

Chapter 5 Establishing a Systemic Virtuous Cycle of Human Resources, Knowledge and Capital for Innovation

Making the most of domestic and international intellectual resources, we will foster and take advantage of “new value.” To this end, we will develop an innovation creation system by circulating human resources, knowledge and funds beyond organizations, sectors and borders to fully bring out their respective abilities, by fostering strong, deep collaboration among private businesses, universities and public research institutions and by strengthening establishment of startups. This will strengthen the international competitiveness of the whole country and accelerate economic growth.

Section 1 Enhancing Mechanisms for Promoting Open-innovation

Innovations are realized mostly by private businesses. However, collaboration with universities and public research institutions as well as more flexible business partnerships are important to accelerate commercialization. In order to promote open innovation globally, it is important to develop a system for cooperation and co-creation where partners can use their respective strengths and complement each other. It is also important to increase the mobility of human resources, knowledge and funds to create an environment that facilitates innovations.

Since January 2017 MEXT has been holding the Open innovation Co-Creation Congress. The congress sorted obstacles from the perspective of universities and national research and development agencies and those from the perspective of the industry, and summarized reform measures to overcome the obstacles in a report “Toward Full-scale Open Innovation – Accelerate construction of a platform for universities and national research and development agencies to generate advanced knowledge-intensive industries” in July of the same year.

Proposals made by the report include: legal changes such as expansion of the scope of national research and development agencies that can invest in venture companies, etc.; system change such as increasing funds that national universities can invest and relaxing of the stock holding period, and support for management reform such as development of an open innovation mechanism and establishment of a program for entrepreneurial people to travel abroad to improve their skills. The proposed measures paved the way to realization.

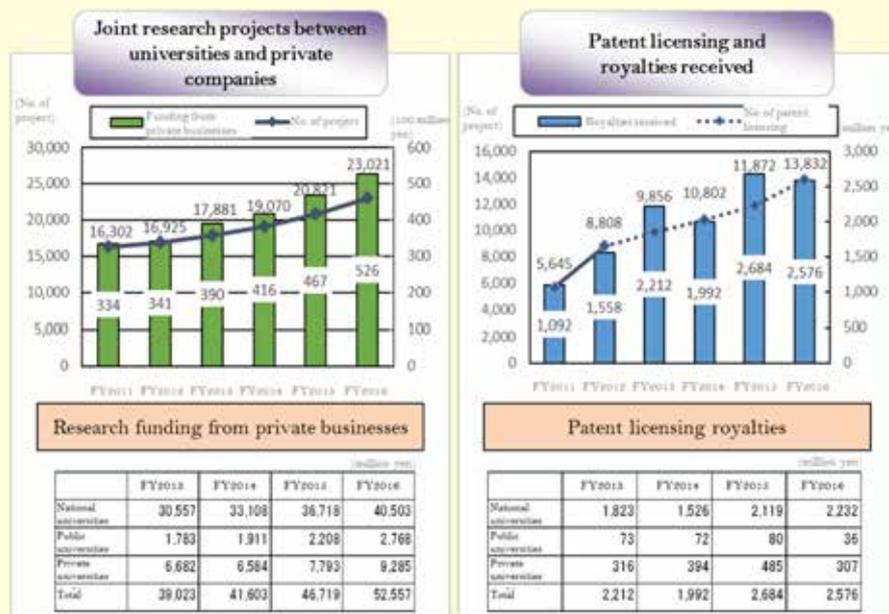
1 Enhancing systems of promotion in companies, universities, and public research institutes

(1) Current status of domestic and international industry-academia collaborative activities

A. Status of industry-academia-government collaboration at universities

Since the corporatization of national universities in April 2004, industry-academia-government collaboration activities have been increasing. In FY 2016, the number of collaborative research activities between universities and private corporations was 23,021 (a 10.6% increase over the previous year) and the amount received for joint research from private corporations was about 52.7 billion yen (a 12.5% increase over the previous year). In contrast to FY 2011, the number of the cooperative research activities increased by approximately 40%. In addition, the number of patent licensing reached 13,832 (Figure 2-5-1).

Figure 2-5-1 Transition in achievements of joint research at universities



Notes: 1. Subjects: national, public and private universities

- The term "Universities" indicates universities, junior colleges, technical colleges and inter-university research institutes
- The number of patent licenses denotes the number of patents that have been licensed or transferred (including patents pending)
- A broken line is used for FY 2012, because that was the year when countries began to use the counting method stipulated in the Patent Cooperation Treaty (PTC).
- "Total" and "total of intermediate total of national, public and private universities" amount may not match because values of less than 1 million yen are rounded.

Source: Implementation Status of Industry-Academia-Government Collaborations at Universities (2016), MEXT (as of February 16, 2018)

B. Activities of the Technology Licensing Organization (TLO)

As of August 28, 2017, 35 TLOs had been approved by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Economy, Trade and Industry (METI) under the Act on the Promotion of Technology Transfer from Universities to Private Business Operators (Act No. 52 of 1998). In FY 2016, the number of patent licenses reached 9,120.

(2) Development of industry-academia-government collaboration systems at universities

The Government sets a goal to strengthen the industry-academia-government collaboration systems and triple the investment from private businesses to universities and National Research and Development (R&D) Agencies over the next 10 years. In response, at the Council of Industry-Academia-Government Dialogues for the Promotion of Innovation that was held jointly with METI, MEXT formulated the Guidelines for Fortifying Joint Research Through Industry-Academia-Government Collaboration in November 2016, compiling the challenges for universities and National R&D Agencies to strengthen industry-academia-government collaboration and prescriptions for the challenges from the industry perspective. MEXT is working to spread the guidelines. To appropriately address the diverse risks (e.g., conflicts of interest, the prevention of technology leaks) that accompany improvements in industrial-academic collaboration, MEXT

has been supporting the creation and expansion of a system for managing the risks involved in the industry, university and government collaborative activities through its Industry-Academia-Government Collaborative Risk Management Model Project. Further in April 2017, the ministry jointly with Japan Business Federation and METI published the “University Fact Book for Promotion of Matching in Industry-Academia-Government Joint Research – Pilot Version” to advance “visualization of universities’ efforts for industry-academia-government collaboration.

Under the Industry-Academia Collaborative Support Project Through Accumulation of Knowledge, the Ministry of Agriculture, Forestry and Fisheries (MAFF) has allocated coordinators (experts in agriculture, forestry and fisheries and in the food industry) around the country to capture needs, collect and provide research seeds, support industry-academia-government matching, introduce and support R&D funding, and support commercialization.

(3) Enhancement of R&D through industry-academia-government collaboration

The Japan Science and Technology Agency (JST) is conducting the following programs: 1) the Adaptable & Seamless Technology Transfer Program through Target-Driven R&D (A-STEP), which seamlessly covers the exploration of prospective technological seeds developed at universities and public research institutes and their practical application in industry, 2) the Strategic Promotion of Innovative R&D (S-Innovation), which supports R&D carried out under themes selected from excellent research outputs in academia and aims to create technological foundations of new industries, 3) Collaborative Research Based on Industrial Demand, which supports basic research in academia that could resolve technical challenges commonly seen in industry and 4) the Next-Generation Technology Transfer Program (NexTEP) to support private corporations that are working on the large-scale practical application of university research outputs, whose application involves development risks.

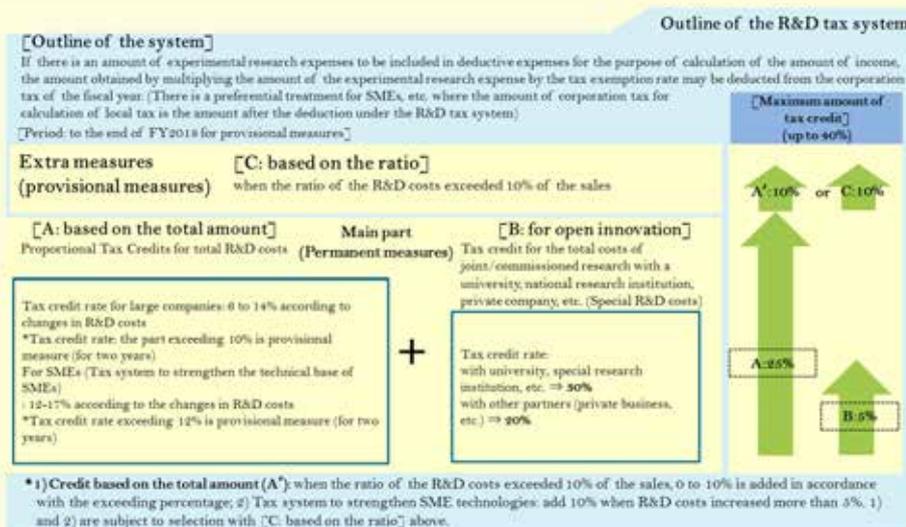
The Ministry of Internal Affairs and Communication (MIC) is promoting technological and social demonstrations of IoT and a new generation network in industry-academia-government partnership using the NIST comprehensive test bed that has been developed and managed by the National Institute of Information and Communications Technology (NICT).

(4) Preferential treatment to promote R&D investment by the private sector

To promote R&D in the private sector, the government provides various tax measures¹ (Figure 2-5-2).

¹ System of corporation tax credit for businesses conducting test and research in accordance with the amount of test and research expenses

Figure 2-5-2 R&D taxation system



Source: created by MEXT based on METI materials

(5) Utilization of awards programs

A. The 15th Award of Winners Contributing to Industry-Academia-Government Collaboration (Linking Innovation Award) (FY 2017)

To promote industry-academia-government collaboration, 14 such collaborations were given this award by the Prime Minister and other ministers for their contributions to this effort (Table 2-5-3).

Table 2-5-3 Award winners for contributions to industry-academia-government collaboration

| Award | Project | Winner |
|---|--|--|
| Prime Minister's Award | Development of industrial products from a single crystal diamond | Naoji FUJIMORI, President, EDP corporation Akiyoshi CHAYAHARA, Chief Senior Research Scientist, National Institute of Advanced Industrial Science and Technology (AIST) Hideaki YAMADA, Senior Research Scientist, AIST Yoshiaki MOKUNO, Team Leader, AIST |
| Minister of State for Science and Technology Policy Award | Industry-academia-government partnership for development of "generic technology for practical application of flexible organic electronics" | Hitoshi NAKADA, Professor of Industry Relations, Deputy Director of the Innovation Center for Organic Electronics (INOEL), Yamagata University Mitsuhiro KODEN, Professor of Industry Relations, Innovation Center for Organic Electronics (INOEL), Yamagata University |
| Minister of State for Science and Technology Policy Award (Regional Revitalization Award) | <i>Fukuiro Kirari</i> Project: a new local industry-academia-government partnership model to create new products one after another by visiting companies and providing comprehensive support from the development proposal to IP creation and market cultivation | Kazuo HOKKIRIGAWA, Professor, Graduate School of Engineering, Tohoku University Muneaki TACHIBANA, President, Yamakawa Printing Co.,LTD. Masao UCHIBORI, Governor of Fukushima Prefecture |

| | | |
|---|---|---|
| Minister of Internal Affairs and Communications Award | Industry-academia-government partnership for development and spread of <i>Koetora</i> , an application to support the hearing impaired | Yutaka ASHIKARI, Director, System Development Office, Advanced Speech Translation Research and Development Promotion Center, NICT Teruji KOBAYASHI, President, FEAT Limited Setsuji ARIKI, Managing Director, Telecommunications Carriers Association |
| Minister of Education, Culture, Sports and Science Award | Development of a low-cost inverter that meets the power system harmonics regulation to realize the global spread of energy-saving air conditioners | Kiyoshi OHISHI, Professor, Graduate School of Engineering, Nagaoka University of Technology Hitoshi HAGA, Associate Professor, Graduate School of Engineering, Nagaoka University of Technology Morimitsu SEKIMOTO, Senior Engineer, Technology and Innovation Center, Daikin Industries, Ltd |
| Minister of Health, Labour and Welfare Award | Industry-academia-government partnership for development of an ElmammoAvant Class Dedicated Breast PET System | Taiga YAMAYA, Team Leader, Dept. of Radiation Measurement and Dose Assessment, National Institute of Radiological Sciences, National Institutes for Quantum and Radiological Science and Technology Yuji NAKAMOTO, Associate Professor, Division of Clinical Radiology Service, Kyoto University Hospital Keiji KITAMURA, General Manager, Radiation Technology Unit, Technology Research Laboratory, Shimadzu Corporation |
| Minister of Agriculture, Forestry and Fisheries Award | Industry-academia-government partnership for development of extra-strength wheat <i>Yumechikara</i> and bread using wheat produced in Japan | Atsuo MORITA, President, Pasco Shikishima Corporation Hiroaki YAMAUCHI, Professor, Department of Life and Food Sciences, Obihiro University of Agriculture and Veterinary Medicine Yumechikara Breeding Group, Hokkaido Agricultural Research Center, National Agriculture and Food Research Organization |
| Minister of Economy, Trade and Industry Award | Successful Overseas Business Development Concerning Joined Bodies of Resin and Metal Dissimilar Materials Taking Advantage of International Standardization | Shin HORIUCHI, Chief Senior Researcher, Nanomaterials Research Institute, AIST Masanori NARITOMI, Chairman, Taiseiplas Co., Ltd |
| Minister of Economy, Trade and Industry Award | Research and Development of Robot OS Titled "RT-Middleware" and International Standardization Thereof | Noriaki ANDO, Team Leader, Robot Innovation Research Center, AIST Robot Business Promotion Council, Japan Robot Association Technical Committee on RT System Integration, System Integration Division, The Society of Instrument and Control Engineers |
| Minister of Land, Infrastructure, Transport and Tourism Award | Industry-academia-government partnership for development of Energy-CO ₂ -Minimum (ECM) Cement Concrete System | Masamichi AOKI, ECM joint R&D team; Executive Manager, Research & Development Institute, Takenaka Corporation Noboru SAKATA, ECM joint R&D team; Director of Technology Development Department, Civil Engineering Management Division, Kajima Corporation Etsuo SAKAI, Specially Appointed Professor, Department of Materials Science and Engineering, School of Materials and Chemical Technology, Tokyo Institute of Technology |
| Minister of Environment Award | Industry-academia-government partnership for development of apparatus to speedily detect asbestos | Akio KURODA, Professor, Graduate School of Advanced Sciences of Matter, Hiroshima University Kiyoshi SEKIGUCHI, Board Director; Manager of Development Division, Siliconbio Inc. Tatsuya TAKAHASHI, Sales Division, Opto Science, Inc. |

| | | |
|--|---|--|
| Keidanren (Japan Business Federation) Chairman Award | R&D of the world's most advanced cells that contribute to strengthening of the competitiveness of the storage battery industry | Zempachi OGUMI, Professor Emeritus, Kyoto University |
| President's Award, SCJ | Industry-academia-government partnership for clinical development of artificial cellular blood vessels | Shizuka AKIEDA, Board Director CEO, Cyfuse Biomedical K.K. Koichi NAKAYAMA, Professor, Department of Regenerative Medicine and Biomedical Engineering, Faculty of Medicine, Saga University Manabu ITO, Assistant Professor, Department of Thoracic and Cardiovascular Surgery, Faculty of Medicine, Saga University |
| Special award of the Industry-academia-government partnership contributor nomination committee | R&D and preparation for product development of innovative Carbon Fiber Reinforced Thermo Plastics (CFRTP) for automobiles in industry-academia-government partnership | Akihiro SASO, Professor, Department of Aerospace Engineering, Graduate School of Engineering, Nagoya University Takashi ISHIKAWA, N Designated Professor, National Composite Center, Nagoya University |

2 Inducing a virtuous cycle of human resources for innovation creation

For innovation creation, it is necessary to promote mobility of the world's leading researchers across organizational barriers of universities, public research institutions and companies.

The cross appointment system enables researchers to work when employed by more than two organizations in a university, public research institution or company and engage in R&D and education according to their role at the respective organization under a certain degree of defined effort management. MEXT, METI and other ministries/agencies concerned are promoting the system (Chapter 4, Section 1, 2 (3)).

MEXT is also conducting review toward flexible direct cost expenditure to enable paying of labor costs to the principal researcher on the premise of the human resource and payroll system reform at the national universities (Chapter 4 Section 3, 3).

3 Creating “spaces for co-creation” to concentrate human resources, knowledge, and capital

(1) Developing platforms for industry-academia-government collaboration

To promote STI promptly and effectively, it is necessary to develop forums for industry-academia-government collaboration.

A. Formation of a world-leading locally oriented R&D and demonstration base

MEXT has been implementing the World-leading Locally Originated R&D and Demonstration Base (Research Complex) Promotion Program towards the creation of world-class innovations and regional revitalization. The program aims to develop research complexes to assist local industries, universities, governments and financial institutions in their efforts for commercialization of the results of advanced and collaborative R&D by researchers in different fields in Japan and abroad, which is integrated with human resource development. In FY 2017, the ministry provided support for three complexes (Figure 2-5-4).

Figure 2-5-4 Program to promote world-class community-based R&D and demonstration centers (research complex)



Source: Created by MEXT

B. Creation of Innovation Centers for Advanced Interdisciplinary Research Areas

MEXT is promoting the Creation of Innovation Centers for Advanced Interdisciplinary Research Areas to form bases for R&D, from the first stages to future commercialization under industry-academia collaboration for advanced interdisciplinary research areas, which are considered important for innovation creation; 3 institutions have been supported as of FY 2017 (Figure 2-5-5).

Figure 2-5-5 List of projects being implemented under the Creation of Innovation Centers for Advanced Interdisciplinary Research Areas

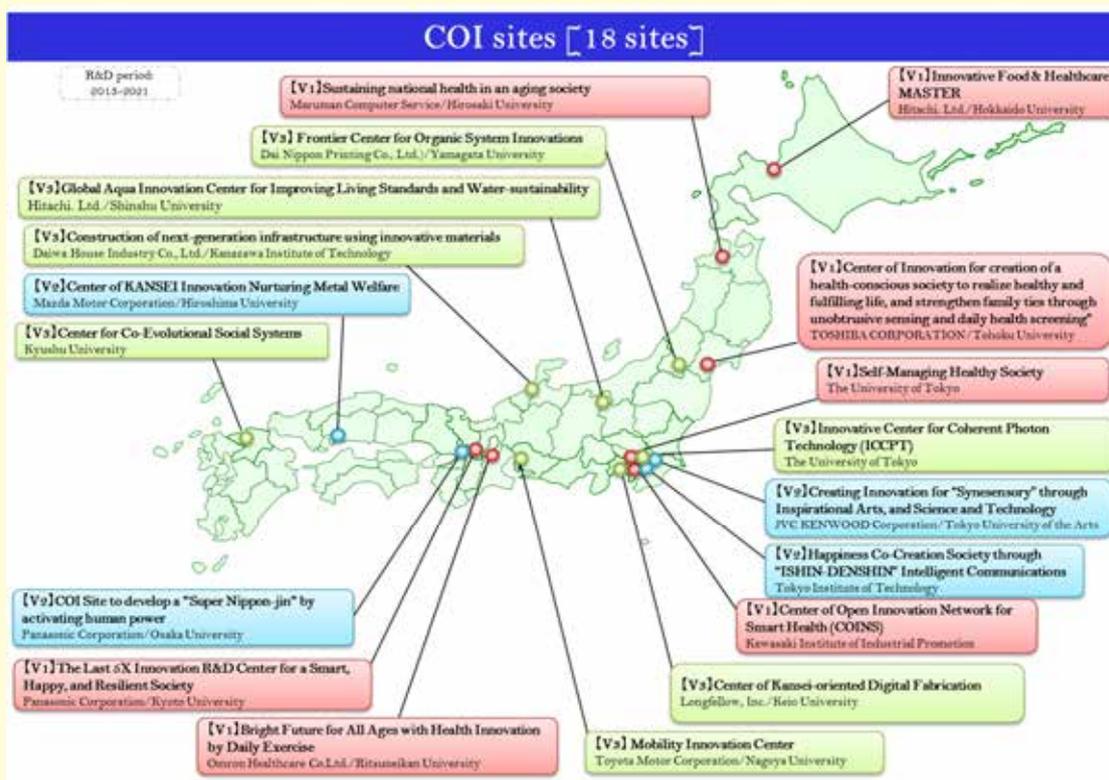


Source: Created by MEXT

C. Developing centers for the creation of cutting-edge innovation

Since FY2013 MEXT has been implementing the Center of Innovation (COI) Program. Under the Center of Innovation (COI) Program, R&D is promoted in 18 bases to realize cutting-edge innovations in industry-academia collaboration (Figure 2-5-6).

Figure 2-5-6 COI sites



Source: Created by MEXT and JST

The National Institute of Advanced Industrial Science and Technology (AIST) has been exploring technological seeds and promoting R&D projects while capturing the various technological needs of industry and society. Specifically, AIST is promoting the activities of Tsukuba Innovation Arena (TIA), an open innovation hub. AIST has participated in 19 technology research associations as part of an undertaking to form a co-creation platform (as of January 2018).

D. Forming Open Innovation Platform with Enterprises, Research Institute and Academia

Japan Science and Technology Agency has been implementing the Program on Open Innovation Platform with Enterprises, Research Institute and Academia (OPERA) since FY2016. Using funds for matching with private companies, the program aims to realize full-scale industry-academia partnership at the organization level toward full-fledged open innovation in Japan. The activities under the program include: integrated promotion of large-scale joint research in noncompetitive fields in consortiums of multiple companies, human resource development of master's course students and reform of industry-academia partnership of universities.

(2) Developing open innovation centers

A. Tsukuba Science City

Tsukuba Science City has been developed as a center of R&D and education of the highest level in Japan, away from the congestion of Tokyo. The city has more than 300 research institutes, including 29 national experimental research and education institutes, and has been promoting many governmental plans, such as those for research exchanges and the functional improvement of international research exchanges.

The city has been aiming to organize a world-class nanotechnology research center at which three core institutes (NIMS, AIST and Tsukuba University) serve as the major force. In June 2009, the Tsukuba Innovation Arena Nanotechnology (TIA-nano) was launched as a base for industry-academia-government collaboration. Currently, the High Energy Accelerator Research Organization and the University of Tokyo joined the center, which increased the number of core institutes to five. Research fields were also expanded to bio, computational science and IoT based on the existing nanotechnology research. The center changed its name to TIA to make a new start. Through the past activities, commercialization has been achieved in the fields of carbon nanotube (CNT), silicon carbide (SiC) and power electronics.

Aiming to foster next-generation human resources in the field of nanotechnology and to create new industries that will lead Japan in the future, the TIA graduate school collaboration project held the Summer Open Festival in 2017 at the TIA Collaboration Building and others. It attracted 411 young researchers, including undergraduate students, graduate students and business researchers from throughout Japan. Under the Nanotech CUPAL¹ human resource development project, which has been implemented to facilitate career enhancement and mobility improvements for young researchers in nanotechnology, practical training courses have been held that provide young researchers with opportunities to learn fundamental and elemental technologies for R&D. Course participants totaled more than 250 in FY2017.

B. Kansai Science City

Kansai Science City is promoting the construction of towns that will play a role as bases for developing the world's culture, science and research and the nation's economy. As of the end of FY 2017, it had about 130 facilities at which various research activities were under way.

(3) Promoting Open Innovation Platform for industry academia partnership in diverse fields

MAFF has been promoting development of a platform for accumulation and utilization of knowledge to promote technological innovation and realize commercialization based on the market needs at an unprecedented pace by introducing innovative technologies of various fields into agriculture, forestry, fisheries and foods.

In April 2016 MAFF set up the Industry-Academia-Government Collaboration Council as a platform for accumulation and utilization of knowledge. As of March 2018 the council had 2,395 members including companies from diverse industries, with 117 R&D platforms set up to work on specific research tasks. In addition, the R&D platforms formed a research consortium to conduct innovative R&D, which has supported R&D of 17 tasks through projects based on requests for proposals using the matching fund method. Other efforts include holding of regional matching forums to support local R&D and dissemination of

¹ Nanotech Career-up Alliance

technologies.

(4) Creating an environment that facilitates matching of technology seeds and needs

In order to promote effective matching of technology seeds and needs to accelerate industry-academia and inter-industry open innovation and creation/development of R&D-based startups, the Cabinet Office aims to create an environment for autonomous and flexible cross-sectoral collaborations and exchanges of various matching projects by relevant ministries/agencies and the industry. To this end, the Cabinet Office set up the Science & Innovation Integration (S&II) Conference in July 2017. As part of its activities, the conference implemented a forum to encourage innovations in local areas in December of the same year and also started a hearing survey for visualization of support measures covering private businesses as well.

MEXT and METI, in cooperation with the JST and New Energy and Industrial Technology Development Organization (NEDO), held the Innovation Japan 2017 - University Trade Fair & Business Matching Event, which was Japan's largest matching forum, with people gathering from universities, public research institutions and private corporations at Tokyo Big Site on August 31 and September 1, 2017.

In cooperation with the relevant ministries and institutions, MAFF holds the Agribusiness Creation Fair every year. The objective is to exhibit technology seeds from private corporations, universities, public experimental research institutions and independent administrative institutions, and to promote collaboration with institutions which are in need of technology. In FY 2017, the exhibition was held in October in an exhibition hall where private corporations were promoting industrial use of their new technologies. At the fair, 145 institutions from throughout Japan exhibited their seeds and about 38,000 people attended.

Section 2 Enhancing the Creation of SMEs and Startup Companies to Tackle New Business Opportunities

Entrepreneurial startups of modest size that are flexible and quick in making decisions are better suited to innovation and the commercialization of technological seeds in a short period of time. It is important to build a system for continued and effective support in close industry-academia-government collaboration to support business activities of small and medium-sized enterprises and startups toward speedy creation of new markets.

1 Cultivating an entrepreneurial mentality

Since FY2017 MEXT has been implementing Exploration and Development of Global Entrepreneurship for NEXT generation (EDGE-NEXT) to enhance venture creation in Japan through an entrepreneur development program for undergraduate and graduate students, young researchers and others.

2 Promoting the creation of startup companies at universities

The number of university-launched startups decreased to 47 in FY2010 but has been increasing in recent years, reaching 127 in FY2016 (33.7% increase against the previous year). For the future, it is necessary to improve the environment for sustainable management including business tasks such as market cultivation

toward creation of high-quality university-launched startups that can identify true market needs and grow into global businesses.

The JST implements the Program for Creating Start-ups from Advanced Research and Technology (START). Under this program, from the stage before starting business, it provides supports for creation of university-launched ventures with growth potential by combining public funds and commercialization knowhow in the private sector. Since FY2017 START includes Start-up incubation from COre Research (SCORE) that provides human resources who are willing to undertake social implementation of research results with entrepreneurial education and supports their exploration for business models.

In addition, the Support Program of Capital Contribution to Early-Stage Companies (SUCCESS) invests in the foundation and capital increases of startups that utilize R&D outcomes of the JST, or offers labor and technical support whereby early-stage startups can promote the commercialization of R&D results through their business activities.

3 | Creating environments conducive to new business

(1) Support for R&D-type startups

MIC has been implementing the Challenge Program for ICT Innovation Creation (I-Challenge!). The program uses the connoisseur capabilities, management know-how and project development abilities of experts who support business projects to support R&D during the business model verification phase, so that SMEs that have innovative technological seeds and ideas can start new businesses.

Through NEDO, METI is implementing the R&D-based Startup Support Program with integrated support ranging from discovery of technology seeds to their commercialization in Japan. With the aim of revitalizing partnerships with startups in industry and accelerating commercialization by startups, the ministry implemented a study meeting of experts to sort obstacles that operating companies and startups face in the process of partnership, and then investigate and develop tools useful for facilitating their collaboration. In May 2017 METI compiled the “Guidance on Collaboration” that connects challenges and best practices of operating companies and startups to provide reference useful for both of them.

(2) Support by the Small Business Innovation Research System (SBIR system)

Under the small business innovation research (SBIR) system, subsidies and commissions have been granted (special subsidies) to provide small and mid-sized businesses and private persons not running a business¹ with assistance for R&D on new technologies. Several industrialization support measures, including the provision of patent fee reduction/exemption and special loans by the Japan Finance Corp., have also been taken. In FY 2017, seven ministries (MIC, MEXT, MHLW, MAFF, METI, MLIT and MOE) designated 96 special subsidies in all and earmarked about 46 billion yen as expenditures for small and medium enterprises (SMEs) and micro enterprises.

¹ For example, university researchers and other individuals who intend to start a new business or establish a company.

4 | Helping initial demand and endorsing the trustworthiness of new products and services

(1) Development and strengthening of SMEs and startups using public procurement

To support small, medium and venture companies by using government procurement, the government initiated the “Cabinet Office Open Innovation Challenge 2017” where such companies try to meet concrete needs of state organs and discover new technologies and ideas toward commercialization. 15 proposals have been certified. Certified companies will carry out feasibility study with counseling from advisors provided by the Cabinet Office toward commercialization through matching, etc. with operating companies.

With the aim of innovating government projects and securing initial demand for the small, medium and venture companies, the government started study of guidelines for promotion of use of such companies for government procurements.

Section 3 Strategic Use of International Intellectual Property and Standardization

In order to further improve the quality of intellectual property management, it is important to develop a strategy to not only use but also to maximize the value of our IP. To this end, we promote incorporation of IP and standardization strategies into business strategy, while at the same time encouraging creation of new open innovations through heightened awareness of IP holders and utilization of patents.

1 | Promoting use of IP assets in innovation creation

In response to changes in the world innovation environment, the following approaches towards the development and implementation of international standardization strategies, the review of IP systems and the improvement of IP-related systems have been promoted.

(1) IP (IP rights/R&D data) management of the government’s R&D projects

A. Initiatives concerning patent rights and other intellectual property rights

In order to commercialize national R&D results as much as possible, METI ensures appropriate IP management for each R&D project commissioned by the government based on the “Guidelines for IP management in commissioned R&D” (May 2015).

In national R&D pertaining to agriculture, forestry and fisheries, MAFF is working on IP management assuming commercialization of research outcomes from the initiation stage of research based on the “Intellectual Property Policy for Agriculture, Forestry and Fisheries” (February 2016).

B. Initiatives concerning R&D data

In light of the progress of the 4th industrial revolution, METI developed the “Guidelines for Data Management in Government-commissioned Research and Development” (December 2017) in order to create new businesses and strengthen competitiveness by promoting utilization of R&D data.

(2) Development and provision of patent information

To respond to the increasingly sophisticated and diversified user needs for patent information, the Japan Patent Office (JPO) has provided a patent information provision service called Patent Information Platform (J-PlatPat¹), which provides patent information through the Internet.

The JPO has operated the System for Searching and Translating Documents from Chinese and Korean, which aids investigations on the burgeoning patent documents of China and South Korea, and the Foreign Patent Information Service (FOPISE²), which provides patent information of ASEAN³ and other countries.

Furthermore, to expedite the use of IP, the JPO provides information on licensable patents and research tool patents in the form of a database through the National Center for Industrial Property Information and Training (INPIT).

The JST is making efforts that range from the discovery of high-quality research achievements through support for patent acquisition and onward to industrialization. Specifically, the agency is giving full support to the utilization of intellectual property through the Promotion of the Use of Intellectual Property. This includes supporting the strategic acquisition of foreign patents by universities through use of their research results, collecting and packaging some patent rights scattered across some universities for more efficient use and offering patent information to universities free of charge through the Internet (J-STORE⁴).

(3) Acceleration of the examination system

To meet the need among patent applicants for expedited patent rights acquisition, the JPO has conducted an accelerated examination system that applies under certain conditions. Additionally, they have, since August 2011, been implementing the Accelerated Examination and Accelerated Appeal Examination to Support Recovery from Earthquake Disasters, in order to speed the examination of patent applications from people and business facilities affected by earthquakes, so as to allow them to apply intellectual property towards restoration.

The Act for Special Measures Promotion of Research and Development Businesses etc. by Specified Multinational Enterprises (Act for Promotion of Japan as an Asian Business Center) (Act No. 55 of 2012) was enacted to promote activities that will attract R&D bases and supervisory bases of global enterprises to Japan. The patent applications applied as the results of R&D projects approved under the Act were, on a trial basis, included in the subject of the acceleration of the patent examination system.

(4) Developing and strengthening patent examination system

The JPO worked to maintain and improve its examination capacity also in FY2017 by re-employing some examiners under limited-time contracts after the termination of their term, for example. Continued efforts were also made for development and strengthening of the patent examination system.

¹ <https://www.j-platpat.inpit.go.jp/>

² Foreign Patent Information Service <https://www.foreignsearch.jpo.go.jp/>

³ Association of South-East Asian Nations

⁴ <https://jstore.jst.go.jp/>

(5) Collective examination for IP portfolio supporting business activities

In recent years, along with the globalization of business activities and the diversification of business structure, the intellectual property strategies of businesses have been changing to those that originate from their business. The JPO studied a new examination system to meet the needs of patent applications in response to the Global IP Initiative. The JPO has conducted a new initiative, collective examination for IP portfolio supporting business activities, under which it examines applications and grants rights interdisciplinary according to the timing of the applicant's business development, in order to support applications for comprehensive intellectual property. The new initiative applies to groups of intellectual rights (i.e., patents, design rights and trademarks) that are associated with domestic and overseas projects.

(6) Implementation and the publication of a survey on technology trend

There are calls for coordination between R&D strategies and intellectual property strategies, to facilitate the utilization of patent information on R&D. Therefore, the JPO has comprehensively analyzed technology trends by analyzing patent application trends in light of R&D trends and market trends. It has published the results.

(7) Experts' support for commercialization and crosslink

In order to create internationally competitive industries, the JPO, through the INPIT, has dispatched intellectual property management experts, called Intellectual Property Producers, to universities and R&D consortiums, where public funds are allocated in expectation of innovative output. To expedite the use of IP by Universities, the JPO INPIT dispatches "IP Advisors for industry-academia collaboration" who are experts in IP management to universities engaging in cooperative industry-academia activities toward commercialization.

In order to assist in the formulation of research plans that are to be implemented in collaboration among universities, national R&D agencies and public experimental research institutions, MAFF deploys approx.140 coordinators throughout the country who are specialized in the agriculture, forestry, fisheries and food industries. This support includes the introduction of viewpoints of the management of technology (MOT), including the strategic use of intellectual property.

(8) Efforts for security export control

In order to prevent leak of technology information, METI promoted efforts on security export control including guidance for universities and public research institutions on compliance with the Foreign Exchange and Foreign Trade Act (Act No. 228 of 1949) by holding about 100 briefing sessions on security export control in FY2017.

2 Accelerating strategic international standardization and enhancing related support systems

(1) Promoting an intellectual property strategy and an international standardization strategy

With the progress of economic globalization, the importance of various intellectual activities that are sources of economic growth has been increasing. To enhance the competitiveness of Japanese industries and

improve the lives of the citizens, it has become important for Japan to create advanced technologies and rich culture, and to link these to the creation and expansion of businesses. The Intellectual Property Strategy serves as the foundation for such activities.

The Intellectual Property Strategy Headquarters launched the IP Promotion Plan 2017 in May 2017 for the creation and protection of intellectual property. The plan includes: construction of an IP system to strengthen industrial competitiveness through promotion of use of data and artificial intelligence; integrated promotion of IP and standardization strategy that leads the global market, promotion of IP utilization by local, medium and small companies, and industry-academy and inter-industry partnerships. According to the plan, the Intellectual Property Strategy Headquarters has been leading the activities to promote the Intellectual Property Strategy in collaboration with the ministries and agencies concerned.

(2) Active efforts for international standardization

In order to strengthen the competitiveness of our industries in the global market, in FY2017 the Industrial Structure Council and the Japanese Industrial Standards Committee discussed approaches to new standard certification and compiled a report in October. Based on the report, the government considered revision of the Industrial Standardization Act (JIS Act) and submitted the bill to revise the Industrial Standardization Act to the 196th ordinary session of the Diet.

The Growth Strategy 2017 (Cabinet Decision on June 9, 2017) set forth “promotion and acceleration of strategic standardization.” With the advent of the 4th industrial revolution, every piece of equipment and every factory will be connected. In line with the strategy, METI is working to strengthen international standardization systems in the public and private sectors including standardization beyond the borders of industries.

Specifically, METI has been implementing international standardization regarding smart manufacturing as part of the 2017 program to promote and spread international standardization related to rational use of energy. AIST is supervising the promotion with participation of several private businesses. For strategically important R&D themes and cross-cutting themes, a system to promote international standardization activities has been developed in cooperation with National R&D Agencies and private businesses. For human resource development, METI personnel are sent for lectures on standardization at universities and training courses are provided to develop young human resources who will lead international standardization. Based on the “three action plans to develop human resources for standardization” announced in FY2016, METI developed model curriculums on standardization education for university teachers (faculty development teaching materials) and established new standardization qualification schemes through the Japanese Standard Association (JSA).

In order to develop a system to support certification, METI opened a consulting service on certification under the project to support export-related certifications conducted by JETRO¹⁾. The ministry also held seminars, and prepared and distributed pamphlets.

The ministry has been conducting overseas technical cooperation for collaboration with Asian countries in international standardization activities and promotion of their active participation. In FY2017

¹ Japan External Trade Organization

standardizing organizations and businesses concerned gathered from Japan, China and South Korea and discussed possible fields of cooperation for standardization. METI has been working to strengthen cooperation with Asian countries in international standardization activities by holding human resource development seminars for Asia in cooperation with the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and also advancing a project for international harmonization and standards development/dissemination at the Sub-Committee on Standards and Conformance of the Asia-Pacific Economic Cooperation (APEC¹).

Based on the Third Recommendations on the direction of a new telecommunications technology strategy (Consultation No. 22 of 2014) of the Telecommunications Council in July 2017 and other recommendations, MIC is promoting standardization activities at standardization organizations including de jure standardization organizations such as the ITU² and standardization forums in the private sector toward international standardization of information communication technologies in the wireless factory, smart home and other priority areas.

Water supply has been included as a specific strategic field for international standardization, so the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Ministry of Health, Labour and Welfare (MHLW) are promoting its strategic international standardization under the IP Promotion Plan to ensure that Japanese corporations launching water supply and sewerage system businesses in the global market can achieve high competitiveness. Currently, these two ministries are actively participating in the Asset Management Area (ISO/TC224WG6& ISO/TC251) and the Crisis Management Area (ISO/T224WG7) to lay out policies for ISO International Standards.

(3) Promotion of the Global IP Initiative

Amidst growing economic globalization and open innovation, the JPO is promoting the Global IP Initiative (laid out by the JPO in July 2011) to incrementally improve global IP infrastructure, so that Japanese companies can smoothly engage in business internationally. Currently, the JPO is implementing the “patent prosecution highway (PPH³)” with 41 nations (as of January 2018). This will allow patent applicants whose patents have been deemed patentable to apply for early examination in other countries. As a new effort to contribute to international cooperation in patent examination, the JPO and the U.S. Patent and Trademark Office (PTO) have conducted the JP-US Collaborative Search Pilot Program on August 1, 2015. Under this program, the patent examiners in Japan and the U.S.A. conduct independent searches on advanced technology applications and share the search results and opinions before forwarding the examination results to the patent office of each country. The first-phase trial program was completed on July 31, 2017, and the 3-year second-phase trial program started under a new operation system on November 1 of the same year.

¹ Asia Pacific Economic Cooperation

² International Telecommunication Union

³ Patent Prosecution Highway

Section 4 Reviewing and Improving the Regulatory Environment for Innovation

In order to ensure speedy commercialization of knowledge and technologies that are the source of innovations, and their adaptation to the exponential development of ICT, the government will review the systems for new products and services to maximize innovations' potential to change society.

1 Reviewing systems in accordance to new products, services, and business models

(1) Regulations and systems for accelerating innovation

Although regulations and systems have been established for the promotion of safe, smooth R&D, these could potentially impede innovation due to excessive strictness. The Japanese government has been promoting a system called National Strategic Special Zones. The system is positioned as a breakthrough point for regulator and system reforms under the Japan Revitalization Strategy. In addition, the conventional Comprehensive Special Zone System and other special zone systems are expected to be increased. These systems are expected to accelerate innovation.

A. Efforts for National Strategic Districts

The government submitted a bill to revise the Act on National Strategic Special Zones to the 196th ordinary session of the Diet. The revision intends to set up Sand Boxes with area limitation in National Strategic Special Zones and rationalize ex-ante regulations while strengthening ex-post checking by establishing a surveillance and evaluation system, in order to ensure speedier and smoother demonstration tests toward realization of near-future technologies of automatic driving, unmanned aircrafts (drones) and radio utilization based on Growth Strategy 2017 and new economic policy packages, etc. Promptly after the enforcement of the revision bill, the government will work for utilization of the sand box system in special zones and carry out demonstration tests with increased vigor.

B. Efforts for the Comprehensive Special Zone System

The government has selected 7 areas to designate as International Strategic Zones, in order to form industrial and functional clusters that will drive Japan's economic growth. It has also selected 36 areas as Comprehensive Special Zones for Local Revitalization to strengthen regions through local vitalization in which the use of local resources is maximized, and it has comprehensively support the selected areas through preferential measures on regulations and support measures regarding taxation and financing.

2 Improving IP systems in response to the tremendous development in ICT

In the age of the 4th industrial revolution, use of new information properties including AI creations, 3D data and databases whose creativity is hard to recognize will spread beyond contents industries (e.g. novels, music and paintings) to other industries (manufacturing, agriculture, advertising, insurance and financial, transportation, healthcare, etc.) Building an IP system that forms their foundation has become increasingly important in order to strengthen our industrial competitiveness.

In this context, the Intellectual Property Strategy Headquarters set up the "New Committee on

Information Properties” to discuss future IP systems that will form the foundation for promotion of the use of new information properties including data and AI (learning process of AI, related technologies and products). The committee discussed protection and utilization of valuable data and machine learning, especially AI using deep learning, which are not covered by the copyright under the current IP system, and worked on a detailed study of support for contracts regarding data use, securing of a fair competitive order, creation of an environment to promote data preparation for learning by AI, appropriate protection of learnt models and other matters, and compiled a report. The direction of the measures suggested in the report was incorporated in the Intellectual Property Strategic Program 2017. Study will be continued on rights with restriction for the purpose of promotion of data utilization and protection of AI products under the IP system.

With the aim of flexible response to changes in the usage environment of works accompanying the development of digital networks, MEXT is studying development of flexible provisions on limitations on copyrights in the Copyright Act including analysis of their effects and influence. In April 2017 the ministry compiled a report at the Council for Cultural Affairs. Based on the report, the cabinet decided and submitted a bill for partial revision of the Copyright Act to the Diet in February 2018.

At the committee on the approach to IP system with the 4th industrial revolution in mind, METI studied corporate strategies in response to the 4th industrial revolution and the intellectual property system and operations that support the strategies, and compiled a report in April 2017. For the initiatives that the report found appropriate to be implemented in the future, METI is working to develop an IP system in response to the 4th industrial revolution, which includes revision of the Unfair Competition Prevention Act, the Industrial Standardization Act and the Patent Act. With the rise of IoT-related technologies, AI and other new technologies, inventions related to software have been developed in many technical fields. In this context, JPO revised the parts concerning software-related inventions of the Examination Standards for Patent and Utility Model in Japan and the Examination Handbook for Patent and Utility Model in Japan in March 2018 in order to ensure full understanding by examiners and users in various technical fields.

Section 5 Developing Innovation Systems that Contribute to “Regional Revitalization”

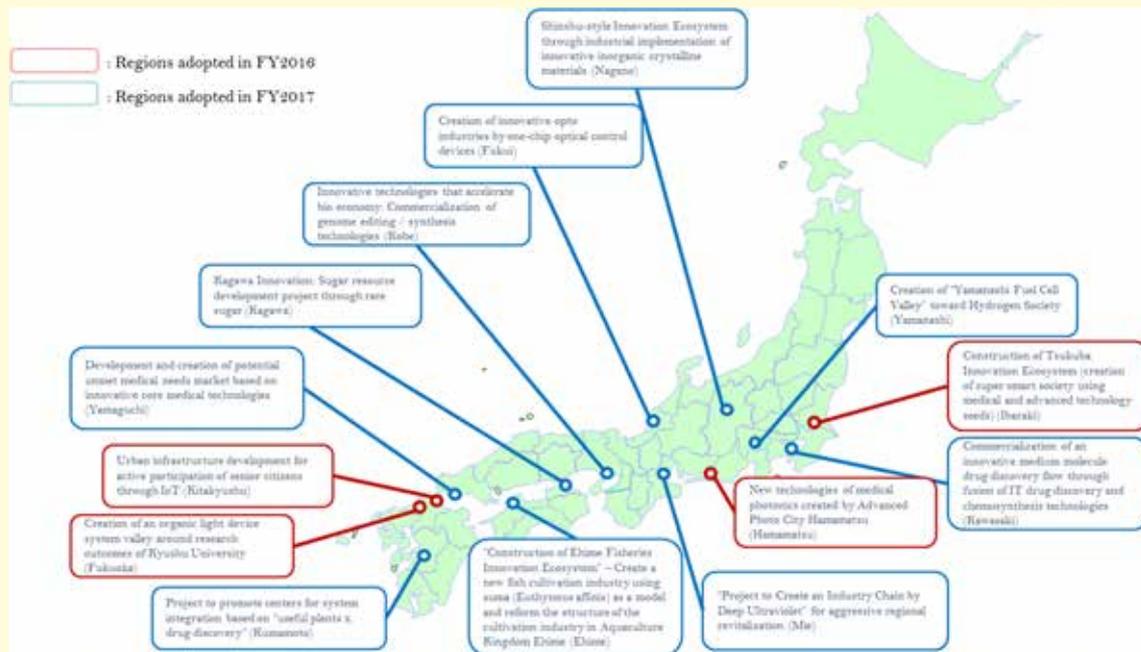
We can find strengths and buds to create innovations in various regions. In order to take make use of regional features to create new products/services and increase added-value of the existing industries, it is important to build an autonomous and sustainable innovation system in each region.

1 Revitalizing regional companies

Toward formation of regional innovation ecosystem and regional revitalization, it is necessary to shift from the stage of quantitative expansion of mechanism building to start innovation to the stage of using regional technology seeds to create successful models with a large social impact with an eye to their global expansion. To this end, MEXT launched the “Program to build regional innovation ecosystems” in FY2016. Under this program, MEXT is supporting commercialization projects with high risk but big social impact

by setting up project producing teams in regional universities that are trying to contribute to the growth of the region, gathering human resources and technologies around the source of the regional competitiveness (core technology, etc.) and developing a commercialization plan that can be globally deployed. 14 regions have been adopted in total by FY2017 (Figure 2-5-7).

Figure 2-5-7 List of regions supported by the “Program to build Regional Innovation Ecosystems”



Source: MEXT

In order to support prospective core companies of the region in their efforts in new fields/business and facilitate their growth, METI is supporting networking with external nationwide resources (universities, partner companies, financial institutions, etc.) by using human resources for support. For further growth of regional core companies, METI is providing hands-on support for formulation of commercialization strategies and cultivation of markets by using human resources for support. In cooperation with ministries and agencies concerned, METI established the “Global Network Council” by organizing global coordinators who are experts in commercialization viable in the international markets. The council is supporting development of commercialization strategies and cultivation of markets with a view to the global market.

By utilizing the New Market Creation Standardization System, the ministry decided on the standardization of 5 items that had been proposed by well-established businesses and SMEs as of the end of FY2016. In addition, METI expanded the partner organizations of the Partnership System for Supporting Utilization of Standardization to 118 in 47 prefectures across the country. Under this system, local authorities and business promotion organizations, local financial institutions, universities and public research institutions (partner organizations), and the Japanese Standards Association work in collaboration and provide information and advice to local businesses on their strategic utilization of standardization.

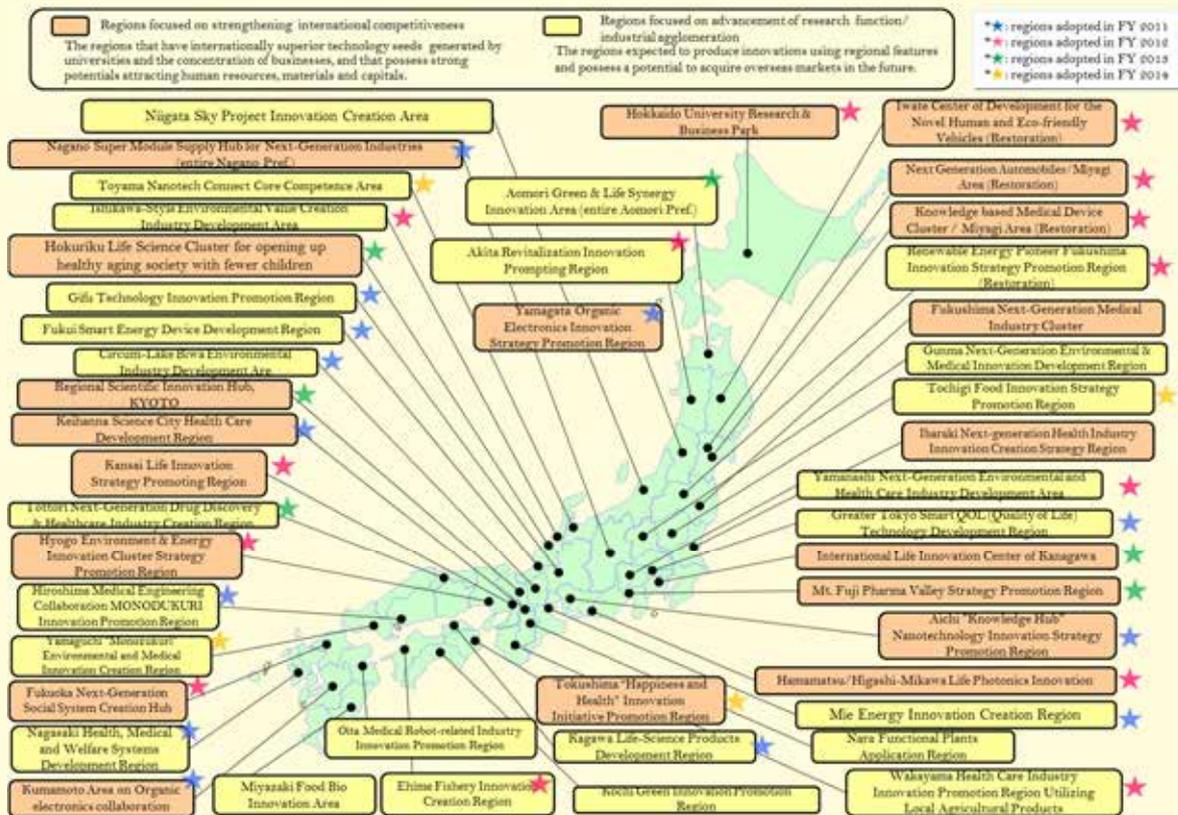
2 Driving innovation systems that make use of local characteristics

(1) Development of a regional innovation system

With the aim of regional innovation, MIC, MEXT, MAFF and METI have been designating certain regions as Innovation Strategy Promotion Regions. These regions are those in which original concepts have arisen through partnerships or other cooperation between local authorities, university research institutes, other research institutes, businesses and financial institutions. MIC, MEXT, MAFF and METI have mobilized policies to establish support systems that target these regions and that provide continuous support, from initial research to commercialization.

As of FY 2017, 45 regions had been selected: 20 Regions Focused on International Competitiveness, in which local universities have internationally competitive technological seeds, internationally competitive businesses have gathered, and there is a strong potential to attract labor, goods and money from abroad; and 25 Regions Focused on Advancement of Research Function/Industrial Concentration, which are expected to create innovations based on local features and which have the potential to capture overseas markets in future (Figure 2-5-8).

Figure 2-5-8 Regions in which Innovation Promotion Strategies have been supported



* To support Independent regional activities with focus on the development of intellectual property and human resources, program to support regional innovation strategies (33 regions) and Great East Japan Earthquake recovery support initiative (4 regions) were adopted.

Source: MEXT

Under the Strategic Information and Communications Research and Development Promotion Program (SCOPE), MIC is promoting R&D proposed by companies and universities conducting R&D on ICT that

will contribute to the creation of new local industries, promote local industries and vitalize local society.

Under the Regional Industry-Academia Value Program, MEXT is working to create high value-added and competitive regional STI. Under this program, matching planners strategically connect seeds from universities to the needs of regional businesses throughout Japan. These planners support the universities and businesses in areas ranging from cooperative research to the commercialization of the seeds and help businesses in solving their problems.

Under the program to strengthen infrastructure for stimulation of regional investments in the future, MEXT is developing new common infrastructure for creation of regional innovations by creating an environment that encourages local companies to use IoT technologies through support for introduction of IoT equipment to public R&D institutes.

For the purpose of expanding regional commercialization functions, the JPO is dispatching a Project Producer to each of three organizations for the period from FY2016 to FY2018. They plan business by identifying latent needs and support creation of an environment for business creation from matching of seeds to business finance and development of markets by constructing and using a regional network including financial institutions.

Under the program for the promotion of science and technology research on agriculture, forestry and fishery and food, MAFF has set research topics that could lead to local vitalization using ideas and solutions to issues faced by manufacturers, in order to promote cooperative industry-academia-university R&D led by prefectural experimental research institutions and local universities. It specifically supports research on local innovation strategies. In addition, MAFF has assigned industry-academia-university collaborative coordinators nationwide who are experts in agriculture, forestry and fishery and on food industries. They promote R&D in these fields through collection/identification of needs and collection/provision of seeds while supporting industry-academia-government matching, introducing and supporting R&D funding and supporting commercialization.

MAFF also hosts local matching forums to support local R&D and the diffusion of technology.

AIST is working in close coordination with public experimental research institutions (PERIs) through human exchange to discover needs of local companies and provide them technical support using technology seeds of AIST. Specifically, AIST commissions or employs 113 PERI personnel and former senior officials as AIST Innovation Coordinators who coordinate “bridging” to local companies, and has been strengthening the cooperation system among PERIs as well as their cooperation with AIST through the Industrial Technology Liaison Council and also supporting improvement of technical abilities of personnel and human resource development at PERIs. Furthermore, AIST is actively promoting cooperation with local authorities by signing a comprehensive agreement, and cooperation in the technical field suitable for the characteristics of the regional industry by using the subsidy program of local authorities. This way, by transferring its technical seeds to business activities at the local and national levels to contribute to technical competitive power of local companies, AIST is working on regional revitalization.

(2) Supporting protection of regional IP

JPO conducted visiting interviews where examiners and appeal examiners travel to interview places across Japan, TV interviews in which applicants can participate using their own personal computer through

an internet channel, and circuit appeal/trial board for oral proceedings across Japan. JPO also conducted the program to promote patents at regional centers. Under this program, on-site interviews and seminars on patent rights are held simultaneously in research parks, universities and other places that gathers regional SMEs, startups and research facilities.

3 Promoting policies that encourage local initiative

(1) Support for independent and sustainable regional growth

Support from a medium- to long-term perspective is important for individual regions to build their innovation system based on their respective strengths toward independent and sustainable growth.

The Cabinet Office and MEXT are making a study on setting inspection indicators so that ministries, agencies and local authorities can understand the situation of Innovation Ecosystem in the regions.

Based on the action plan for revitalization of regional IP formulated in September 2016, and in order to ensure finely-tuned support for the regions and SMEs, the JPO compiled goals to be achieved by 2019 with consideration of the characteristics of each prefecture in December 2017.

Section 6 Cultivating Opportunities for Generating Innovation in Anticipation of Global Needs

In response to global challenges including energy, resources and food security and natural disasters, we will explore opportunities to create innovations by strategically taking leadership using our technical capabilities and experience in field implementation and anticipating future needs.

1 Promoting R&D that anticipates global needs

For the purpose of referring to overseas information in formulating policies on science and technology, a system needs to be created for the continuous collection, accumulation and analysis of overseas information in a structured and organized manner, and for the use of such information across multiple sectors and disciplines. MEXT and other organizations have been working on this.

As part of its exploration and analysis of long-term changes toward R&D meeting global needs in the future, the National Institute of Science and Technology Policy (NISTEP) is advancing the “Horizon Scanning” initiative. The initiative is aimed at identifying new moves in ST and society (signs of change) that are likely to have a big impact on society in the future through systematic and continued monitoring to find potential opportunities and risks. As part of the efforts, NISTEP has opened the KIDSASHI site that rapidly provides information obtained through Horizon Scanning in the context of uncertainty of future prospect.

The Center for Research & Development Strategy (CRDS) of the JST is investigating and analyzing overseas trends to benefit the formulation of STI policies.

JSPS Overseas Offices collect information on trends in science and technology, support efforts by Japanese universities to expand their international bases and activities, collaborate with organizations engaging in science promotion and hold symposiums. In FY2017, JSPS Washington Office and the Japanese Consulate General jointly held a Japan-US academic exchange forum under the theme: “Food Science for the Future”.

The forum improved the presence of Japanese researchers who were active in the United States and offered a place for networking among Japanese and American researchers.

They are also strategically promoting international joint research and research exchanges with the world's leading science and technology nations to address the economic and social challenges that we face (Chapter 4 Section 2-1(3), Chapter 7 Section 3).

2 | Developing systems to promote inclusive innovation

(1) The promotion of cooperation with developing countries on issues of global concern

To promote science and technology cooperation with developing countries in Asia, Africa and Latin America, MEXT, the JST, Japan Agency for Medical Research and Development (AMED), the Ministry of Foreign Affairs (MOFA) and Japan International Cooperation Agency (JICA) have been collaboratively implementing the Science and Technology Research Partnership for Sustainable Development (SATREPS) program by utilizing Japan's advanced science and technology and Official Development Assistance (ODA). The program promotes international joint research toward addressing global issues and utilization of research outcomes based on the needs of these countries. These projects address issues relating to the environment, energy, bioresources, natural disaster prevention and mitigation, and infectious diseases control. From FY 2008 through FY 2017, 125 SATREPS projects in 47 countries (including 65 projects in Asia and 32 projects in Africa) were adopted for implementation.

MEXT launched a program that combines international joint research with government scholarships for international students. Specifically, the government provides scholarships for international students who wish to study at Japanese universities that participate in the SATREPS program. This program makes it possible for young researchers from countries participating in international joint research projects to earn degrees in Japan. Thus, MEXT is cooperating with other countries in developing their human resources.