Section 1 Situation of R&D and promotion of study to support the basis of monodzukuri

As of fiscal 2008, there were 254 engineering-related university departments, including 76 at national universities, 20 at public universities, and 158 at private universities. A total of 404,419 students were studying in engineering-related departments, with an annual enrollment limit of 87,593. In fiscal 2007, the number of applicants for engineering-related departments, which had been declining since 1992, stood at 533,246.

The ratio of new graduates of engineering-related departments who choose to obtain jobs to those who advance to graduate schools has been stable since 1999. Of the 95,216 new graduates in fiscal 2007, 61% chose to obtain a job. Of the new graduates who chose to obtain a job, 79% engaged in occupations requiring specialized and technical skills in sectors closely related to manufacturing, such as mechanical and electrical engineering. By industry, new graduates who chose to obtain a job in the manufacturing industry accounted for 36%.

<table>
<thead>
<tr>
<th>National</th>
<th>Public</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of departments</td>
<td>76</td>
<td>20</td>
<td>158</td>
</tr>
<tr>
<td>Number of students</td>
<td>135,564</td>
<td>12,813</td>
<td>256,042</td>
</tr>
<tr>
<td>Enrollment limit</td>
<td>28,722</td>
<td>2,974</td>
<td>55,897</td>
</tr>
</tbody>
</table>

Source: Survey by MEXT

[Table 4-1 Current State of Engineering-Related Departments at Universities] (As of FY2008)

[Chart 4-2 Changes in the Number of Applicants in Engineering-Related Departments]

[Chart 4-3 Numbers of Engineering-Related Department Graduates Choosing to Obtain a Job and Those Advancing to Graduate Schools and Other Institutions]
As of May 2008, there were 64 colleges of technology, including 55 national colleges, 6 public colleges, and 3 private colleges, with a total of 56,135 students (excluding students in advanced courses). The number of annual enrollment limits was 10,915, of which 10,555 (96.7%) were in engineering-related fields such as electrical/electric engineering and mechanical engineering.

Of the new graduates in fiscal 2007, 54.1% chose employment and 42.5% advanced to universities or moved on to advanced courses. The job opening-to-application ratio was very high, at 23.8, and 99.4% of the applicants obtained a job. The rate of those who entered technical and specialized vocational areas as technical workers was 92.3% of the total. Meanwhile, students who wish to receive more advanced education are permitted to join such universities as Nagaoka University of Technology and Toyohashi University of Technology as third-year students, for example. In fiscal 2007, 26.7% of the graduates advanced to universities.

In addition to the standard 5-year course, a two-year post-graduate course for more advanced education and research training is available at colleges of technology. Of the new graduates in fiscal 2007, 15.8% moved on to such advanced courses. Students who have completed advanced courses and who have passed an examination given by the National Institution for Academic Degrees and University Evaluation granted a bachelor’s degrees. Of the students who completed advanced courses in fiscal 2007, 35.4% moved on to graduate school.

### Table 4-4 Current State of Colleges of Technology

<table>
<thead>
<tr>
<th>Classification by the founder</th>
<th>National</th>
<th>Public</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of schools</td>
<td>55 (54)</td>
<td>6 (4)</td>
<td>3 (2)</td>
<td>64 (60)</td>
</tr>
<tr>
<td>Number of courses</td>
<td>242</td>
<td>7</td>
<td>8</td>
<td>257</td>
</tr>
<tr>
<td>Number of classes</td>
<td>242</td>
<td>20</td>
<td>11</td>
<td>273</td>
</tr>
<tr>
<td>Enrollment limit</td>
<td>9,680</td>
<td>760</td>
<td>475</td>
<td>10,915</td>
</tr>
<tr>
<td>Number of students enrolled</td>
<td>50,104</td>
<td>3,947</td>
<td>2,084</td>
<td>56,135</td>
</tr>
</tbody>
</table>

**Note 1:** Figures in parentheses represent the number of schools with advanced courses
**Note 2:** The above figures include schools that have suspended invitations for enrollment.

**Source:** Survey by MEXT

### Table 4-5 Employment Rate and Job Opening-to-Application Ratio in the Past Five Years

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of job finders</td>
<td>54.2%</td>
<td>53.8%</td>
<td>53.8%</td>
<td>54.3%</td>
<td>54.1%</td>
</tr>
<tr>
<td>Employment rate</td>
<td>98.1%</td>
<td>97.7%</td>
<td>98.7%</td>
<td>98.7%</td>
<td>99.4%</td>
</tr>
<tr>
<td>Job opening-to-application</td>
<td>10.4</td>
<td>12.5</td>
<td>15.6</td>
<td>20.1</td>
<td>23.8</td>
</tr>
</tbody>
</table>

**Source:** Survey by MEXT

### Chart 4-6 Employment of Graduates of Colleges of Technology by Job Type in FY2007

- Specialized and technical jobs: 92.3%
- Mechanical/electrical engineering jobs: 52.2%
- Civil engineering jobs: 11.0%
- Mining engineering jobs: 8.4%
- Civil engineering jobs: 11.0%
- Specialized and technical jobs: 92.3%
- Other technical jobs: 6.4%
- Other specialized jobs: 1.8%
- Transportation/communications jobs: 2.9%
- Service/security jobs: 2.0%
- Clerical jobs: 1.1%
- Other jobs: 1.8%

**Source:** Survey by MEXT
As of May 2008, there were 3,401 special training colleges, with a total of 657,502 students. Of these students, 86,843, or 13.2%, were students in industries-related fields, including 30,279 in information processing, 21,214 in car maintenance, and 10,151 in civil engineering and construction. The number of students in the sanitation field stood at 79,395, or 12.1%, including 17,892 in food preparation.

Special training colleges develop human resources who can immediately contribute to society by providing practical job training and specialized technical education. Therefore, graduates of these schools are highly valued, with many of them obtaining jobs in fields related to the subjects they have studied. Of new graduates in industries-related fields in 2007, 90.7% obtained jobs in fields related to their subjects of study.

![Chart 4-7 Changes in the Career Choices of Graduates](chart)

*The vertical axis indicates the number of graduates and the horizontal axis indicates the fiscal year. Source: Survey by MEXT

**Current state of special training colleges**

As of May 2008, there were 3,401 special training colleges, with a total of 657,502 students. Of these students, 86,843, or 13.2%, were students in industries-related fields, including 30,279 in information processing, 21,214 in car maintenance, and 10,151 in civil engineering and construction. The number of students in the sanitation field stood at 79,395, or 12.1%, including 17,892 in food preparation.

Special training colleges develop human resources who can immediately contribute to society by providing practical job training and specialized technical education. Therefore, graduates of these schools are highly valued, with many of them obtaining jobs in fields related to the subjects they have studied. Of new graduates in industries-related fields in 2007, 90.7% obtained jobs in fields related to their subjects of study.

![Chart 4-8 Number of Special Training College Students by Course Type](chart)

Source: Basic Survey of Schools 2008
As of May 2008, there were about 2,200 specialized upper secondary schools, with a total of 670,000 students. Of about 2,200 schools, 587, or 11% of the total number of upper secondary schools in Japan, had industries-related courses, with a total of 270,000 students, or 8.1% of the total number of upper secondary school students in Japan. Of the students that completed industries-related courses in March 2008, 69.8% obtained jobs in their home prefecture, indicating that they have become human resources that support local manufacturing industries.

### [Table 4-9 Current State of Specialized Upper Secondary Schools (including national, public, and private schools)]

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number of students</th>
<th>Percentage (%)</th>
<th>Number of courses</th>
<th>Single-course schools</th>
<th>Multiple-course schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocational courses (Specialized upper secondary schools)</td>
<td>Agricultu...</td>
<td></td>
<td></td>
<td>139</td>
<td>312</td>
</tr>
<tr>
<td>Industries</td>
<td>271,968</td>
<td>8.1</td>
<td>587</td>
<td>Two or more vocational courses of study</td>
<td>202</td>
</tr>
<tr>
<td>Commerce</td>
<td>228,789</td>
<td>6.8</td>
<td>744</td>
<td>Vocational course of study + ordinary course of study</td>
<td>1,209</td>
</tr>
<tr>
<td>Fisheries</td>
<td>9,458</td>
<td>0.3</td>
<td>45</td>
<td>Vocational course of study + integrated course of study</td>
<td>39</td>
</tr>
<tr>
<td>Home economics</td>
<td>46,007</td>
<td>1.4</td>
<td>319</td>
<td>Vocational course of study + ordinary course of study + integrated course of study</td>
<td>20</td>
</tr>
<tr>
<td>Nursing</td>
<td>12,794</td>
<td>0.4</td>
<td>97</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Information</td>
<td>2,759</td>
<td>0.1</td>
<td>24</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Welfare</td>
<td>9,922</td>
<td>0.3</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>670,054</td>
<td>19.9</td>
<td>2,249</td>
<td>-</td>
<td>1,470</td>
</tr>
<tr>
<td>Integrated courses</td>
<td>159,209</td>
<td>4.7</td>
<td>323</td>
<td>Ordinary course of study + integrated course of study</td>
<td>38</td>
</tr>
<tr>
<td>Ordinary courses</td>
<td>2,427,838</td>
<td>72.3</td>
<td>4,025</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other courses</td>
<td>101,610</td>
<td>3.1</td>
<td>586</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>3,358,711</td>
<td>100.0</td>
<td>7,183</td>
<td>-</td>
<td>5,243</td>
</tr>
</tbody>
</table>

*The above statistics cover schools with full-day courses and those with part-time courses (correspondence-course schools are not covered). Source: Survey by METI

### [Table 4-10 Employment Rate, etc. in the Past Five Years for New Graduates of Industries-Related Courses of Study]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of job seekers</td>
<td>54,806</td>
<td>55,374</td>
<td>55,885</td>
<td>56,348</td>
<td>55,384</td>
</tr>
<tr>
<td>Ratio of job seekers to the total number of graduates</td>
<td>51.9%</td>
<td>53.9%</td>
<td>57.5%</td>
<td>60.0%</td>
<td>62.6%</td>
</tr>
<tr>
<td>Employment rate</td>
<td>95.1%</td>
<td>96.4%</td>
<td>97.3%</td>
<td>97.5%</td>
<td>98.2%</td>
</tr>
<tr>
<td>Ratio of job offers to applicants</td>
<td>3.3</td>
<td>3.7</td>
<td>4.6</td>
<td>5.3</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Source:
*1 Survey by MEXT
*2 Survey by the National Association of Principals of Technical Senior High Schools
In fiscal 2007, internship programs were implemented at 503 universities (67.7% of all universities; up 1.9 percentage points from the previous year), at 170 junior colleges (43.6% of all junior colleges; up 3.0 points from the previous year), and at 61 colleges of technology (100% of all colleges of technology; up 1.6 points from the previous year), indicating that the number of institutes of higher education implementing internship programs is steadily increasing.

In fiscal 2007, 68.1% of all public upper secondary schools (full-day schools) provided employment experiences through internship programs, and 91.7% of vocational courses did so.

In fiscal 2007, 95.8% of public lower secondary schools provided workplace experiences, up 1.7 percentage points from the previous year. As for the period of workplace experience, 21.1% provided five days of experience, up 15.1 points from 2004.

*The above percentages are the ratios of schools that implemented internship programs as part of their curriculum subjects.
Source: Survey by MEXT
The number of joint research programs between national, public, and private universities and private companies came to 16,211, up 1,454 (10%) from the previous year. For national universities alone, the number of joint research programs with private companies increased by 1,249, or 10%, indicating that national universities continued to actively engage in joint research after they were incorporated. The total amount of research funds received by universities in relation to joint research stood at around ¥40.1 billion, up by around ¥3.3 billion (9%) from the previous year. For national universities alone, research funds received totaled around ¥33.1 billion, up by around ¥2.8 billion (9%) from the previous year.

The number of research programs commissioned to national, public, and private universities stood at 18,525, up 480 (3%) from the previous year. For national universities alone, the number stood at 10,584, increased by 502 (5%), indicating that national universities continued to actively conduct commissioned research. The total amount of research funds received in relation to the implementation of commissioned research came to about ¥160.7 billion, up by around ¥18.7 billion (13%). For national universities alone, the amount stood at around ¥127.9 billion, up by around ¥17.7 billion (16%).
Section 2 Promotion of regional R&D for strengthening of industrial capabilities

Under the Third Science and Technology Basic Plan, manufacturing technology is deemed as one of the four areas in which R&D activities are conducted with an emphasis on issues that are considered fundamental for the nation's existence and which need to be addressed by the government.” In addition, regional R&D promotion is deemed to be an important task that should be tackled by the government under this plan.

(Knowledge cluster initiative)

“Knowledge cluster” are promoted under regional initiatives. Knowledge cluster conduct R&D activities to meet the needs of companies, with core universities and other public research institutions, and seek to attract human resources, information, and investment from other regions and countries by taking advantage of the results of R&D to advance regional industries, develop new products, and improve services.

[Chart 4-16 Regions Implementing Knowledge Cluster Initiative in FY2008]
Start of the nano-materials business

A Nagano prefecture-based manufacturer of injection molding machines that engaged in joint R&D with Shinshu University’s Faculty of Engineering commercialized resinous composite materials using CNT (carbon nanotube) and resin (plastics) and, in September 2007, established the relevant business division and started selling compound pellet materials and molded products using this material. The development of this new material created a new field of multi-function resinous composite materials by enabling the CNT to exercise its superiority in terms of special structure, strength, and electric and thermal conductivity through the combination of the CNT and resin. There are expectations that the new material will replace plastics and metals as a material in a variety of applications, including as a material for products that require strength and prevention of electrification, such as semiconductor trays (for carrying parts) used in production lines and for fuel tube joints for automobiles.

Commercialization of an ultra-small sensor capable of directly measuring radicals in plasma

Previously, radicals in plasma, which play an important role in fine processing and formation of thin films, could be measured only by large-size optical spectrometers. The Tokai Region Nano Technology Manufacturing Cluster reduced the size of optical spectrometers capable of measuring radicals in plasma to several millimeters in diameter by developing a new lighting source and succeeded in commercializing a radical monitor that enables the easy, precise measurement of radicals.

The world’s first successful development of automated nano-etching equipment that automatically optimizes ultra-fine processing based on radical measurement

The Tokai Region Nano Technology Manufacturing Cluster successfully manufactured a prototype of equipment that enables optimum nano-etching through automated control that ensures an optimum plasma state based on the feedback of the real-time measurement of the density of radicals with the use of the above-mentioned radical monitor. There are hopes that successful commercialization of this equipment will bring about innovation to semiconductor etching equipment, for which a drop in the yield rate is expected as a result of a further advance of miniaturization.

In an industrial cluster, local SMEs and venture companies form a human network with universities, research institutes, financial institutions, etc., and sow the seeds of innovation that will create a succession of new businesses and new industries. As of March 2009, there were 18 projects being operated by industrial clusters across Japan, with about 10,700 middle-ranking companies and SMEs and about 290 universities (including colleges of technology) forming broad-area networks. In addition, about 2,450 organizations across Japan, including research institutes, financial institutions, trading houses, and other companies, are supporting companies participating in industrial clusters.
**Industrial Cluster Projects (18 projects across Japan)**

*What is an industrial cluster?*

An industrial cluster refers to a broad-area network of companies, universities and other organizations in a region that aims to accelerate innovation and create new industries and new businesses through mutual use of intellectual resources.

- About 10,700 middle-ranking companies and SMEs and about 290 partner universities (including technical colleges) form broad-area human networks.
- A total of 2,450 organizations and companies, including 96 public research organizations, 404 industrial support organizations, 227 financial institutions, and 98 trading companies support industrial clusters.

**Draft budget for fiscal 2009:** ¥1.2 billion

Budget funds are earmarked for support measures that contribute to the creation of new businesses and industries at the local level under 18 projects across Japan, including experts’ coordinating activities, promotion of industry-academia joint research, support for the development of new sales channels and provision of various information.

**(Results of the formation of clusters at the local level)**

In the City Area Program, which has been implemented by the MEXT since fiscal 2002, 1,524 people from 414 public research organizations including universities and 1,707 people from 939 private-sector organizations participated in fiscal 2007. In each region, such organizations actively engaged in activities to form a network of cooperation between industry, academia, and government, such as industry-academia-government joint research programs, interchange meetings, and research forums.

As a result of industry-academia-government joint research activities, 3,797 research papers were published and 1,050 domestic and 146 foreign patent applications were made, indicating that the seeds of technology held by universities and other research organizations are being passed steadily on to industry. In addition, those seeds of technology have been used in many regions to commercialize products, put new technology into practice, and establish new companies, with the total number of such cases reaching 900.

**[Table 4-18 Follow-Up Survey on the City Area Program (Fiscal 2007)]**

<table>
<thead>
<tr>
<th>Areas where the project ended in fiscal 2004 (9 areas)</th>
<th>Number of participating organizations/researchers</th>
<th>Number of cases that led to commercialization, practical application, or the establishment of companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universities/public research institutes</td>
<td>Number of people</td>
<td>Number of organizations</td>
</tr>
<tr>
<td>479</td>
<td>144</td>
<td>414</td>
</tr>
<tr>
<td>Areas where the project ended in fiscal 2005 (9 areas)</td>
<td>356</td>
<td>120</td>
</tr>
<tr>
<td>Areas where the project ended in fiscal 2006 (9 areas)</td>
<td>284</td>
<td>69</td>
</tr>
<tr>
<td>Areas where the project ended in fiscal 2007 (13 areas)</td>
<td>405</td>
<td>81</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,524</strong></td>
<td><strong>414</strong></td>
</tr>
</tbody>
</table>

*The numbers for “participating organizations/researchers” are figures for fiscal 2007. The numbers for all other items are cumulative figures till fiscal 2007.*

---

**[Chart 4-17 Industrial Cluster Projects (18 projects across Japan)]**

- **First Term (2000-2005)**
  - Development Period

- **Second Term (2006-2010)**
  - Development Period

- **Third Term (2011-2020)**
  - Sustainable Development Period

---

**[Table 4-18 Follow-Up Survey on the City Area Program (Fiscal 2007)]**

<table>
<thead>
<tr>
<th>Areas where the project ended in fiscal 2004 (9 areas)</th>
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</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>414</strong></td>
</tr>
</tbody>
</table>

*The numbers for “participating organizations/researchers” are figures for fiscal 2007. The numbers for all other items are cumulative figures till fiscal 2007.*
“Monodzukuri techniques” contribute to improvements in the standard of living and resolution of social problems, including safety and environmental problems, by creating new added-value for products and processes. The manufacturing industry is pursuing R&D concerning value-creating basic manufacturing infrastructures by promoting R&D on the most advanced measurement and analysis technologies and equipment, R&D on basic technologies based on IT and nanotechnology, and the development and utilization of the most advanced, large-scale R&D infrastructures.

[Column: Development of an Automated Sugar Chain Analyzer for Early Diagnosis of Diseases]

A team led by Professor Shinichiro Nishimura of Hokkaido University established the basic technology for large-scale, quantitative analysis of sugar chains, which is deemed to be effective in early diagnosis of cancer and other diseases, in an equipment development program within the project to develop advanced measurement and analysis technologies and equipment, and succeeded in developing the world’s first automated analyzer. With the use of this new technology and equipment, new diagnosis markers for lung cancer, cancer of the pancreas and rheumatism were discovered.

[Column: Activities to Develop and Spread the VCAD System]

RIKEN has made basic programs of the VCAD (Volume-CAD) system, which integrates process such as product design, prediction of functions and structures, and simulation of the manufacturing process, available for free, with the number of basic programs made available by December 2008 standing at 17.

[Column: Support for Nanotech Research through the Nanotechnology Network Project]

The Nanotechnology Network Project is intended to promote the fusion of various research fields through the sharing of research facilities and equipment owned by 26 research organizations across Japan, including universities and incorporated independent agencies, and to develop and strengthen the infrastructure for nanotechnology research. The achievements of activities that have been conducted so far include the creation of a catalyst with enhanced functions by integrating minute particles of different metals, such as nickel and zinc, into a cluster of particles, compared with the functions of a catalyst comprised of particles of a single element. The new catalyst is expected to be used for the development of methanol-based fuel cells, opening up new potential for the manufacturing industry.
Section 4 Development of monodzukuri human resources through school educational programs

Based on the fact that the amended Basic Act on Education now specifies that relevance to vocation and lifestyle is to be emphasized, and that an attitude that respects labor is to be taken, activities consisting of workplace experience were also prescribed in the new Courses of Study.

With due consideration to the above, the government provides manufacturing education from elementary school to university according to the development stage of the children, and also promotes a variety of activities related to monodzukuri as a part of social education.

Since school education in particular faces such challenges as how to facilitate the transition from school to work and society and how to meet the requirements for advanced knowledge and skills, in December 2008, the Central Council for Education was consulted with regards to the future state of career and vocational education in schools. These issues are currently under active deliberation from a broad perspective.

(Universities are promoting the development and implementation of coordinated educational programs combining experiments and practical lessons with lectures through cooperation with local communities and industry. Colleges of technology provide five years of consistent practical and creative education with an emphasis on experiments and practical lessons, and students improve themselves by competing with each other through a variety of contests, such as Robot Contests. Special training colleges provide practical vocational education in a variety of fields, such as industrial technology, in cooperation with industry.)

Column: Establishment of a Base for Manufacturing Education through Practical PBL at Yokohama National University (Selected as a “project to support the fostering of manufacturing engineers” in fiscal 2007)

This project is intended to foster, through PBL (Problem-Based Learning) education based on comprehensive engineering that does not focus on any particular field of research, excellent engineers who have practical engineering skills and the skills of working members of society (problem-identifying ability, problem-solving ability, ability to put plans into practice, creativity, communication skills, and presentation skills), all of which are strongly required by industry, and who can immediately contribute to real-life society. In order to enable an understanding of manufacturing in its entirety and individual processes of manufacturing, the manufacturing of racing cars and human-powered aircrafts, for example, is adopted as the theme of this project, since such cars and aircrafts are comprised of numerous components that need to be designed and analyzed through active discussions involving many students. The manufactured products will be displayed at a national students’ contest, which not only enables the participating students to improve their ability to put ideas into practice by reflecting on the processes of manufacturing based on the evaluation of their products by business people but also enhances their motivation.

[A human-powered aircraft manufactured by students flying]
Title: Competition of Ideas — The Robot Contest between National Colleges of Technology from Across Japan

The Robot Contest is a nationwide educational event in which technical college students compete with each other in ideas and technology under an annual competition theme, providing the opportunity for them to experience the fun of making robots based on their own ideas and with their own hands and to recognize the importance of coming up with ideas and share the delight of monodzukuri.

The 21st Robot Contest, which was held in 2008 under the theme “Robo-Evolution: Major Evolution of Life,” invited students, for the first time, to compete in the manufacturing of bipedal robots. In the contest, each robot was required to first make one round of the 12 meter track in multi-legged mode, pass a hurdle measuring 50 centimeters wide and 20 centimeters high, and shift to a biped mode over a prescribed period of 20 seconds and finally compete for time in this mode.

Title: Example of an Activity at a Special Training Colleges

Ueda College of Fashion (Osaka Prefecture) provides a practical education program in cooperation with leather manufacturers in Tatsuno City, Hyogo Prefecture, as a part of efforts to cooperate with a materials-producing region and realize local revitalization.

This activity helps to increase students’ commitment to monodzukuri and advance their skills through the processes of designing clothing and miscellaneous goods and manufacturing samples of them. In addition, products made by students have been displayed at a variety of events, including the Kansei-Japan Design Exhibition (sponsored by METI), which was held at the Musée des Arts Décoratifs (the French national museum of decorative arts) in the Palais du Louvre.

Title: Education programs on monodzukuri in elementary and lower secondary education

Elementary, lower secondary, and upper secondary schools, as well as schools for special needs education, have been providing education programs on monodzukuri in various subjects based on the new Courses of Study. Career education has been enhanced through the introduction of at least five days of a workplace experience (the Career Start Week). It is necessary to consider how to enhance such activities so as to enable individual schools to make progress in career education efforts.

Meanwhile, specialized upper secondary schools, in cooperation with universities and research organizations, support a unique education that includes the acquisition of advanced techniques and skills, and have been promoting education that combines classroom lectures with long-term practical training in the workplace in cooperation with local companies.

<table>
<thead>
<tr>
<th>Column: Example of an Activity at a Special Training Colleges</th>
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<tbody>
<tr>
<td>Ueda College of Fashion (Osaka Prefecture) provides a practical education program in cooperation with leather manufacturers in Tatsuno City, Hyogo Prefecture, as a part of efforts to cooperate with a materials-producing region and realize local revitalization. This activity helps to increase students’ commitment to monodzukuri and advance their skills through the processes of designing clothing and miscellaneous goods and manufacturing samples of them. In addition, products made by students have been displayed at a variety of events, including the Kansei-Japan Design Exhibition (sponsored by METI), which was held at the Musée des Arts Décoratifs (the French national museum of decorative arts) in the Palais du Louvre.</td>
</tr>
</tbody>
</table>

Title: Competition of Ideas — The Robot Contest between National Colleges of Technology from Across Japan

[Winner of Robocon Grand Prix: “Gymnastics” by Tsuyama National College of Technology]
[Column: “National Creation and Manufacturing Education Fair for Junior High School Students”]

The “National Creation and Manufacturing Education Fair for Junior High School Students” is held annually under the sponsorship of the National Japanese Junior High School Technology and Home Economics Education Research Association and other organizations in order to allow junior high-school students across Japan to have the pleasure of making things, to increase their interest in manufacturing, and to provide an opportunity for the publication of the achievements of their learning in the subjects of technology and home economics and for an interchange between students and teachers.

Contests held as part of this event include "Go for It! 'Woodworking Skills' Champion," which is related to wood processing, the "Creative Ideas Robot Contest" related to electricity, machines, and control, "The Best Ideas for Shorts," which is related to apparel production, and "A Special Box Lunch for You; Contest" related to food preparation. Participants with excellent performance are awarded prizes by the Minister of Education, Culture, Sports, Science and Technology.

About 12,000 people attended the ninth fair that was held in fiscal 2008 in Tokyo’s Adachi Ward and watched the contests, and more than 40,000 people attended regional preliminaries held in other prefectures. Thus, this event provides one opportunity for more people to understand manufacturing.

[A student competing in "Go for It! 'Woodworking Skills' Champion"]

[Column: Example of Monodzukuri Education at a School for Special Needs Education]

A school for special needs education named Hokkaido Date Koto Yogo Gakko has adopted practical, job training at technical course of its upper secondary school department for the acquisition of basic manufacturing skills through metal processing such as manufacturing portable cooking stoves for barbecuing. Students work cooperatively the manufacturing process including line-drawing on materials, and sell the products at school festivals.

Students not only acquire basic manufacturing skills through metal processing, but also feel a sense of fulfillment that they are contributing to the daily lives of local people through their sales activities oriented to local people and the community.

In addition, the graduates engage in manufacturing metal products and furniture, while school teachers visit their workplaces so as to provide post-graduation instruction.

[Column: Participation in the National Skill Olympic Games (Ogaki Technical High School in Gifu Prefecture)]

In the National Skill Olympics Games for the mechatronics trade, participants compete in skills related to mechanical technology, electronics technology, and programming with the use of a model of an automated production line. Together with company employees and occupational trainees, upper secondary school students participate in the National Skill Olympic Games in a bid to advance to the International Youth Skill Olympics.

[Column: Project to Foster Personnel that Support Local Industries]

This project has been implemented jointly by MEXT and METI since fiscal 2007 in order to foster personnel who support local manufacturing industries through cooperation between technical upper secondary schools and local industries. At prefectural and municipal technical upper secondary schools in 29 regions across Japan, there are ongoing projects in which students are trained under internships at local companies or under the Dual Training System for about 20 days in order to acquire professional skills and projects in which students receive instructions directly from skilled company workers.
Various organizations are engaged in a diverse range of activities in order to promote monodzukuri education, and the Ministry of Education, Culture, Sports, Science and Technology supports such activities.

[Column: Chiba City Museum of Science]
Chiba City Museum of Science (Chiba Prefecture) is engaged in experiential activities to prompt people to notice what is hidden from the eyes by having museum employees and volunteers interact with visitors under various programs with the concept “Humans are the Heroes.” The Techno Town on the ninth floor of the museum is an exhibition zone that explains the “technologies and principles” that lie behind products and machines that we see in our everyday life unconsciously, thereby acquainting visitors with the wonderful creativity of humans. Under workshop programs implemented in various zones, science handicraft lessons using familiar materials are provided every day. In addition, the “Science Club for Boys and Girls” is operated throughout the year to provide education through craftwork. The museum, in cooperation with the Chiba Foundation for the Promotion of Industry, has also opened a section that explains the monodzukuri activities of local companies.

[Column: Example of a Project to Exhibit Skills for the Conservation Techniques for Cultural Properties]
The Miyako Association for the Conservation of Bunmi, which has undertaken the preservation of the selected skill of cultivation and thread making of ramie (Boehmeria nivea), trains successors who can pass this skill on to future generations. Under the project to exhibit skills selected for preservation, the association exhibited panels related to the skill and showed an actual performance of making thread and other processes.
Part 2 Measures and Policies Implemented in Fiscal 2008 Relating to the Promotion of Manufacturing Infrastructure Technology

1. Matters Related to Research and Development of Manufacturing Infrastructure Technology

Matters related to research and development of manufacturing infrastructure technology

(1) Revision of the New Economic Growth Strategy

The New Economic Growth Strategy, which was adopted in June 2006, was revised and approved by the cabinet in September 2008, as the government selected measures that should be strengthened or implemented more quickly in order to indicate a new path to future growth and realize this growth. As a result of the revision, it is required for the government to actively promote R&D and the development of an environment for the realization of new industries capable of making great contributions to the advancement of the parts and materials industries necessary for further development of Japan’s manufacturing industries. The government is also required to actively promote international expansion of domestic demand-oriented industries, such as the daily-use products industry.

(2) Tax system for promoting research and development (scale of tax cuts: 651 billion yen [in fiscal 2008])

i) Tax credit system relating to the total amount of experiment and research costs

A tax exemption equivalent to 8% to 10%* of the total amount of experiment and research costs (the upper limit set at 20% of the amount of the corporate taxes to be paid for the relevant fiscal year) continued to be applicable, according to the research and experiment cost ratio (the ratio of experiment and research costs to the total sales).

*The tax exemption ratio relating to special experiment and research costs is a figure obtained by subtracting the tax exemption rate relating to experiment and research costs from the rate of 12%.

ii) Tax system for strengthening SMEs’ technology infrastructures

Regarding R&D activities conducted by SMEs, a tax exemption equivalent to 12% of the experiment and research costs (the upper limit set at 20% of the amount of corporate taxes to be paid for the relevant fiscal year) continued to be applicable.

iii) Tax deduction system relating to an increase in experiment and research costs

In addition to i) and ii) above, it was arranged that either a tax deduction system related to an increase in experiment and research costs or a tax deduction system related to the portion of the amount of experiment and research costs in excess of 10% of the average sales was applicable (the upper limit set at 10% of the amount of corporate taxes to be paid for the relevant fiscal year, separately from the upper limits concerning i) and ii) above.

(3) Formulation of a technology strategy map

Since the 2005 adoption of a the first technology strategy map that takes into consideration future needs of society and the people and advances and other developments related to technologies, the government has been revising it annually to review its contents and expand the range of fields covered. In April 2008, the technology strategy map 2008, which covers 29 fields, up from 25 in the previous year’s version, was announced.

(4) Steady promotion of programs for innovation (198.6 billion yen)

The 17 R&D programs that have been implemented by METI since fiscal 2008 have been consolidated into the following seven programs for innovation under more basic policy goals. Under these programs for innovation, the government promoted R&D activities and measures necessary for the commercialization of the achievements of the activities (regulatory reforms, standardization, etc.) in a comprehensive manner and encouraged the creation of innovation through the promotion of S&T.

i) IT innovation program     iii) Nanotech/materials and components innovation program
ii) Nanotech/materials and components innovation program  iv) Energy innovation program
v) Environment and safety innovation program     vi) Health and comfort innovation program
vii) Aerospace innovation program
Matters related to research and development of manufacturing infrastructure technology

(5) Thorough management of trade secrets and thorough prevention of leakage of technology

Explanatory meetings were held at 16 locations across Japan to widely communicate the contents of the Unfair Competition Prevention Act. In addition, a government booth was established at an SME business fair, a pamphlet concerning the management of business secrets was published on METI's website, and efforts to spread and raise awareness about appropriate methods of managing business secrets were made through the Public Relations Office. Furthermore, in response to the recommendations included in a report submitted by the study group on the appropriate management of technology information, the subcommittee on how to protect information technology of the Industrial Structure Council’s Intellectual Property Policy Committee held a series of discussions from September 2008 and drew up a report entitled “Regarding the direction of the review of criminal punishments concerning business secrets” in February 2009.

Collaboration between manufacturing businesses and universities, etc.

(1) Partnership between industry and academia for human resource development (1.77 billion yen)

Partnership between industry and academia for human resource development to create a positive growth cycle for collaboration between industry and academia for human resource development in Japan, the “Industry-Academia Partnership for Human Resource Development” was established in fiscal 2007 to provide opportunities for dialogue and actions relating to human resource development for both the academic and industrial circles. In fiscal 2008, an interim report on this partnership was drawn up and specific measures were taken, including the development of human resource development model programs in various fields, through industry-academia collaboration and the development of a systematic method for fostering and evaluating students' basic social skills.

(2) Career Gateway to Asia (3.05 billion yen)

In order to form a network with other Asian countries, promote the globalization of Japanese universities and companies, and strengthen the competitiveness of Japanese industry, since fiscal 2007, the government has been implementing the Career Gateway to Asia program, which promotes the development of advanced overseas human resources capable of contributing to Japanese industry by implementing projects to provide Asian students staying in Japan with specialized education, Japanese language education, corporate culture education, internships, and employment-support through industry-academia collaboration. In fiscal 2008, around 1,300 foreign students participated in the Career Gateway to Asia.

2. Matters Related to Securing Manufacturing Workers

Prevention of unemployment and other matters related to employment stability

(1) Maintenance and stabilization of employment through the subsidy for employment adjustments (5.53 billion yen)

In order to prevent unemployment and stabilize the employment situation in other ways in cases where companies are forced to reduce business activity for economic reasons such as economic cyclical changes and changes in the industrial structure, a subsidy for employment adjustments was provided to companies that strive to maintain employment by suspending business operations temporarily or sending employees on loan to other companies.
Development and improvement of vocational capabilities

(1) Job training for displaced workers and people looking to change jobs
While employment conditions continue to be harsh, job training is being implemented by consigning training to various kinds of private-sector education and training institutions, such as special training schools, universities, NPOs, companies seeking workers, etc., in addition to public facilities for the development of vocational capabilities, in order to promote the smooth re-employment of workers, including manufacturing workers who were forced to leave their jobs.

In addition, in order to enable people who are not eligible for unemployment insurance to take training courses without worrying about expenses, a system to provide such people with funds to cover their living expenses during the training period and to exempt them from repayment was established in November 2008 and was expanded in January and February 2009.

Furthermore, the government established public facilities for the development of vocational capabilities, including vocational capability development schools (totaling 173 schools as of April 2008), vocational capability development junior colleges (9), vocational capability development universities (9), a comprehensive vocational capability development university (1), vocational capability development promotion centers (62) and vocational capability development centers for people with disabilities (19).

(2) Establishment of the job card system
The job card system was established in April 2008 in order to enable people with limited opportunities for vocational ability development, such as “freeters,” women who have finished raising children, and single mothers, to enhance their capabilities and shift to stable jobs. This system first enlightens freeters and others about employment and helps them identify problems through careful career counseling and then provides them with practical job training that combines practice in the workplace and classroom lectures. The evaluation of the training results and work experience are noted on their job cards for use in their job search.

Job training under this system includes:

i) Fixed-term practical training: Practical training provided by companies to freeters and other people with little experience of working as a regular worker by employing them for three to six months.

ii) System for fostering personnel with practical skills: Training provided by companies mainly to new graduates to develop core personnel by employing them for six months to two years.

iii) The Japanese version of the dual system: training provided to freeters and women who have finished raising their children, usually for four months, by private education and training organizations commissioned by the government.

These programs provide opportunities to develop vocational capabilities and promote a shift to stable employment.

3. Matters Related to Cultivation of Infrastructure in the Manufacturing Industry

Promotion of industrial clusters, etc.

(1) Program for promoting regional industrial location (5.375 billion yen)
Under this program, regions drew up basic plans in light of their own characteristics, and the government provided subsidies for projects to realize the plans, including projects to invite companies, develop human resources, and construct plants and other business sites for rental. In addition, “one-stop service” related to industrial location was provided by the Japan Industrial Location Center. Regarding measures to make institutional improvements, the Industrial Location Promotion Act was amended to add business sectors related to agriculture, forestry, and fisheries to the scope of sectors eligible for a special depreciation measure. In addition, a lending program by Japan Finance Corporation was established to support activities to promote industrial location and engagement in advanced business by SMEs.

(2) Program to support regional revitalization, including traditional manufacturing regions (1.088 billion yen)
In order to promote the development of manufacturing regions and industrial cluster regions, subsidies were provided to support ambitious initiatives by manufacturing regions, including projects by local SMEs and associations to develop new sales channels, develop products that accurately capture the market needs, and foster personnel.
Cultivation of small and medium-sized enterprises

(1) Improvement of subcontracting transactions

i) Enforcement of the Subcontract Proceeds Act

In order to make subcontracting transactions more effective and efficient, a written survey was conducted on new businesses and subcontracting businesses and on-site inspections of them were implemented based on the Subcontract Proceeds Act. In light of the results of these surveys and inspections, guidance for improvement was given to businesses that have violated or may violate the Subcontract Proceeds Act or may violate the law.

ii) Implementation of special on-site inspections

Special on-site inspections of prime contractor businesses that belong to sectors that are strongly affected by a rise in prices of crude oil and raw materials were implemented to conduct intensive checks as to whether or not they were making an unfair demand for price cuts, which is a practice prohibited under the Subcontract Proceeds Act.

iii) Guidelines on improvement of subcontracting transactions

In order to raise awareness about and promote the best practices concerning subcontracting transactions, 120,000 copies of the revised edition of a pamphlet listing such best practices were printed.

iv) Consultation centers for subcontractors

48 consultation centers for subcontractors were opened, including the headquarters and regional centers in the 47 prefectures, in order to provide conscientious consultations regarding subcontracting transactions, implement out-of-court dispute settlement procedures, and raise awareness about and promote guidelines on improvement of subcontracting transactions.

v) Countermeasures against a surge in prices of crude oil and raw materials

In order to support SMES including subcontractors that find it difficult to sufficiently pass the rapid rise in prices of crude oil and raw materials on to product prices, METI issued a ministerial notice that specifically describes the unfair demand for price cuts, which is a prohibited practice.

(2) Promotion of innovations in management

The following measures were implemented in order to support innovations in management by SMEs intended to significantly improve management through new business activities conducted in quick response to changes in the economic environment, such as the development and production of new products, the development and provision of new services and the introduction of new methods of producing and selling products and providing services.

i) Loans provided by governmental financial institutions

Low-interest loans were provided to individual SMEs, associations and voluntary groups implementing projects to carry out innovations in management after obtaining approval of their business innovation plans based on the Act for the Promotion of New Business Activities by Small and Medium-Size Enterprises.

ii) Special cases related to the Small and Medium-Size Enterprise Credit Insurance Act

As special cases of the ordinary insurance, unsecured insurance, and small-lot special insurance as specified under the Small and Medium-Size Enterprise Credit Insurance Act, support was provided to facilitate the supply of funds for projects implemented after approval of business innovation plans based on the Act for the Promotion of New Business Activities by Small and Medium-Size Enterprises.

(iii) Program to develop platform systems for SME management innovation (2 billion yen)

A system constituting the infrastructure of an Internet-based software provider that enables SMEs to easily make their business operations efficient at low cost and applications software for financial accounting and salary calculations that operate on the system were developed.
4. Matters Related to Promotion of Studies Concerning Manufacturing Infrastructure Technology

Monodzukuri education in school education

(1) Career Education Project (232 million yen)
In order to foster children's concepts of career and work, career education was promoted through the establishment of a framework for local cooperation and the implementation of “Career Start Week,” a workplace experience project intended mainly for lower secondary school students that lasts at least 5 days.

(2) Project to foster personnel that support local industries (390 million yen)
The relevant ministries (METI, MLIT, and the Ministry of Agriculture, Forestry and Fisheries), together with specialized upper secondary schools and local business circles, implemented initiatives to foster professional workers who protect the culture of manufacturing as well as culinary and everyday life and support local industries.

(3) "Become a specialist (super specialized upper secondary schools)" project (120 million yen)
A project was implemented in collaboration with universities, research organizations, and others, to reinvigorate specialized upper secondary schools through the provision of support for such distinctive initiatives as education that incorporates advanced technologies and skills.

(4) Project to develop human resources with advanced practical skills through industry-academia collaboration (513 million yen)
Educational programs that help to develop human resources with practical skills through industry-academia collaboration at universities and colleges of technology were developed and implemented.

(5) Plan for promoting vocational education through collaboration with special training colleges and colleges of technology (147 million yen)
Under the plan, the government, in collaboration with special training colleges and colleges of technology, provided opportunities for upper secondary school students to participate in various kinds of work experiences by introducing examples of employment-related knowledge, skills and qualifications to the students and by having them participate in vocational experience workshops. In addition, the plan was intended to foster young people’s job consciousness and motivation to study technology and acquire skills that contribute to manufacturing by holding vocational experience workshops in various regions.

5. Necessities Related to the Promotion of Other Manufacturing Infrastructure Technology (6.516 billion yen)

(1) Project to train economic and industrial human resources (6.516 billion yen)
A training program related to Japanese companies’ technologies and management know-how was implemented for industrial engineers in developing regions. In fiscal 2008, training was provided in Japan and abroad for SMEs and supporting industries in developing regions, mainly in Asia.