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.

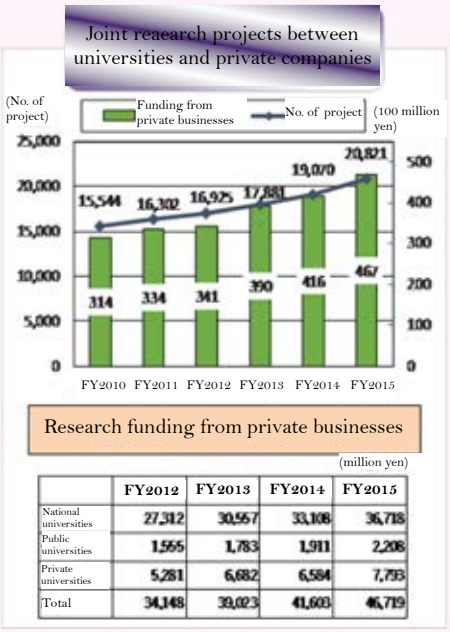
1 Enhancing systems of promotion in companies, universities, and public research institutes

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

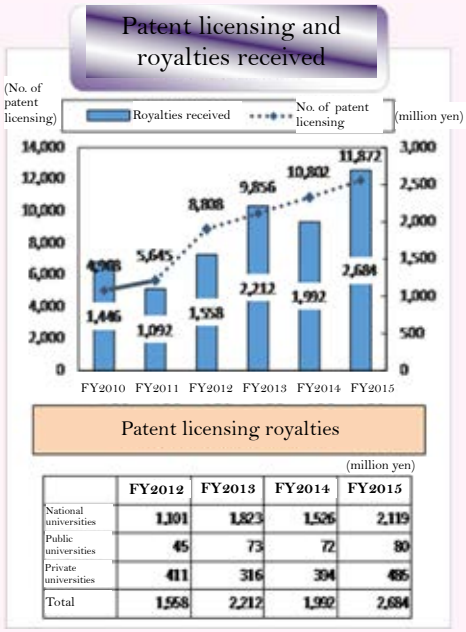
①Status of industry-academia-government collaboration at universities

Since the corporatization of national universities in April 2004, industry-academia-government collaboration activities have been increasing. In FY 2015, the number of collaborative research activities between universities and private corporations was 20,821 (a 9.2% increase over the previous year) and the amount received for joint research from private corporations was about 46.7 billion yen (a 12.3% increase over the previous year). In contrast to FY 2010, the number of the cooperative research activities increased by approximately 30%. In addition, the number of patent licensing reached 11,872 (Figure 2-5-1).

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



	FY2012	FY2013	FY2014	FY2015
National universities	27,312	30,557	33,108	36,718
Public universities	1,565	1,783	1,911	2,208
Private universities	5,281	6,682	6,584	7,793
Total	34,148	39,023	41,603	46,719



	FY2012	FY2013	FY2014	FY2015
National universities	1,101	1,823	1,526	2,119
Public universities	45	73	72	80
Private universities	411	316	394	485
Total	1,558	2,212	1,992	2,684

Notes: 1. Subjects: national, public and private universities
2. The term "Universities" indicates universities, junior colleges, technical colleges and inter-university research institutes.
3. The number of patent licenses denotes the number of patents that have been licensed or transferred (including patents pending)
4. 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).
5. "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 (2015), MEXT (as of January 13, 2017)

②Activities of the Technology Licensing Organization (TLO)

As of September 26, 2016, 36 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 2015, the number of patent licenses reached 8,241.

(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, 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.

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.

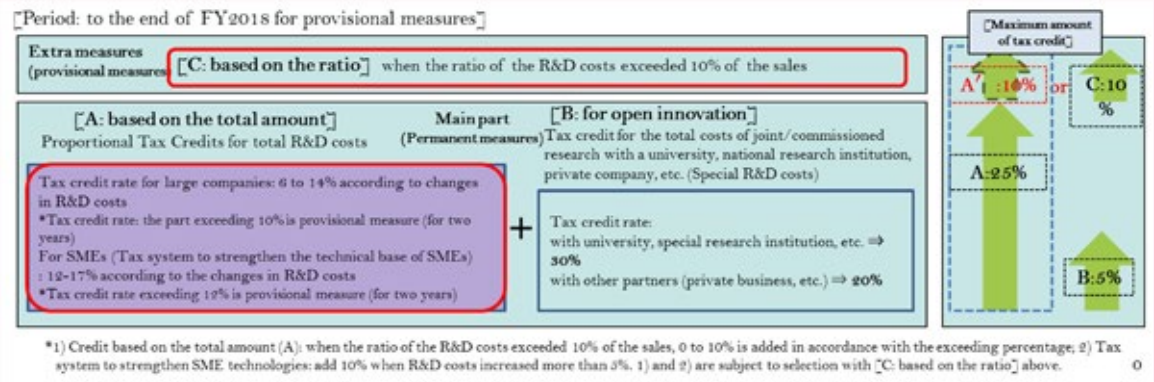
The Ministry of Internal affairs and Communication (MIC) is promoting cooperative industry-academia-government R&D and demonstration tests using the New Generation Network Testbed (JGN[1]-X1) that has been developed and managed by the National Institute of Information and Communications Technology (NICT).

(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 measures[2]. In the FY2017 tax reform, they were reviewed as shown in Figure 2-5-2.

1 Japan Gigabit Network
2 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

<Points of FY2017 tax reform (Special Tax Credit on special R&D costs, etc.) >

1) Development of "the 4th industrial-revolution-oriented" services using big data, etc. is added to the scope of R&D costs.

2) Tax credit based on increase is abolished. For credits based on the total amount, the system of tax credit of 8 to 10% of the total amount of R&D costs is reorganized to introduce a system to change the tax credit rate within the range of 6 to 14% according to the rate of change in R&D costs in order to strengthen the incentives for increasing R&D investments.

3) In order to scale up the support for SMEs, while maintaining the existing tax credit rate at 12% with the maximum rate of 25%, a system is introduced to increase the tax credit rate up to 17% and add 10% to the maximum rate when R&D costs increased by over 5%.

4) Procedures pertaining to open innovation R&D are simplified: the limitation of costs pertaining to joint research included in Special R&D Costs is abolished and they are recognized as costs of the research, for example

5) The period of application of [C: based on the ratio] is extended two years to the end of FY2018.

(5) Utilization of awards programs

①The 14th Award of Winners Contributing to Industry-Academia-Government Collaboration (Linking Innovation Award) (FY 2016)

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 high-performance nonvolatile storage and its evaluation and manufacturing equipment, and building of an integrated electronics R&D center based on international industry-academia collaboration	Tetsuo ENDOH, Director of the Center for Innovative Integrated Electronic System and Professor of School of Engineering, Tohoku University Gishi Chung, Corporate Director of Tokyo Electron Limited Masaki YAMAMOTO, Executive Director, Keysight Technologies International
Minister of State for Science and Technology Policy Award	Development of high-functioning artificial joints and surgical operation support system in medical-engineering collaboration	Yoshio NAKASHIMA, Chairman, Teijin Nakashima Medical Co., Ltd. Medical Engineering, Department of Mechanical Engineering and Science, Graduate School of Engineering, Kyoto University Industrial Technology Center of Okayama Prefecture
Minister of Internal Affairs and Communications Award	Industry-academia-government collaboration for development of DAEDALUS	Daisuke INOUE, Director, Cybersecurity Office Cybersecurity Laboratory, National Institute of Information and Communications Technology (NICT) Katsunari YOSHIOKA, Associate Professor, Graduate School of Environment and Information Studies/ Institute of Advanced Science, Yokohama National University Yasuhiro KUNIMINE, President, clwit, Inc.
Minister of Education, Culture, Sports and Science Award	Development and industrialization of innovative super-energy-saving soft magnetic material (NANOMET®) in Industry-academia-government collaboration	Akihiro MAKINO, Research Professor, Institute for Materials Research, Tohoku University Jun'ichi UMEHARA, Specially-appointed (visiting)Professor, Institute for Materials Research, Tohoku University Tsuyoshi NOMURA, Specially-appointed (visiting) Professor, New Industry Creation Hatchery Center, Tohoku University
Minister of Health, Labour and Welfare Award	Industry-academia-government collaboration for development of Heart Sheets (autologous skeletal myoblast sheets) that are regenerative medicine product for serious heart failure	Yoshiki SAWA, Professor, Graduate School of Medicine, Osaka University Shigeru MIYAGAWA, Specially Appointed Professor, Graduate School of Medicine, Osaka University Tadashi SAMESHIMA, Executive Officer, TERUMO Corporation
Minister of Agriculture, Forestry and Fisheries Award	Development of method and device for high-speed stirring salting of seaweed	Shin'ichi ISHIMURA, President, Ishimura Industrial Co. Muneyuki ONODERA, Chief Researcher, Use and Processing Department, Iwate Fisheries Technology Center
Minister of Economy, Trade and Industry Award	Practical application of the world's first hepatic fibrosis diagnosis system using saccharide	Hishasi NARIMATSY, Principal Research Manager, Biotechnology Research Institute for Drug Discovery, National Institute of Advanced Industrial Science and Technology (AIST) Atsushi KUNO, Senior Chief Researcher, Biotechnology Research Institute for Drug Discovery, AIST Yoichi TAKAHAMA, Director, Immunology & Chemistry Product Engineering Div., ICH Business Unit, Sysmex Corporation

Minister of Economy, Trade and Industry Award	Development of sherbet-type sea ice-maker	Hiroshi NAGAISHI, Innovation Coordinator, Hokkaido Center, AIST Takaaki INADA, Chief Researcher, Research Institute for Energy Conservation, AIST Atsushi SATO, President, Nikko Corporation Akeya YOSHIOKA, Principal Researcher, Department of R&D, Hokkaido Industrial Technology Center
Minister of Land, Infrastructure, Transport and Tourism Award	Development of hydrogen station using sewer sludge digester gas	Masaki TAJIMA, Visiting Professor, International Research Center for Hydrogen Energy, Kyushu University Soichiro TAKASHIMA, Mayor of Fukuoka Hideki TAKASHIMA, Deputy General Manager, Energy Project Office, Mitsubishi Kakoki Kaisha,ltd Koji NAKAGAWA, General Manager, New Business Development Department, Toyota Tsusho
Minister of Environment Award	Development research of clinker-free concrete with dehydrated sludge powder and by-produced mineral admixture	Tetsushi KANDA, Principal Researcher, Kajima Tech. Research Institute Ken OHKAWA, Manager, Testing Department, Sanwasekisan Corporation Tetsurou KASAI, Professor, Department of Civil Engineering, Tokai University
Keidanren (Japan Business Federation) Chairman Award	Industry-academia-government collaboration for development of production process using microwave	Yasunori TSUKAHARA, Specially-appointed Associate Professor, Joint Research Chair on Microwave Chemistry, Graduate School of Engineering, Osaka University Iwao YOSHINO, President, Microwave Chemical Co., Ltd.
President's Award, SCJ	Development of multilayered sheet of three types of human iPS cell-derived cardiovascular cells	Jun YAMASHITA, Professor, Center for iPS Cell Research and Application, Kyoto University Yasuhiko TAHATA, Professor, Institute for Frontier Medical Sciences, Kyoto University Kenji KAKUTA, President, iHeart Japan Corporation
Special Award of the Selection Committee of Contributors to Industry-Academia-Government Collaboration	Academia-financial institution collaboration system for innovations from Yamagata	Hiroyuki ONO, Professor Graduate School of Science and Engineering, Yamagata University Yonezawa Shinkin Bank SHONAI BANK, Ltd.
Special Award of the Selection Committee of Contributors to Industry-Academia-Government Collaboration	Industry-academia-government collaboration for R&D on Carbon Nanotubes	Motoo YUMURA, Principal Researcher, CNT-Application Research Center, AIST Kenji HATA, Director, CNT-Application Research Center, AIST Shigeki TOMONOU, Invited Researcher, CNT-Application Research Center, AIST Mitsuo UENO, Assistant Manager, CNT Department, Technology Research Association for Single Wall Carbon Nanotubes Kohei ARAKAWA, Special Chief Engineer, ZEON Corporation

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 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.

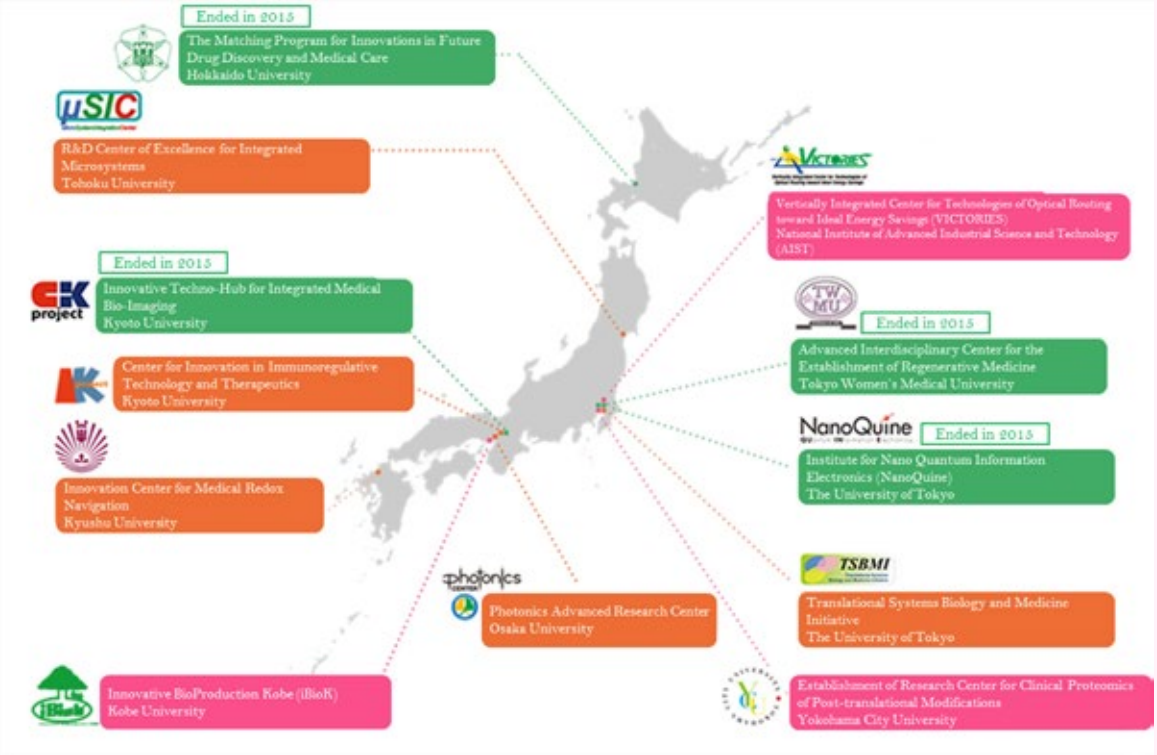
① Formation of a world-leading locally oriented R&D and demonstration base

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 2015, the ministry provided support for three complexes.

② 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; 8 institutions have been supported as of FY 2016 (Figure 2-5-4).

■Figure 2-5-4 / List of projects being implemented under the Creation of Innovation Centers for Advanced Interdisciplinary Research Areas



Source: Created by MEXT

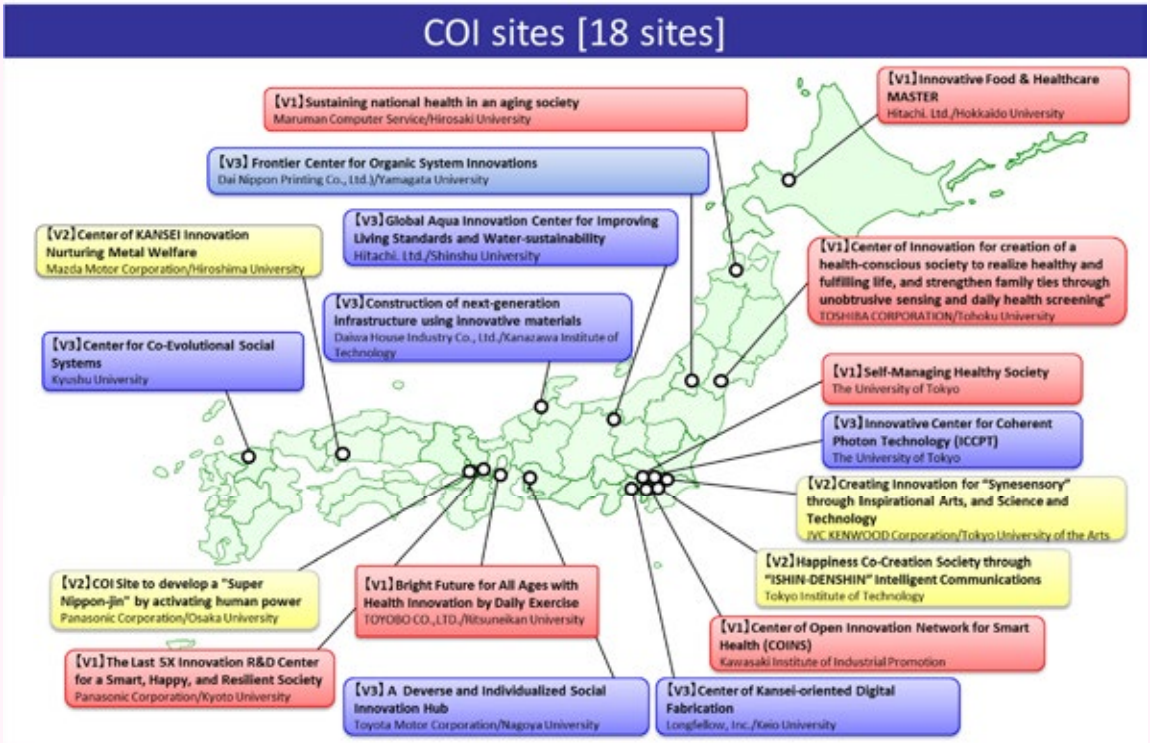
③Forming bases for commercialization of local research products

The program to develop regional ST demonstration bases is aimed at commercialization of local research outcomes created through basic research. Under this program, MEXT has supported facility/equipment development of 22 bases to accelerate joint R&D, demonstration and commercialization by universities, public research institutions, private businesses and other players on the same premise.

④Developing centers for the creation of cutting-edge innovation

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

■Figure 2-5-5 / COI sites



Source: Created by MEXT and JST

As the first three years (Phase 1) of the COI program ended in FY2016, the first interim evaluation of its results and progress was conducted and each COI site was asked to reflect the evaluation results and make improvements.

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 22 technology research associations as part of an undertaking to form a co-creation platform (as of January 2017).

⑤Forming 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. The program aims to accelerate open innovation in Japan. To this end, it expects universities in cooperation with industry to use all their intellectual properties to create "technology/system innovation scenarios" toward development of new core industries, plan and propose joint research in noncompetitive fields based on the scenarios and expand industry-academia partnership for basic research and human resource development.

(2) Developing open innovation centers

① 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 32 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. In April 2012, the High Energy Accelerator Research Organization joined the center followed by the University of Tokyo in April 2016, 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 2016 at the TIA Collaboration Building and others. It attracted 398 young researchers, including undergraduate students, graduate students and business researchers from throughout Japan. Under the Nanotech CUPAL[1] 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 230 in FY2016.

② 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 2016, it had about 130 facilities at which various research activities were under way.

(3) Organizing a co-creation platform under which industry and universities interact through discussions

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 2017 the council had over 1,583 members including companies from diverse industries, with 52 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 supported R&D of 10 tasks using the matching fund method. Other efforts include holding of regional

1 Nanotech Career-up Alliance

matching forums to support local R&D and dissemination of 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 started study on creation of an environment for autonomous and flexible cross-sectoral collaboration and exchanges of various matching projects by relevant ministries/agencies and industry.

MEXT and METI, in cooperation with the JST and New Energy and Industrial Technology Development Organization (NEDO), held the Innovation Japan 2016 - University Trade Fair & Business Matching Event, which was Japan's largest matching forum, with people gathering from universities, public research institutions and private corporations to Tokyo Big Site. MEXT and METI, in cooperation with the JST and NEDO, held the Innovation Japan 2016 - University Trade Fair & Business Matching Event, which was Japan's largest matching forum, with people gathering from universities, public research institutions and private corporations.

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 2016, the exhibition was held next to an exhibition hall in which private corporations were promoting the industrial use of their new technologies. At the fair, 141 institutions from throughout Japan exhibited their seeds and about 37,000 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

The Enhancing Development of Global Entrepreneurs (EDGE) program under MEXT, launched in FY 2014 provides the most advanced human resource development for young researchers and graduate students who are learning skills such as entrepreneurship, start-up know-how and idea creation methods in collaboration with private sectors and overseas institutes.

2 Promoting the creation of startup companies at universities

The number of university-launched startups decreased to 95 companies in 2015 compared with 252 per year in the peak years of 2004 and 2005. Some university-launched startups encountered business issues, such as securing sales channels. Therefore, MEXT deems it necessary to improve the environment for creation of high-quality university-launched startups that can identify true market needs and grow into

global businesses.

The JST has launched the Program for Creating Start-ups from Advanced Research and Technology (START). Under this program, universities and independent administrative agencies conduct R&D towards commercializing technologies that are high risk but have great potential by using the commercialization know-how of private-sector experts. Under this program, projects for selecting and fostering technological seeds has also been conducted.

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!) since FY 2014. The program invites venture capitalists to support business projects by serving as experts, and it uses the connoisseur capabilities, management know-how and project development abilities of these experts to provide support during the business model verification phase, so that SMEs can start new businesses that have innovative technological seeds and ideas as a result of R&D.

METI through NEDO is implementing the R&D-based Startup Support Program for integrated support ranging from discovery of technology seeds to their commercialization in Japan. In FY2016 with the aim of revitalizing partnerships with startups in industry and accelerating commercialization by startups, the ministry is investigating and developing tools useful for supporting development for practical application by R&D-based startups that are conducting new joint research with an operating company as well as for facilitation of their collaboration.

(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 business with assistance for R&D on new technologies. Several industrialization support measures, including the provision of patent fee reductions and low-interest loans by the Japan Finance Corp., have also been taken. In FY 2016, seven ministries (MIC, MEXT, MHLW, MAFF, METI, MLIT and MOE) designated 99 special subsidies in all and earmarked about 46 billion yen as expenditures for small and medium enterprises (SMEs) and micro enterprises.

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

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

In order to meet technology needs of ministries, agencies and organizations requiring development procurement and R&D, the government started study of a realistic and sustainable mechanism to support SMEs and startups by using public procurement in Japan. The study includes effective methods to discover technologies and ideas of R&D-based SMEs and startups and pursue matching with large companies that

are system integrators.

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 management of the government's R&D projects

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).

(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-PlatPat), 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 (FOPISER), which provides patent information of ASEAN 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-STORE).

(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 patents 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 in FY2016 also by re-employing some examiners under limited-time contracts after the termination of their term. Continued efforts were also made for development and strengthening of the patent examination system in the FY 2017 budget.

(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 trends

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 with universities, national R&D agencies and public research institutions, MAFF offers support for the deployment of approx.140 coordinators throughout the country who are specialized in the agriculture, forestry, fisheries and food industries. This support includes the introduction of viewpoints on 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 by holding about 100 briefing sessions on security export control in FY2016.

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 2016 in May 2016 for the creation and protection of intellectual property. The plan calls for: the construction of the next-generation IP system in response to digital networking; enhancement of IP education and IP human resource development; promotion of IP strategies in regional areas, SME, agriculture, forestry, fisheries and other fields. To promote the IP strategy according to the plan, the Intellectual Property Strategy Headquarters has been leading the activities under the Intellectual Property Strategy in collaboration with the ministries and agencies concerned.

(2) Active efforts for international standardization.

The Japan Revitalization Strategy (Cabinet Decision on June 2, 2016) and the Public-Private Standardization Strategy (formulated in May 2014) call for the promotion and acceleration of strategic standardization. With the advent of the 4th industrial revolution, every piece of equipment and every factory will be connected. Toward standardization beyond the borders of industries, METI is working to strengthen international standardization systems in the public and private sectors.

Specifically, METI started international standardization regarding smart manufacturing as part of the 2016 program to promote international standardization of 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, training courses are regularly provided to develop young human resources who will lead international standardization. METI also published “three action plans to develop human resources for standardization”

compiling measures to be taken by industry, government and academia under the leadership of private businesses. The plans include: appointment of CSO[1]s by companies; establishment of new standardization qualification schemes by the Japanese Standard Association (JSA); provision and improvement of lectures on standardization in universities, etc. and; further involvement in standardization activities by the National R&D Agencies.

In order to develop a system to support certification, METI obtained the participation of certification bodies in the New Export Country Consortium and established a collaboration system consisting of the Japan External Trade Organization (JETRO) and test/certification bodies. Provision of information on overseas certification started on the JETRO website.

The ministry has been conducting overseas technical cooperation for collaboration with Asian countries in international standardization activities and promotion of their active participation. In FY2016 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 (APEC).

MIC is promoting international standardization with a focus on the major areas specified in the Second Recommendations on the direction for a new telecommunications technology strategy (Consultation No. 22 of 2014) for standardization of smartphone, common platforms, wireless access, etc. in July 2016. With the aim of increasing the options available to ICT users and enhancing the global competitiveness of Japan's ICT industries, MIC is also collaborating with de jure standardization organizations[2] such as the ITU[3] and standardization forums[4] in the private sector to promote the international standardization of ICT.

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/PC251) 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

1 Chief Standardization Officer
2 Public standardization bodies such as ITU
3 International Telecommunication Union
4 Standardization bodies led by private sector players (e.g. IEEE, W3C)

the "patent prosecution highway (PPH[1])" with 35 nations (as of March 2017). 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.

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.

① Efforts for National Strategic Districts

The government has been making efforts to promote innovations, mainly of near-future technologies in National Strategic Special Zones based on the Japan Revitalization Strategy 2016. The efforts include Japan's first international drone competition in Semboku City, Akita Prefecture, in July 2016; a delivery demonstration using small unmanned airplanes in Chiba City, Chiba Prefecture, in November 2016; and demonstration tests for full-fledged autonomous driving in Semboku in the same month in order to demonstrate near-future technologies involving small unmanned airplanes and full-fledged autonomous driving.

In an effort to ensure smooth and speedy demonstration of near-future technologies including autonomous driving and small unmanned airplanes, demonstration tests will be actively carried out in National Strategic Special Zones using examples from the Regulatory Sandbox system introduced in foreign countries. The government will also study concrete measures for speedy and concentrated promotion of demonstration tests through fundamental review of prior regulation/procedures while paying full attention to safety including strict compliance with follow-up review rules. The study will be conducted as swiftly as possible roughly within one year after the enforcement of the revision bill, and

1 Patent Prosecution Highway

necessary measures will be taken in Special Zones based on the results.

In order to plan and implement various demonstration tests using the leading-edge autonomous driving system in the areas surrounding Haneda Airport, the subcommittee for an autonomous driving regulatory sandbox will be set up under the National Strategic Special Zone Council for the Tokyo Area to build a regulatory sandbox special zone system.

② 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 "Committee on New Information Properties" to discuss future IP systems forming 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 will discuss 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 work on a detailed study of support for contracts regarding data use, securing of fair competitive order, creation of an environment to promote data preparation for learning by AI, appropriate protection of learnt models and other matters. Study will be continued on rights with restriction for the purpose of promotion of data utilization and protection of AI programs/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, the Council for Cultural Affairs of MEXT is discussing development of flexible provisions on limitations on copyrights in the Copyright Act including analysis of their effects and influence.

Furthermore, METI is conducting comprehensive examination of corporate strategies responding to the 4th industrial revolution and IP system/operation to provide support from the three perspectives of "data utilization", "industrial property rights system" and "international standardization". The JPO added 23 examples that illustrate examination on IoT and AI-related technologies in an easy to understand manner to the Examination Handbook for Patent and Utility Model in Japan in September 2016 and March 2017.

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 four regions 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.

In order to support prospective core companies of the region in their efforts in new fields/business and facilitate their growth, METI supported 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 provided 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 supported 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.

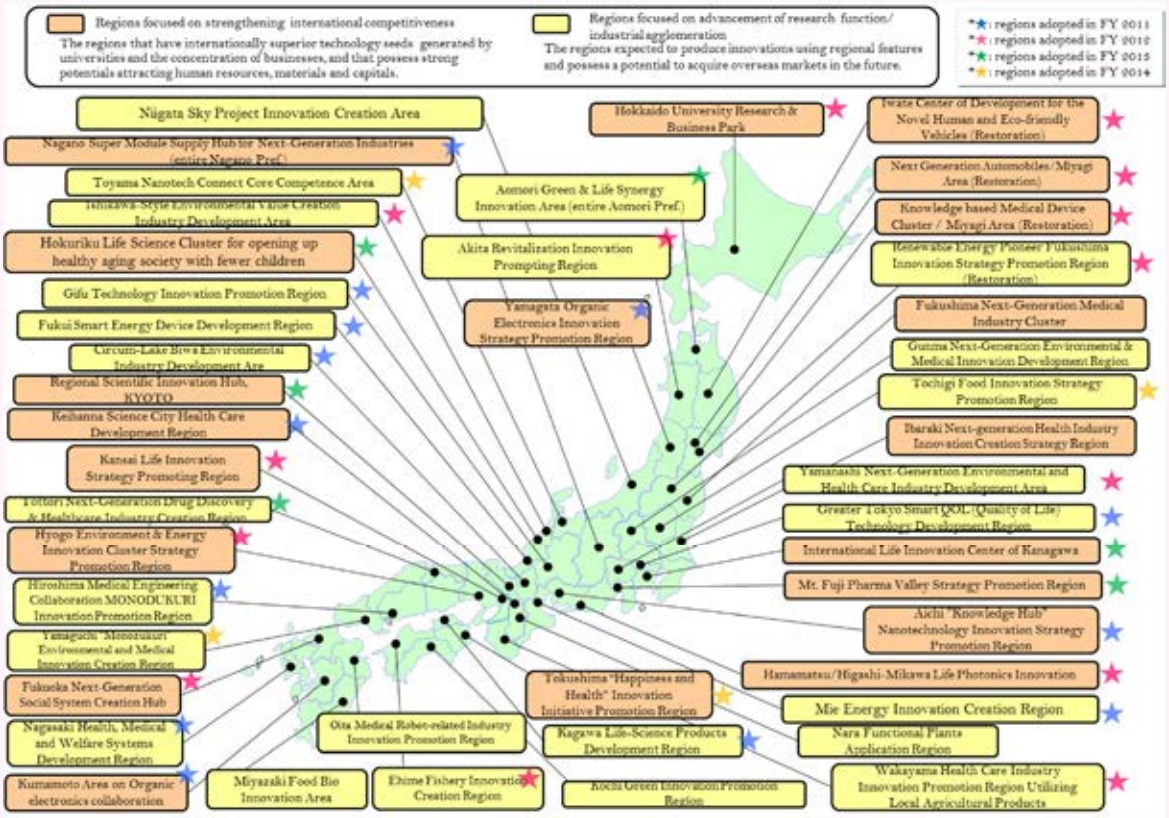
2 Driving innovation systems that make use of local characteristics

(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 2016, 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 2-5-6).

■Figure 2-5-6 / Regions in which Innovation Promotion Strategies have been supported: List of regions selected in FY 2016



* 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

For the promotion of local industries through ICT R&D 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 Matching Planner 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 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 at the Tsukuba Center, the Fukushima Renewable Energy Institute, the Rinkai-Fukutoshin Center and seven other local centers throughout Japan are working in close coordination with public experimental research institutions through human exchange to discover needs of local companies and provide them technical support using technology seeds of AIST. The efforts of the AIST efforts for regional cooperation include active promotion of 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 launched the program to promote patents at regional centers. Under this program, visiting examinations through interview 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 Council for Science, Technology and Innovation (CSTI) follows up relocation of government-related research institutions to local areas promoted by the Headquarters for Overcoming Population Decline and Vitalizing Local Economy in Japan. CSTI in cooperation with MEXT conducts survey of organizations pertaining to regional revitalization (local authorities, public experimental research institution, financial institutions, etc.).

In response to the discussions at the Industrial Structure Council in September 2016, the JPO has formulated the action plan for revitalization of regional IP and is working on further promotion of support for regional areas and SMEs in accordance with the three basic policies: (1) provide steady support, (2) build a support system, and (3) set targets (KPI) and establish a PDCA cycle.

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 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. 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 ODA[1]. 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 2016, 115 SATREPS projects in 46 countries (including 60 projects in Asia and 30 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.

1 Official Development Assistance