Promotion of University-Industry Linkages in Japan

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Today’s Topics

1. Key S&T Indicators Relating to University–Industry Cooperation

2. Administrative Structure and Development of University–Industry Cooperation Policy

3. Overview of Relevant Public Policies and Programs

4. Highlights of NISTEP’s Related Studies
1. Key S&T Indicators and Figures Relating to University–Industry Cooperation
Trend in total R&D expenditure in selected countries
Real values
(2000 base: OECD purchasing power parity equivalent)

Sources: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material-225, August 2013
Flow of R&D funds from funding sectors to performing sectors in selected countries
Japan (2011)

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material-225, August 2013
Flow of R&D funds from funding sectors to performing sectors in selected countries

U.S. (2011)

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material–225, August 2013
Flow of R&D funds from funding sectors to performing sectors in selected countries


Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material–225, August 2013
Flow of R&D funds from funding sectors to performing sectors in selected countries

China(2011)

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material–225, August 2013
Flow of R&D funds from funding sectors to performing sectors in selected countries

Korea (2010)

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material–225, August 2013
The change in the share of the numbers of papers in main countries

Data: 3-years moving average of share tabulated from Thomson Reuters “Web of Science(SCIE, CPCI-S)” by fractional counting.

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material-225, August 2013
Analysis of Paper Publication by sector in Japan

1. Falling number of papers by private companies.
2. Growing number of papers by public research institutions (IAI).
3. Slight decrease in domestic share of national universities.
4. Slight increase in domestic share of private universities.

Number of papers published by sectors in Japan (fractional counting method)

<table>
<thead>
<tr>
<th>All fields</th>
<th>No. of papers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002-2004 (average)</td>
</tr>
<tr>
<td>National universities</td>
<td>29,096</td>
</tr>
<tr>
<td>Public universities</td>
<td>2,789</td>
</tr>
<tr>
<td>Private universities</td>
<td>8,821</td>
</tr>
<tr>
<td>Independent Administrative Institutions</td>
<td>4,572</td>
</tr>
<tr>
<td>Private companies</td>
<td>4,298</td>
</tr>
<tr>
<td>Japan total</td>
<td>56,693</td>
</tr>
</tbody>
</table>
The numbers of patent applications from main countries (1995–2011)

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material–225, August 2013
Change in the trade amount of high technology industry in main countries

The amount of exports

The amount of imports

1996-2010 for Russia
1995-2010 for other countries

Source: National Institute of Science and Technology Policy, Japanese Science & Technology Indicators 2013, Research Material-225, August 2013
Trends in University-Industry Collaboration (Cont’d)

Collaborative Research between University and Industry

Licensing of University Patents
2. Administrative Structure and Development of University-Industry Cooperation Policy
Administrative Structure for S&T Policy

Prime Minister

Cabinet Office
Council for Science and Technology Policy (CSTP)
S&T Basic Plan, Resource Allocation Policy …

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

Coordination

Other Ministries

Universities

- National: 86 univ.
- Local: 95 univ.
- Private: 599 univ.
- Total: 780 univ.

- Independent Administrative Institution: 9 inst.
- Inter-University Research Institute Corporation: 4 corporations (15 inst.)

※Source: FY2011 School Basic Survey
Increase in governmental R&D expenditure
The total budget for governmental R&D expenditure exceeded 17 trillion yen. (result: 17.6 trillion yen)

Construction of new R&D system
- Increase in competitive research funds
- Support plan for 10,000 post-doctoral fellows (including Ph.D students)
- Promotion of industry-academia-government collaboration
- Implementation of evaluation system

Three basic ideas
- Creation of Wisdom
- Vitality from wisdom
- Sophisticated society by wisdom

Key policies
- Strategic priority setting in S&T
  - Promotion of basic researches
  - Prioritization of R&D on national/social subjects
- S&T system reforms
  - Doubling of competitive research funds
  - Enhancement of industry-academia-government collaboration
- Total budget of 2nd basic policy 24 trillion yen
  (result: 21.1 trillion yen)
- Total budget of 3rd basic policy 25 trillion yen
  (result: 21.7 trillion yen)

Administrative Structure for S&T Policy

The 1st Science and Technology Basic Plan (FY1996～2000)
- Basic Concept
  - Integrated development of “STI policies”
  - Further focus on the “role of human resources and the organizations”
  - Realization of Policy Created together with Society
  - Realization of Sustainable Growth and Societal Development into the Future
  - Recovery and rehabilitation from the recent earthquake
  - Green and Life Innovation
  - Enhancing Basic Research and Human Resource Development
  - Establishing the PDCA Cycle and Action Plan for improving science policy

Total amount of the government R&D investment

25 trillion yen → 25 trillion yen

Prepared by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) based on materials prepared by the Cabinet Office
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>'96</td>
<td>To Promote Tech Transfer from University to Industry</td>
</tr>
<tr>
<td>'97</td>
<td>Establishment of TLOs</td>
</tr>
<tr>
<td>'98</td>
<td>“The Law on Promotion of Tech. Transfers from Univ. to Industry.”</td>
</tr>
<tr>
<td>'99</td>
<td>“The Law on Special Measures for Industrial Revitalization”</td>
</tr>
<tr>
<td>'00</td>
<td>Japanese “Bayh-Dole Act”</td>
</tr>
<tr>
<td>'01</td>
<td>“The Intellectual Property Basic Law”</td>
</tr>
<tr>
<td>'02</td>
<td>“The Annual IP Promotion Plan”</td>
</tr>
<tr>
<td>'03</td>
<td>“National University Reform”</td>
</tr>
<tr>
<td>'04</td>
<td>Able to invest to the TLO IP belongs to universities</td>
</tr>
<tr>
<td>'05</td>
<td>Amendment of “The Fundamental Law of Education”</td>
</tr>
<tr>
<td>'06</td>
<td>Re-defining roles of universities</td>
</tr>
<tr>
<td>'07</td>
<td>Screening Process for budget cut</td>
</tr>
<tr>
<td>'08</td>
<td>“New Growth Strategy”</td>
</tr>
<tr>
<td>'09</td>
<td></td>
</tr>
<tr>
<td>'10</td>
<td></td>
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<tr>
<td>'11</td>
<td></td>
</tr>
<tr>
<td>'12</td>
<td></td>
</tr>
<tr>
<td>'13</td>
<td></td>
</tr>
</tbody>
</table>
3. Overview of Relevant Public Policies & Programs
Overview of Promoting Policies for Industry Collaboration & Regional Innovation

【Project for Developing Innovation Systems】

Regional Innovation Strategy Support Program
Effectively support a high-quality locally led scheme to encourage regional innovation. In particular, new support for research conducted by multiple regions.

①Support to Forming Regional Cluster under Local Initiatives

【Creating an environment conducive to beefing up support for commercialization】

②Project for Creating New Industries from Universities
Set up a system to encourage innovation by creating a team at universities and similar institutions to work on commercialization beginning at the invention phase and by promoting unified R&D and business development.

Support for collaborative research (ideas-push)
- ④ A-STEP Adaptable and Seamless Technology Transfer Program through Target-Driven R&D

Support for top-down collaborative projects
1. Large-scale and long-term R&D projects with consortiums
2. Development of systems and technology for advanced measurement and analysis
3. Cooperative basic research projects to solve problems in industry

【Infrastructure of industry-university cooperation】

- University Research Administrator (URA)

【Support for patent applications】

- JST support center for technology transfer
- JST support for overseas patent applications

Outputs / Outcomes of basic research

MEXT Policy  JST Policy

JST stands for Japan science and Technology Agency, which is one of the independent administrative institutions in Japan.
Adaptable and Seamless Technology Transfer Program through Target-Driven R&D (A-STEP)

- Covering all fields of R&D for technology transfer including medical sciences.
- Application is submitted jointly by university researchers and company partners.

Other funding programs (JST, NEDO, etc)
In-house development, etc

Feasibility Study (FS)
To examine commercial viability and start-up ventures based on research results obtained in universities
- Seed validation
- Start-up validation

Optimizing R&D plan
peer-review process

Full-Scale R&D
To promote technology transfer flexibly and seamlessly
- Practical application
- Promoting R&D
- High-risk challenge
- Start-up venture

Stage-gate review

Feed innovation back into society!
Pioneering Results brought by A-STEP and Previous Projects

The innovation was created from a long-term pure and basic research in the industrial world.

Isamu Akasaki (Nagoya univ)

It succeeds in blue LED development of the world first by using gallium nitride (GaN).

The expression of full-color became possible by putting blue LED to practical use.

Impact that blue LED and white LED bring

1960's Discovery of basic principle of LED (United States)
1970's red, green was put to practical use.
1990's that is the invention of Japan puts it to practical use.

Three primary colors of light become complete, and all the colors become feasible.

is achieved by combining the luminescent material with "Blue".

Production increases rapidly, and the usage has expanded greatly.

New market value of about 350 billion yen arose by blue LED a result of development.

Effect by LED production
80.7 billion yen

LED sales of Toyoda Gosei
53.2 billion yen

Effect by product sales
210.9 billion yen

Effect of job creation
32,000 Employment

Development period 1987〜1990

http://www.jst.go.jp/itaku/result/effect.html
Since 1958

1959 Synthetic crystal
- Radios, TVs, Watches, mobile phones, PCs

1962 High luminosity Red LED
- Display

1972 Amorphous metals
- Magnetic components in magnetic devices

1977 GaN-based blue LED
- Display devices

1986 Polymers with phospholipid polar group
- Cosmetics, contact lenses, biocompatible materials

1997 18O-labeled water for PET diagnosis
- Early detection and treatment of cancer

2000 Retinoic acid nanoparticles
- Cosmetics

2003 Large high-precision scanner system
- For cultural assets etc.

2004 Production engineering of valuable antibodies
- Surgical influenza face masks, air cleaners

JST-launched start-ups: 248 (as of Nov. 09; cumulative)
- 12% of all academic start-ups ever established.
- Gross sales: ¥11 B, Employees: 1,800
- Benefit for the overall economy: ¥20 B

Licensing income: ¥19 B (as of Jan. 2010, cumulative)
- Benefit for the overall economy: ¥627 B (approx. estimation)
Structure of the Regional Innovation Cluster Program

Experts and specialists evaluate and select the visions and concepts proposed by individual regions and then MEXT provides the funds to core organizations in order to realize them.

Local governments plan their own cluster visions

Local governments enact various policies in order to realize the regional cluster vision

Core Organizations (Designated by local governments)

Collaboration

Contract Research

Collaboration

Projects of Other Ministries and Agencies

Projects of Local Organizations (Universities, Business Groups, etc.)

MEXT

Proposal

Provision of Subsidies

Planning

Designation
Support to Forming Regional Cluster under Local Initiatives (2012)

Typical Results (FY 2002 to 2010)

- Patents          Domestic 3,829  International  692
- Practical Use (commercialization, Incorporation, etc.) 3,434
- Articles         Domestic 4,655  International  9,435
- Sales of related products
  Approximately 82.2 billion JPY
  (7.53 billion EUR)

Regions with ongoing cluster projects will receive steady support until 2013 when ongoing issues conclude, with consideration to project continuity and consistency, under the banner of the “Program for Fostering Regional Innovation” for ongoing regions.

MEXT strongly supports the formation of world-class clusters, while encouraging regional independence, in cooperation with relevant ministries such as METI.

MEXT supports the creation of new businesses and R&D businesses that utilize unique regional resources through industry-academia-government collaborations.

On Ongoing Regions

Knowledge Cluster Initiative and City Area Program Map

Regions with ongoing cluster projects will receive steady support until 2013 when ongoing issues conclude, with consideration to project continuity and consistency, under the banner of the “Program for Fostering Regional Innovation” for ongoing regions.
Major Achievements

Fukuoka Kitakyushu Iizuka
Global Type : 2nd Stage (FY2007 ~ 2011)

Companies attracted to the region by the efforts to establish a world-class R&D hub of advanced system LSI

(Background)

• Aiming at activating the “Silicon Sea Belt region”, where more than 70% of semiconductors produced in the world are consumed.
• Collaboration with research organizations in the Silicon Sea Belt region in order to promote joint research toward the commercialization of research results.

(Project)

• Expanding the network with other research centers in the Asian region and spurring business exchange activities through interregional exchange events such as international conferences and technical exchange meetings.
• The number of system-LSI-related companies in the region increased by more than ten times during the period from Fiscal 2000 to Fiscal 2011, to 225 companies.
New Inter-Ministry Initiative for Regional Cluster Policy

- **Regional Innovation Strategies Support Program**
  - In Fiscal 2011, MEXT, Ministry of Economy, Trade and Industry (METI) and Ministry of Agriculture, Forestry and Fisheries (MAFF) jointly designated regions with excellent visions toward the creation of regional innovations as “Regional Innovation Strategy Promoting Regions”.
  - Among these regions, those with especially outstanding strategies will receive seamless support from these ministries to help the regions realize their regional innovation strategies comprehensively and efficiently.

- **Innovation Promotion Council**
  - To establish “regional innovation strategies” for the creation of new regional innovations and to implement self-sustainable activities toward the realization

  - **Local governments**
    - Establishment of innovation systems using mainly regional funds
  - **Universities and other research institutions**
    - Research aimed at contributing to the regions
  - **Financial sector**
    - Investment and loan
  - **Companies**
    - Research and development, commercialization of R&D results

- **Support**
  - **MEXT**
    - Role: Provision of support for the formation of intellectual assets and for the development of human resources
  - **METI, MAFF, etc.**
    - Role: Provision of support for the commercialization of research results, development of sales channels, etc.
Regional Innovation Strategy Supporting Program

**Regions focused on advancement of research function/industrial agglomeration**

10. Aomori Green & Life Synergy Innovation Area
11. Gunma Next Generation Novel Environmental Technology
12. Western Metropolitan Smart QOL Technology Development Region
13. Fukui Smart Energy Device Development Region
14. Yamanashi Next Generation Environmental and Health Care Industry Development Area
15. Gifu Technology Innovation Promotion Area
16. Mie Energy Innovation Region
17. Circum-Lake Biwa Environmental Industry Development Area
18. Nara Functional Plants Application Region
19. Wakayama Health Care Industry Innovation Promotion Region
20. Hiroshima Medical Engineering Innovation Promotion Region
21. Kagawa Medical Industry Development Region
22. Kochi Green Innovation Promotion Region
23. Nagasaki Health, Medical and Welfare System Development Region
24. Miyazaki Food Bio Innovation Area

**Regions focused on reinforcement of international competitiveness**

1. Hokkaido University Research & Business Park
2. Yamagata Organic Electronics Innovation Strategy Promotion Region
3. Fukushima Next Generation Medical Industry Cluster
4. Nagano Super Module Supply Hub
5. Aichi Nanotechnology Innovation Strategy Promotion Region
6. Hamamatsu/Higashi-Mikawa Life Photonics Innovation
7. Keihanna Science City Health Care Development Region
8. Fukuoka Next Generation Social System Development Promotion Hub
9. Kumamoto Organic Electronics Cooperation Area

◆ adopted based on Regional Innovation Strategy Program
Various evaluations
Implementation report

MEXT
(Evaluation Committee, Conflict-of-interest Committee)

Various evaluations
Implementation report

(1) Project promoter support type
Provides hands-on support from the seed/early stages and assists activities related to the discovery of seeds by organizations that support commercialization through the creation of start-ups, due diligence, and the integrated management of project development and R&D.

(2) Project support type
Subsidizes R&D costs and commercialization support costs under the management of the project promoter for innovative technology seeds R&D conducted by research organizations such as universities /incorporated administrative agencies.

R&D costs/Commercialization support costs
Activity expenses

University/corporation, etc.
Research representative

Coordination/cooperation
Project management

Project promoter (Unit)
Program for Creating STart-ups from Advanced Research and Technology (START)

- Established and development of start-ups

Pre-venture
- Business Plan
- Concept Formation

Project promoter unit (venture capital unit)
(in charge of portfolio)

Project management (Hands-on support)

Selection of promising technology seeds

Universities, etc. (Researchers/university-industry liaison headquarters)

Selection of promising technology seeds

Attraction of private financing

Venture funds, industry innovation organizations, etc.

*1 Technology seeds: elemental technology
*2 Portfolio: technology seed groups

R&D setting milestones in response to market needs

*Support with costs for R&D and business development

Strict performance evaluation by committee

Recruitment

Investment promotion

Experience, accumulation of knowledge, human resource training, and reutilization of human resources through the creation of successful examples (sustainability)
Support for technology transfer and intellectual property activities in universities by supporting international patent application and offering occasions for Industry-University matching.

- **Support for patent application**
  - Assist international patent application at Univ.
  - Assist developing patent portfolio

- **Promotion of technology transfer**
  - Secure coordination among relevant organizations to promote technology back into society
    - Consultation desk
    - Occasions for matching
      - Innovation Japan
      - New Technology Presentation Meetings

- **Development of experts**
  - Development of human resources with excellent eyes for technology transfer
    - Offer training meeting

- **Accelerating Utilization of University IP**
  - Support to increase the value of patents held by Universities and Public Research Institutions
  - Collaboration with investment institutions
  - Establish "Research Patent Commons" enabling patents to be used gratuitously limited to research, also, offer related information

**Support for Technology Transfer (JST)**

FY2013 budget: 2.8 billion yen

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MEXT MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY-JAPAN
Center of Innovation (COI) Stream
(S&T based Radical Innovation and Entrepreneurship Program)

**Mission:** Create radical innovations under the growth strategy of JAPAN to win the global competition.

**Concerns**

- **Mismatching** between researches and change of industrial structure
- **Insufficient** Academia-Industry Collaboration
- **Gaps** between Research results and radical /destructive innovations
- **Needs** to create unique technologies continuously, which can not be followed by others, to raise the level of Japan's industrial competitiveness

**Solutions**

**Establishment of Radical Agenda**

Based on the “Science and Technology Intelligence”,
- Specify needs of society or markets of ten years later
- Scenario development and research subjects setting that respond to the needs

**Fusion of Different Research Fields to Create Emerging Areas**

Establishment of research system by fusion of wide variety of fields
- Promoting R&D in emerging areas in collaboration with industries
- Open to youth/ international talents

**Research Management by Higher Expertise**

- Management team for promoting seamless R&D from basic research to commercialization
- Introducing viewpoint of both “seeds push” and “needs pull”

**Budget Plan for FY2013: $100M (12 centers to be established)**

**Matrix of Academia-Industry Collaboration**

<table>
<thead>
<tr>
<th>GAP</th>
<th>Explicit Needs</th>
<th>Non-Existence Needs (Future Needs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit needs</td>
<td>Revolutionary</td>
<td>Back Casting</td>
</tr>
</tbody>
</table>

**International Collaboration:** Joint activity of Foresight/ Conceptual Design of COIs/ Exchange of Researchers
4. Highlights of NISTEP’s Related Studies
Related Studies I - Highlights of “Survey on Research Activities of Private Corporations (2012)”: (1) Purpose & Method

• Purpose
  – To understand R&D activities of corporations, and to collect basic data for planning and promotion of policy for science, technology and innovation.

• Investigation items (R&D activities of corporations in FY2011)
  – Trend of R&D expenses and staffs
  – Activities on intellectual property
  – Innovation process (i.e. introduction of new products or services)
  – Cooperation with other organization
  – Influence of the Great East Japan Earthquake

• Target group
  – The survey questionnaire was sent to 3,287 corporations that have capital stock of at least 100 million yen and that conduct R&D activities.
  – Response rate: 44.3% (1,434 corporations responded.)

• Method
  – The survey was conducted from Nov. to Dec. 2012 by questionnaire survey.
  – Financial matters (ex. amount of sales) questioned on the conditions of FY2011, and human resource matters questioned on the conditions at the end of March in 2011
(2) Trend of R&D investment: Changes in external R&D expenditures (comparison by panel data)

- The median of external R&D expenditures has increased
  - by 54.9% (100 million yen to <1 billion yen);
  - by 51.5% (1 billion yen to <10 billion yen);
  - by 51.0% (10 billion yen or more).

Changes in R&D expenditures per corporations of main business unit, by capital classification

<table>
<thead>
<tr>
<th>Capital classification</th>
<th>FY2011</th>
<th>FY2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>100 million yen to &lt; 1 billion yen</td>
<td>144</td>
<td>12246.9</td>
</tr>
<tr>
<td>1 billion yen to &lt; 10 billion yen</td>
<td>167</td>
<td>19804.6</td>
</tr>
<tr>
<td>10 billion yen or more</td>
<td>135</td>
<td>193633.2</td>
</tr>
<tr>
<td>Total</td>
<td>446</td>
<td>69980.7</td>
</tr>
</tbody>
</table>

Note: The corporations that answered external R&D expenditures both in the FY 2010 and FY 2011 were calculated.
(2) Trend of R&D investment: Factor affecting the increase of internal R&D expenditures

- Increase of R&D expenditures of specific field: 48.2%
- Expansion of the fields where R&D activities: 38.5%
- An increase in equipment investment of R&D activities: 35.9%
- An increase in labor cost of R&D activities: 59.4%
- An increase or the expectations of sales and profit: 16.0%
- Influence of public support: 4.3%
- Influence of amalgation and acquisition: 2.9%
- Because R&D was made internal: 1.0%
- Others: 1.8%
(3) Employment of researchers: 
Ratio of corporations hiring researchers

- More than half of the sample did not employ researcher. (The ratio in the survey was 53.8% last year, and it has decreased a little.)
- The hired ratio of researcher with master’s degree was the highest. The corporation of about 90% did not employ the researcher with doctoral degree. The employment of postdoctoral fellows was extremely small.

<table>
<thead>
<tr>
<th>Ratio of Corporations hiring researchers</th>
<th>N (a)</th>
<th>Number of corporations that hired (b)</th>
<th>Percentage of corporations that hired (b/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of researchers (including new graduates and those with mid-career employment)</td>
<td>974</td>
<td>448</td>
<td>46.0%</td>
</tr>
<tr>
<td>with bachelor's degree</td>
<td>974</td>
<td>237</td>
<td>24.3%</td>
</tr>
<tr>
<td>with master's degree</td>
<td>974</td>
<td>351</td>
<td>36.0%</td>
</tr>
<tr>
<td>with doctorate degree</td>
<td>974</td>
<td>101</td>
<td>10.4%</td>
</tr>
<tr>
<td>(Postdoctoral fellows at the time of the adoption)</td>
<td>974</td>
<td>11</td>
<td>1.1%</td>
</tr>
<tr>
<td>Female researchers</td>
<td>974</td>
<td>219</td>
<td>22.5%</td>
</tr>
</tbody>
</table>

Note: Only the corporations that answered the total number of researchers and all the five breakdown items were calculated.
(4) Activities on intellectual property: Ratio of the number of patents by the period before executing

- Before or within less than a decade after receiving a patent, the ratio of the number of patents executed in-house is lower in the case of jointly-owned patents with the university, than the ratio in all patents.

- The ratio of the number of patents executed in more than a decade after receiving it is higher in the case of jointly-owned patents with the university than the ratio in all patents.

⇒ It reflects that patents jointly owned with university have a characteristic of a basic technology far from the preeminence of the market.

The ratio of the number of patents, by the period until executing it by itself

<table>
<thead>
<tr>
<th>Ratio of the number of patents by the period until executing (note 1)</th>
<th>N</th>
<th>Execution before patenting</th>
<th>Ratio less than 3 months after patenting</th>
<th>Ratio between 3 months to&lt;1 year after patenting</th>
<th>Ratio between 1 year to&lt;5 years after patenting</th>
<th>Ratio between 5 years to&lt;10 years after patenting</th>
<th>Ratio more than a decade after patenting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of the number of patents jointly owned with the university by the period until executing (note 2)</td>
<td>880</td>
<td>65.7%  90.0%</td>
<td>6.7%  0.0%</td>
<td>8.0%  0.0%</td>
<td>11.5%  0.0%</td>
<td>4.6%  0.0%</td>
<td>2.4%  0.0%</td>
</tr>
<tr>
<td>406</td>
<td>39.8%  0.0%</td>
<td>2.0%  0.0%</td>
<td>4.2%  0.0%</td>
<td>8.3%  0.0%</td>
<td>4.1%  0.0%</td>
<td>6.5%  0.0%</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Only the corporations that answered all breakdowns and they have at least one national patent were calculated.

Note 2: Only the corporations that answered all breakdowns and they have at least one patent jointly owed with the university were calculated.
(5) Attaining innovation in the major product or service field: Means to secure profits

- The corporations value the strategy to monopolize the technical intelligence obtained by their R&D as a mean to secure the profits of a new product or service, mainly by:
  - Securing exclusive right by patenting
  - Protecting technical intelligence as secrecy

Proportion of firms’ ideas to achieve competitiveness

<table>
<thead>
<tr>
<th>Idea</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Protection by patent and utility model</td>
<td>56.1%</td>
</tr>
<tr>
<td>2. Protection by legal measures concerning intellectual property right other than 1 (design, trademark, and breeder’s right (Plant Variety...)</td>
<td>41.4%</td>
</tr>
<tr>
<td>3. Protect technical knowledge and production knowhow as a business secret</td>
<td>56.3%</td>
</tr>
<tr>
<td>4. Conclusion and use of non-disclosure agreement</td>
<td>61.3%</td>
</tr>
<tr>
<td>5. Complication of product design, Making the “Black Box”(elemental technology)</td>
<td>29.6%</td>
</tr>
<tr>
<td>6. Cost advantages by achievement of scale merit</td>
<td>19.6%</td>
</tr>
<tr>
<td>7. Early product launch of product and service</td>
<td>48.7%</td>
</tr>
<tr>
<td>8. Standardization of product and service</td>
<td>30.7%</td>
</tr>
<tr>
<td>9. Construction and use of brand of corporation, product and service</td>
<td>54.3%</td>
</tr>
<tr>
<td>10. Maintenance of productive system, sales, and service network that can flexibly correspond to demand fluctuation</td>
<td>41.4%</td>
</tr>
</tbody>
</table>
Relationship between the employment of researcher with doctorate degree and radical innovation of a new product, service, and process

- In the corporations that employed the researcher with doctoral degree, the achievement level of radical innovation of product, service and process was 24.8%. The achievement level is higher than that of the corporations which did not employ researchers with doctoral degree.

⇒ It is suggested that there is a correlation between the employment of a highly-professional researcher and the achievement of radical innovation of product, service and process.
(6) Cooperation with other organizations:
 Types of partners for cooperation

1st: University : 63.6% (note: It includes university, National technical college, and the Inter-university research institute.)
2nd: A customer company : 42.0%
3rd: Suppliers of equipment, materials, or parts : 34.9%

<table>
<thead>
<tr>
<th>Organizations</th>
<th>N</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A customer company</td>
<td>356</td>
<td>42.0%</td>
</tr>
<tr>
<td>2. Suppliers such as equipment, materials, and parts</td>
<td>296</td>
<td>34.9%</td>
</tr>
<tr>
<td>3. Competitive enterprise</td>
<td>78</td>
<td>9.2%</td>
</tr>
<tr>
<td>4. Participating company of R&amp;D consortium</td>
<td>149</td>
<td>17.6%</td>
</tr>
<tr>
<td>5. Another company that belongs to the same industry group</td>
<td>147</td>
<td>17.4%</td>
</tr>
<tr>
<td>6. R&amp;D service mediation entrepreneur</td>
<td>15</td>
<td>1.8%</td>
</tr>
<tr>
<td>7. External consultant and private laboratory</td>
<td>132</td>
<td>15.6%</td>
</tr>
<tr>
<td>8. Entrepreneur and venture company</td>
<td>42</td>
<td>5.0%</td>
</tr>
<tr>
<td>9. University</td>
<td>539</td>
<td>63.6%</td>
</tr>
<tr>
<td>10. Public research organization</td>
<td>290</td>
<td>34.2%</td>
</tr>
<tr>
<td>11. Others</td>
<td>43</td>
<td>5.1%</td>
</tr>
</tbody>
</table>
(6) Cooperation with other organizations: Relationship between cooperation level and innovation of a new product, service and process

- In the case of cooperation with other organization, the achievement level of the innovation is higher than in the case without cooperation.
- The achievement level of innovation is lower when without cooperation, because external knowledge is not introduced.
- On the other hand, it is suggested that the R&D ability does not necessarily increase and the achievement level of innovation becomes lower when the degree of dependence to external organization is too high.
(6) Cooperation with other organizations: Relationship between partner diversity and innovation of a new product, service and process

- When the number of types of organization partner is 4, the achievement level of the innovation reaches the highest.

- When the number of types is 4 or less, the achievement level of the innovation tends to rise by increasing of diversity.

- It is suggested that cooperation with diverse external organizations promote the achievement of a new product, service and process.

Relationship between diversity of organization partner and innovation of a new product, service and process

The diversity of organization partner (Mean 20.7%, N=748)
(7) Impact of the Great East Japan Earthquake: Damage caused by the earthquake and subsequent Atomic Power Plant accident

- One's company was damaged: 38.7%
- Production base was damaged: 20.1%
- R&D base was damaged: 8.0%
- Parent company was damaged: 8.8%
- Subsidiary company was damaged: 18.8%
- Base of raw material was damaged: 51.9%
- Delivery place of product was damaged: 46.8%
- Others: 1.6%
- There is no correspondence: 21.2%
### (7) Impact of the Great East Japan Earthquake: R&D activities triggered by the impact of the earthquake

#### The efforts related to R&D activities triggered by the earthquake

<table>
<thead>
<tr>
<th>Effort Description</th>
<th>Japan</th>
<th>Iwate, Miyagi, and Fukushima</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reduction in R&amp;D expense</td>
<td>5.9%</td>
<td>15.6%</td>
</tr>
<tr>
<td>2. An increase in R&amp;D expense</td>
<td>3.7%</td>
<td>3.1%</td>
</tr>
<tr>
<td>3. Approach on new R&amp;D theme</td>
<td>1.8%</td>
<td>14.4%</td>
</tr>
<tr>
<td>4. R&amp;D internal technology that has been laid aside</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>5. Change and merge of R&amp;D theme (it includes the change in the cost distribution)</td>
<td>7.0%</td>
<td>9.4%</td>
</tr>
<tr>
<td>6. Distribution of human resource who remains by stagnation of production</td>
<td>0.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>7. The R&amp;D base located in the ruined area was moved to other regions of Japan</td>
<td>0.6%</td>
<td>3.1%</td>
</tr>
<tr>
<td>8. The R&amp;D base located in the ruined area was moved to foreign country</td>
<td>0.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>9. The R&amp;D base located in the non-ruined area was moved to other regions of Japan</td>
<td>0.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>10. The R&amp;D base located in the non-ruined area was moved to foreign country</td>
<td>0.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>11. The R&amp;D base located in foreign country was moved to Japan</td>
<td>0.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>12. Others</td>
<td>0.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>13. There is no correspondence</td>
<td>76.9%</td>
<td>65.6%</td>
</tr>
</tbody>
</table>
2011 East Japan Earthquake

Damage caused by Tsunami

Casualties
• Dead 15,868
• Missing 2,847
• Injured 6,100

Damage caused by Ground Liquefaction

Fukushima Nuclear Power Plant Accident

Damage caused by Ground Shaking

Metropolitan Tokyo Turmoil
Review of the Impact of the Great East Japan Earthquake

- **Date**: March 11, 2011 (Fri.) 14:46
- **Epicenter**: Off the coast of Sanriku, depth 24 km
- **Earthquake size**: Magnitude 9.0
- **Tsunami**: Over 40 m (run-up height)
- **Area flooded**: 561 km² (approximate)
- **Deaths**: 15,866 (as of July 4, 2012)
- **Power outage**: About 8.71 million homes (entire Tohoku region & part of Kanto)
- **Water outage**: About 2.3 million homes (entire Tohoku region & part of Kanto)
- **Fukushima nuclear power plant accident**: Massive emission of radioactive material
ITS Japan provided “Car traffic information map” displaying available routes and their actual car traffic overlaid onto digital map on the internet, aiming at assisting the transport of disaster victims and rescue/rehabilitation workers.

- This comprehensive map was being created through utilizing integrated traffic information of ITS, based upon probe information collected anonymously and statistically by Honda, Pioneer, Toyota and Nissan.

- It was their first effort ever to deal with respective information unilaterally and to provide them daily to general public.
Individuals contribute to data generation

Conventional Traffic Information System

Fixed sensor data

Central Tokyo

Traffic Control Center

Mobile Device based System

Probe Data

Central Tokyo

GPS

Location Time

Traffic Information

Source: Dr. Watanabe, Chairman of ITS Japan, Presented at 19th ITS World Congress Vienna, Austria
Connected people helped each other

Crisis Response website opened in two hours by Google Japan

<table>
<thead>
<tr>
<th>Service</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Person Finder</strong></td>
<td>All data entered by individuals become publicly available, and viewable and usable by anyone.</td>
</tr>
<tr>
<td><strong>Shelter Resident Lists</strong></td>
<td>Emailed photos are uploaded to a photo album and scanned to be made searchable in Person Finder.</td>
</tr>
<tr>
<td><strong>YouTube Message</strong></td>
<td>Video messages from the evacuees are shared at the YouTube site.</td>
</tr>
<tr>
<td><strong>Shelter Information</strong></td>
<td>Shelter locations, water and food distribution, and local resources portal map are shared.</td>
</tr>
<tr>
<td><strong>Probe Car Data Map</strong></td>
<td>Routes actually used on the previous day are shown on the map.</td>
</tr>
</tbody>
</table>

Source: Nippon Keizai Shimbun, April 3, 2011
Establishing a Foothold for Nationwide Expansion of Tsunami Education Using a Comprehensive Tsunami Disaster Scenario Simulator

Led by Prof. Toshitaka KATADA, Disaster Research Center, Gunma Univ.

Outline of implemented R&D Outputs

An education tool “Comprehensive Tsunami Disaster Scenario Simulator” was developed, which can simulate a damage caused by Tsunami, with condition-settings such as crisis-awareness level of local residents triggered by earthquake motion, whether evacuation is recommended or not, daily awareness level of residents on disaster crisis, experience of past Tsunami disaster, in addition to simulating physical reach and height of Tsunami based upon epicenter and magnitude of triggering earthquake.

Developing Comprehensive Tsunami Scenario Simulator for Targeted Area

Collaborating with targeted area using Tsunami Simulator

- Raising Residents’ Awareness on Disaster
  - Lecture Program
  - Workshops
- Upgrading Tsunami Crisis Management Plan
  - Identifying issues
  - Assisting disaster management planning

Disseminating Awareness-Raising Activities Nationwide

(Final Goal) Upgrading Disaster-Management Level against Tsunami Nationwide

Children in Kamaishi, evacuating from designated facility to a safer hill by their own judgment on 11 March, 2011

Mission-Oriented Research Program (FY2001-05) Implementation-Support Program (FY2007-11)

Awareness-Raising Activities on Tsunami Disaster Saved 2,926 Pupils of Elementary & Secondary Schools

Continued efforts were made using the simulator, for raising local residents’ disaster-awareness level and education in elementary and secondary schools, to create a robust community against Tsunami disaster. Consequently, in the wake of Great East Japan Earthquake in Kamaishi-City, senior-grade students have taken a leadership in evacuation, assisting junior-grade pupils and elderly persons, and made a further evacuation from a designated facility to a safer hill by their own judgment, not being trapped by initial prediction, thanks to their high awareness level. That has resulted in saving 2,926 students (99.8% of the total elementary and secondary schools) in Kamaishi (widely known as ‘Kamaishi-Miracle’).
Promptly Issuing Certificates of Disaster Victim

- Development of Problem-Solving Capacity for Crisis Management using GIS [FY2007-09] (R&D Focus Area: Information Technology & Society)

  - Led by: Prof. Haruo HAYASHI, Disaster Prevention Research Institute, Kyoto University

- Implementation of the Building Damage Evaluation and Household Recovery Support Systems for Local Governmental Post-Disaster Operations [FY2009-12]
  - Led by: Prof. Satoshi TANAKA, Fuji Tokoha University

**Outline of Implemented R&D Outputs**

After a large-scale disaster happened, in order to help survivors to rebuild their daily lives it is necessary for local governments to accurately grasp damage level of individual houses, and to issue a Disaster Victim Certificates. They offered a one-stop information system including comprehensive management of support services, which can process promptly and precisely a bulk of disaster damage information by fully utilizing paper-based form, in addition to the existing system with normal computer processing.

**Outcomes by Implementation**

After Niigata Chuetsu-oki Earthquake in 2007, it took only about 1 month from determining the damage level of houses to issuing Disaster Victim Certificates. After Great East Japan Earthquake, outputs from this project were also implemented in Iwate Pref. and other districts as well. They were also adopted in Disaster Management Plan of Tokyo Metropolitan Government, and on-site training is being conducted in disaster-affected area.

Anyone can act as an official surveyor by clear criteria and adoption of paper-based form.

Loosely integrating Residents Registry, Taxation Registry and Houses Damage Survey Data, for promptly issuing Disaster Victim Certificates.
Background and aim of research

• Unveil with whom and how local companies build up relationship in a region
• Categorize local companies in term of situation of university-industry-government collaboration.
• Extract the characteristics of regional triple helix

[ Definition of University-industry-government collaboration ]
  • Technical Consultation
  • Joint R&D
  • Use of research equipment
  • Human resource development
Framework of Research

➢ Research object
  - Focusing on manufacturing industry
  - 3 prefectures extracted (Yamagata, Gunma, Nagano)
  → Key elements / factors:
    1. Local area (with less population density)
    2. Agglomeration of Processing and Assembly industry
    3. Available local resources (established single national university, similar scale and level)

➢ Methodology
  – Postal questionnaire survey

➢ Research duration
  – October 22th ~ November 12th 2012
## Profile of extracted 3 Regions

<table>
<thead>
<tr>
<th></th>
<th>Yamagata</th>
<th>Gunma</th>
<th>Nagano</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location from Tokyo</td>
<td>350km North</td>
<td>100km North</td>
<td>200km North-west</td>
</tr>
<tr>
<td>industry</td>
<td>Electronics and machinery industry</td>
<td>Automobile and electronics industry</td>
<td>Electro-device &amp; precision machinery industry</td>
</tr>
<tr>
<td>resource</td>
<td>Yamagata Univ.</td>
<td>Gunma Univ.</td>
<td>Shinshu Univ.</td>
</tr>
</tbody>
</table>
Relationship with Academia
Relationship with Public Research Institutes

- Collaboration: 64.5% (Yamagata), 62.1% (Gunma), 47.9% (Nagano)
- Technical Consultation: 40.3% (Yamagata), 41.3% (Gunma), 23.7% (Nagano)
- R&D: 15.2% (Yamagata), 15.4% (Gunma)
- Use of research equipment: 45.5% (Yamagata), 46.3% (Gunma)
- Human resource development: 20.9% (Yamagata), 12.1% (Gunma)
- Other: 8.4% (Yamagata), 0.9% (Gunma)
- No Collaboration: 30.3% (Yamagata), 31.5% (Gunma), 46.8% (Nagano)
- n/a: 5.2% (Yamagata), 6.4% (Gunma), 5.3% (Nagano)
Consultations on Technical Issues
Type of Regional ‘Triple Helix’ in 3 regions

- **Yamagata**
  - Univ-Gov: 22.7%
  - Univ: 4.7%
  - Gov: 16.6%
  - Private/Self: 10.9%
  - No R&D Univ-Gov: 24.2%
  - No R&D Private/Self: 16.6%

- **Gunma**
  - Univ-Gov: 27.4%
  - Univ: 3.2%
  - Gov: 9.5%
  - Private/Self: 9.5%
  - No R&D Univ-Gov: 13.2%
  - No R&D Private/Self: 36.3%

- **Nagano**
  - Univ-Gov: 41.3%
  - Univ: 4.7%
  - Gov: 10.4%
  - Private/Self: 6.0%
  - No R&D Univ-Gov: 13.4%
  - No R&D Private/Self: 18.1%

Legend:
- ① Univ-Gov
- ② Univ
- ③ Gov
- ④ Private/Self
- ⑤ no R&D Univ-Gov
- ⑥ no R&D Private/Self

University-Industry-Government Relationship

<table>
<thead>
<tr>
<th>R&amp;D Experience</th>
<th>University</th>
<th>Government</th>
<th>Private or Self</th>
</tr>
</thead>
<tbody>
<tr>
<td>Done</td>
<td>①</td>
<td>④</td>
<td></td>
</tr>
<tr>
<td></td>
<td>②</td>
<td>③</td>
<td></td>
</tr>
<tr>
<td>Not Done</td>
<td>⑤</td>
<td>⑥</td>
<td></td>
</tr>
</tbody>
</table>

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