to Support the Foundations of Monodzukuri

(1) Efforts by universities (engineering), colleges of technology, specialized high schools, and specialized training colleges in fostering manufacturing human resources (Chart 4-1)

- Universities (engineering) are providing practical engineering education in collaboration with the industrial world. MEXT is implementing investigations and research on students' common attainment targets in practical engineer education at universities, based on a report on quality assurance in engineer education compiled in FY2010.
- Colleges of technology provide experience-oriented specialized education with a focus on experiments and practical training sessions. MEXT implements projects to support excellent educational reform efforts aimed at fostering human resources for manufacturing industry, who will play a major role in creating innovation (Chart 4-2).
- Specialized high schools are working on unique projects for fostering future specialists in collaboration with universities or research institutes.
- Specialized training colleges are creating industry-academia-government consortiums and implementing human resource training measures and development of new learning systems, in order to secure experts who have new knowledge/techniques that respond to industrial structural changes and globalization and who can play a core role.
- Educational institutions such as universities and specialized training colleges are fostering human resources who will engage in manufacturing and in protection and use of intellectual property rights in such fields as fashion, content, design, food, tradition, and culture.
- As a measure toward restoration of manufacturing industry in the areas affected by the Great East Japan Earthquake, MEXT is supporting the efforts of universities, etc. to promote industrial revival in coordination/cooperation with municipalities or other universities, etc. In addition, MEXT is supporting the efforts of specialized training colleges to promote the sophistication of educational contents, such as the development of educational programs through industry-academia-government collaboration (Chart 4-3).

(2) Enhancement of educational/cultural capacity for fostering human resources for manufacturing industry

- The new Courses of Study (school curriculum guidelines) stay focused on monodzukuri education, improve the teaching contents of Technology and Home Economics classes, and the government is comprehensively pushing ahead with enhancing science/math education that will underpin science and technology (Chart 4-4).
- Efforts are being made to create teaching materials for carrying out career education and to establish a system for helping students achieve social and vocational independence in the higher education phase.
- The National Museum of Emerging Science and Innovation（Miraikan）has been providing opportunities for visitors to think about realizing a sustainable social system and enriching peoples' lives in the future through exhibitions featuring the themes of "creativity" and "information society" among others. The National Museum of Nature and Science, Tokyo, is also holding exhibitions and providing educational support through exhibitions commemorating the 100th anniversary of the Nobel Prize.
- Manufacturing traditions should be handed over to future generations by fostering successors of important intangible cultural properties and protecting selected conservation techniques.

(3) Research and development of monodzukuri fundamental technologies

- In FY2011, the government has launched the development of measuring and analysis techniques/equipment that are necessary for making achievements in R&D aimed at dramatically improving the performance and reducing the cost of fuel cells, etc., and has initiated the joint use of already developed equipment at research sites.
- An X-ray-free electron laser facility (SACLA) was developed and established through putting together the technology of more than 300 domestic companies, and the facility succeeded in producing light with the world's shortest wavelength in June 2011. The facility was made available for joint use by researchers, etc. in March 2012 (Chart 4-5).
- Next-generation super computer "K computer," boasting the world's second highest level computational performance achieved its performance target, 10 petaflops, in November 2011. It gained the world's highest position in performance ranking in June and November 2011 (Chart 4-6).
- The government is carrying out fundamental R&D for creating new substances or new materials, and promoting the R&D of materials for sophisticating and increasing the reliability of environmental and energy materials.

(4) Promotion of Research and development based on collaboration between the government, industry, and academia

- It is important to encourage practical application of the research results of universities, etc. through industry-academia-government collaboration (Chart 4-7). Therefore, the government is implementing various R&D programs focused on technology transfer as well as projects to support the filing of foreign patent applications and to provide opportunities for researchers to explain new technology to companies.
- The government also implements projects for creating an environment where universities, etc. can sustainably carry out industry-academia-government collaboration activities, by providing support in carrying out international industry-academia-government collaboration or in allocating industry-academia-government cooperation coordinators.
- The government works on a program to support regional efforts that focus on intangible and human aspects, such as gathering researchers and fostering human resources, for regions that are found to substantially contribute to achieving the regional innovation strategy.

[Chart 4-1: Number of new graduates successfully finding a job (FY2010)]

	Upper secondary schools (engineering-related courses)	Colleges of technology	Universities (engineering-related departments)
Number employed	50,392	5,519	43,295
Number of workers engaged in production processes or labor services (percentage)	30,919 (61.4%)	20 (0.4%)	270 (0.6%)
Number of workers engaged in professional or highly-technical tasks (percentage)	5,105 (10.1%)	5,149 (93.3%)	31,754 (73.3%)

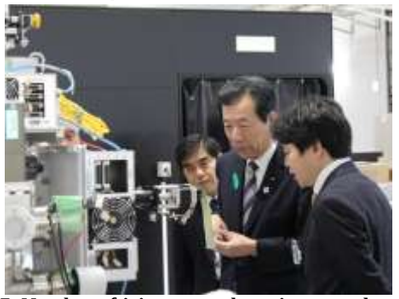
Source: MEXT, "School Basic Survey."

[Chart 4-2: KOSEN Robot contest]

[Chart 4-3: Automotive embedded systems engineering (Tohoku Computer College)]

[Chart 4-4: Lower secondary school students participating in a project for delivering wind-up flashlights/radios to disaster-affected areas]

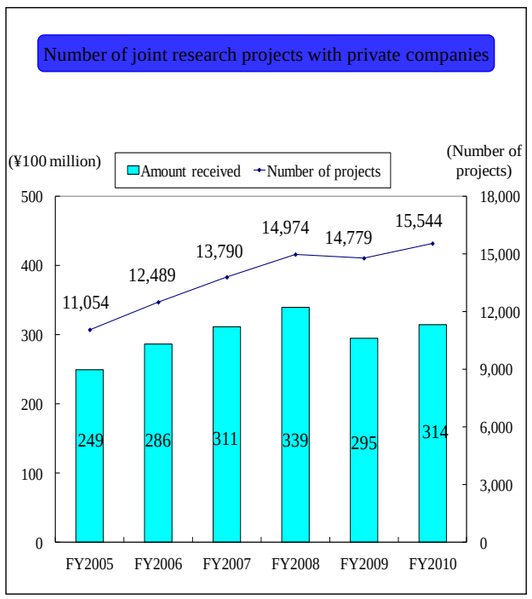
[Chart 4-5: X-ray free electron laser facility (SACLA)]

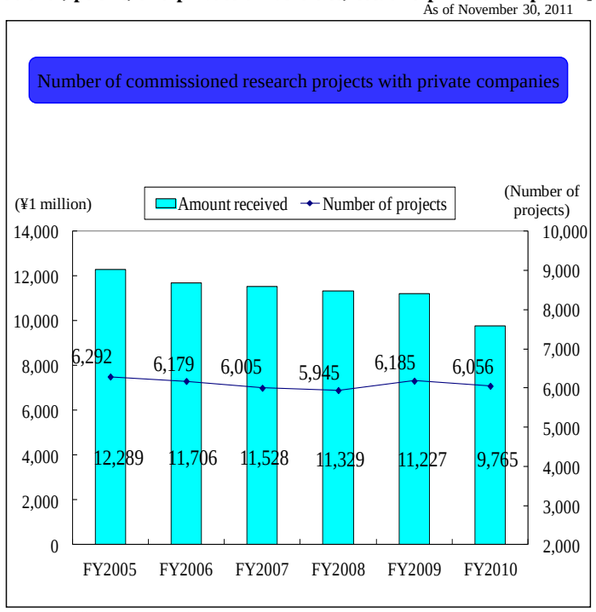


[Chart 4-6: Supercomputer "K computer"]

[Chart 4-7: Number of joint research projects, etc. between national, public, and private universities, etc. and private companies]

As of November 30, 2011





Source: MEXT, "FY2010 Implementation Status of Industry-Academia collaboration, etc. by Universities, etc."
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