

Chapter 6 Deepening the Relationship between STI and Society

In order to respond to social changes and economic/social challenges in the future, we need dialogue and collaboration with diverse stakeholders. To this end, the government, universities, public research institutions, science museums will play central roles in developing co-creation platforms and promoting efforts to ensure the public nature of research.

Section 1 Promoting Co-creative STI

1 Dialogue and collaboration with stakeholders

In an effort to promote the establishment of international communication, the Japan Science and Technology Agency (JST) implements the Program for the Promotion of International Policy Dialogs Contributing to the Development of Science and Technology Diplomacy, under the JST initiative for Infrastructure Development for Promoting International Science and Technology Cooperation. This program supports the organizers of international meetings that are held to provide a broad range of stakeholders, who are playing leading roles in globally advancing science and technology in industry, academia and government, with opportunities to discuss the future direction of science and technology.

2 Stakeholder initiatives for co-creation

(1) Efforts by public organizations

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) had policy dialogues with experts from various fields to discuss a framework for the designing of a vision for future society, future research, research human resources, and the foundation of innovation. On August 3, 2018, the Task Force for Science and Technology System Reform published the Report: Science and Technology System Reform for the Co-Creation of a Future Society. Also, in cooperation with other relevant organizations, including experimental research institutions and local authorities, MEXT held the 60th Science and Technology Week from April 15 to 21, 2019. During this week, these organizations held various events across Japan, such as facility tours, experiment workshops, lectures, and awarding ceremonies for the MEXT Minister Prize for Science and Technology and other awards. Also, MEXT distributed copies of a poster titled “Geo-Evolution Japan – One for Every Household –” to elementary, junior high, and high schools as well as science centers and museums in order to arouse people’s curiosity and promote their understanding of science and technology across generations spanning from young children to adults.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) provides producers, consumers and mass media with information and opportunities to exchange opinions on the R&D of advanced technology in agriculture, forestry and fisheries. MAFF also sends researchers to give lectures. The National Research and Development Agencies under MAFF open their facilities to the public and provide lectures throughout the year, helping to raise awareness by facilitating interactive communication with the public about their research activities and by exhibiting research results.

The Japan Aerospace Exploration Agency (JAXA) provides various educational activities in space

science, such as the Cosmic College, and lecturers to schools and seminars.

RIKEN offers various programs to citizens and conducts outreach activities. For example, RIKEN prepares booklets that introduce the latest research results and puts animated films on the website in an effort to reach a broader range of people in order to explain the latest research results and scientific phenomena. In an effort to introduce the fun, depth and width of science through books, RIKEN sends “100 Science Books” and “100 Science Books for Juniors,” etc. to elementary, junior-high and high schools, public libraries and book stores across the country.

The National Institute for Materials Science (NIMS) is active in introducing its research to the public, particularly to young students who might become scientists in the future. For this purpose, NIMS has a video site titled *Material's Eye* that showcases the mysteries of various materials. NIMS is devoting great effort to help people develop an understanding of, and an interest in, science.

The National Institute of Advanced Industrial Science and Technology (AIST) operates permanent exhibition facilities and opens its facilities to the public in 11 locations nationwide. In addition, AIST actively promotes S&T communication programs through events such as experimental classrooms and the AIST Open Laboratory. AIST also creates and publishes videos and web contents to explain the latest research outcomes in an easy-to-understand manner in an effort to communicate research outcomes.

<Reference> Video sites of individual organizations

○RIKEN channel

<https://www.youtube.com/user/rikenchannel>

○NIMS Movie Library

<https://www.nims.go.jp/publicity/digital/movie/index.html>

○AIST Video Library

https://www.aist.go.jp/aist_j/aistinfo/video/video_main.html

Universities and public research institutions make efforts to widely disseminate information on research results to the general public.

The Council for Science, Technology and Innovation (CSTI) encourages researchers who receive annual public research funds of 30 million yen or more for individual research projects to actively communicate with the public regarding the contents and the results of their research activities. In addition, the results of the Public Opinion Poll on S&T and Society in FY2017 (Cabinet Office) also showed that people think the public should be more involved in the discussion of science and technology policies.

In order to solve various social challenges represented by environment/energy, the low-birth aging society and disaster prevention/mitigation, the Research Institute of Science and Technology for Society (RISTEX) of the Japan Science and Technology Agency (JST) has been conducting R&D in partnership with diverse stakeholders by taking advantage of knowledge of the humanities and social science in addition to natural science. In FY2019 RISTEX launched a new R&D program that will identify social challenges of the various communities toward achievement of SDGs that are typical social challenges and create solution scenarios and solutions.

(2) Enhancement of activities conducted by science museums

JST has been promoting co-creation, where various stakeholders discuss relationships between science technology innovation and social challenges and collaborate to connect the discussions to policy formation, knowledge creation and social implementation. As part of the activities JST holds Science Agora that is one of the greatest open forums in Japan, and supports dialogue and collaboration activities by local authorities, etc. in order to promote co-creation activities in regional communities. Miraikan - The National Museum of Emerging Science and Innovation acts to think about the relationship between advanced S&T and society with visitors to the museum. It promotes interactive communication between researchers and the general public through its exhibitions and events. It also encourages collaboration of science museums and schools across the country as the hub of Japan's S&T communication activities.

The National Museum of Nature and Science holds exhibitions that provide opportunities to expand people's interest in nature and science across generations, encouraging them to think together, and provides age-appropriate learning support (learning support depending on different backgrounds). Other activities of the museum include: dissemination of model projects to improve the science literacy focused on communication using the exhibitions, spread of learning support activities for effective cooperation between schools and the museum, and a training course for curators of natural science museums.

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Science publicity that changed the lives of young people - Material's eye on YouTube

The number of registrants for NIMS on YouTube exceeded 150,000. Visitors to its events grew nine-fold in the four years and have been breaking records for the sixth straight year!!

までりある's eye

The National Institute for Materials Science (NIMS) is attracting many young people to the complex world of material study. Its public relation inspired some high school students to study materials and choose a university for this purpose. Its PR method was introduced here by KOBAYASHI Ryuji, Chief, Public Relations Office, Corporate Planning Division, NIMS, who received the 2017 Minister of MEXT Award: Understanding Enhancement category.

Unlike space, robotics and other fields that widely create interest, material study was one of the fields that had little appeal to the public. In this context NIMS launched the Public Relations Visualization Strategy in 2013. The strategy aims to overwhelm visitors with high-quality visual materials so that they can get a visceral sense of the beauty of material study. Another feature of the strategy is the focus on young people who will play important roles in the future because you cannot reach anyone with the vague target "citizens." By this NIMS aimed to lead in raising the level of awareness of material study in Japan.



KOBAYASHI Ryuji, Chief, Public Relations Office, Corporate Planning Division and Material's eye on YouTube

Source: NIMS

This was the starting point of Material's eye on YouTube. Its total number of views and channel registrants rapidly increased to the second place among Japanese universities and research institutions in one and a half years. The total number of views and channel registrants per video rank at the top. There is a way for the unglamorous material field to outstrip space, a field that interests everyone. This shows the potential of science publicity in other fields. Now, the number of registrants of Material's eye exceeds 150,000, doubling from the previous year for the sixth consecutive year, but the impact is beyond video viewing. Growing interest in material study increased the number of visitors to NIMS public event more than nine times in four years. Universities and high schools wished to use the videos in their lectures and multiple science museums are showing the videos as permanent exhibits.

The fundamental factor for gaining overwhelming support is "creating a frame of mind" to want very badly to know difficult mathematical formulas rather than wanting to "avoid" these formulas.

Many science public relations emphasize "plain explanation" and there are many books that explain science in an easily understandable manner, but they rarely attract readers for some reason. They cannot generate interest. Material's eye sticks to the conviction that people will begin to study even somewhat difficult things if they are interested enough.

Did the message reach the original target: young people who will play important roles in the future? Analysis of the channel registrants shows that the overwhelming majority of the viewers are from 18 to 24 years old. This corresponds to the age group of high school students choosing their university and undergraduates who are to decide their field of specialization after general education. The effect of the support from these young people is clearly felt from the comments that young people post every spring.

"The series aroused my interest in material engineering and I entered a university in this field."

Public relations of one research institution influenced the life choices of young people. Science publicity should keep this in mind. If research institutions of various fields make attempts at PR activities that appeal to young people, immense potential may be opened for the future of the country.

(3) Efforts of the Science Council of Japan and academic societies

The Science Council of Japan (SCJ) holds academic forums as part of its activities to feed outcomes of research back to society. In FY2019, it held eleven forums covering a wide range of subjects, including "Venture Incubation through Industry-Academia Cocreation," "Future of Science and Gender Equality – to Promote Gender Equality of Universities and Academic Societies" and "On Application of Genome Editing Technology to Human Embryo."

The academic societies are voluntary associations organized mainly by researchers at universities and

other research institutions. They play important roles in research evaluation, information exchanges and communication beyond those of individual research organizations, and they contribute to the development of academic research through academic research meetings, seminars and symposiums that disseminate the latest results from quality research and academic journals.

Through programs such as the Grants-in-Aid for Publication of Scientific Research Results, MEXT subsidizes international conferences held by academic societies and symposiums, and other undertakings to strengthen international information dissemination.

(4) Promotion of risk communication

The Consumer Affairs Agency (CAA), the Food Safety Commission, the Ministry of Health, Labour and Welfare (MHLW) and MAFF are collaboratively promoting risk communication activities for food safety. The 2003 Basic Food Safety Act (Act No. 48 of 2003) made the government responsible for informing the nation about food safety. Meetings are held for exchanges of opinions on various topics, including the safety of imported food products, pesticide residues, safety of food additives, prevention of food poisoning, efforts for food safety and the safety of functional foods. These ministries and agencies have promoted especially proactive risk communication efforts in response to the TEPCO Fukushima Daiichi Nuclear Disaster since FY2011, such as holding opinion exchanges with consumers and participating in exhibitions at events for parents and children.

3 Scientific advice for policymaking

With the aim of formulating policies for science, technology and innovation by following a rational, evidence-based process, MEXT has been promoting the Science of science, technology and innovation policy program. In this program, by supporting researchers who pursue science, MEXT promotes STI policies, supports centers (universities) that foster human resources, implements STI policies in society and networks these centers to establish a system that systematically fosters human resources nationwide. In doing so, MEXT uses the Science for Redesigning Science, Technology and Innovation Policy Center (SciREX¹ Center), which was established at the National Graduate Institute for Policy Studies (GRIPS), as the hub. MEXT organizes and networks core centers at the University of Tokyo, Hitotsubashi University, Osaka University, Kyoto University and Kyushu University in collaboration with these universities. Indicators and evidence-based policies were developed, including those related to the economic and social ripple effects of government investment in R&D.

The National Institute of Science and Technology Policy (NISTEP) has established an information base for the collection and accumulation of data that are necessary for the formulation of STI policies and for research, analysis and study on STI. Results of research using the information base are provided to and used by various policy councils of the Cabinet Office and MEXT for study of the next Basic Plan, for example.

The Research Institute of Science and Technology for Society (RISTEX) of the JST is supporting the R&D projects through open call (the 2nd phase started in FY2016). The aims of these projects are as follows: (1) analyzing from various perspectives the social issues, the status and the feasibility of S&T that

¹ Science for RE-designing Science Technology and Innovation Policy

has the potential to address such issues, and (2) based on the evidence, developing the methods and indicators to formulate policies through rational processes. In FY2019, R&D and policy implementation were promoted for five newly adopted projects in addition to the eleven projects that have been adopted by FY2018.

The Center for Research and Development Strategy (CRDS), JST grasps and overviews the trends of STI in Japan and abroad as well as related policies, studies R&D strategies and makes proposals that contribute to STI policies. As the importance of technological innovation is increasing with the advancement and sophistication of technologies, there is an increasing need for strategic investment of limited resources. In this context, the Technology Strategy Center (TSC) of the New Energy and Industrial Technology Development Organization (NEDO) is collecting and analyzing information on technology and market trends at home and abroad with the aim of contributing to policy making for access to markets based on the information. TSC is also working for human resource development including expansion of training courses for business people toward promotion of social implementation of R&D results.

4 Ethical, legal, and social initiatives

(1) Efforts for development of systems for life science research

A. Approaches to bioethical issues

Today's rapidly advancing life science is beneficial to people, but raises ethical questions which may threaten human dignity and rights. The relevant ministries and agencies have formulated the necessary regulations.

Regarding research using human fertilized embryo, the Council for Science, Technology and Innovation (CSTI) compiled the "Second Report on the revision of the 'Basic Principles on the Handling of Human Embryos': on the use of genome modification techniques including genome editing on human embryos" on June 19, 2019. The report recommends that the following activities be permitted: (1) Basic research of genetic and congenital diseases using genome modification techniques including genome editing on surplus embryos from assisted reproductive medicine; (2) Basic research of assisted reproductive medicine on gametes or human fertilized embryos created for research purposes using genome modification techniques including genome editing, and: (3) Research of mitochondrial diseases using nuclear transfer technology on human fertilized embryos. In order to ensure proper implementation while permitting the research above, MEXT and MHLW are conducting studies toward revision of "Ethical Guidelines for Research Using Gene-altering Technologies on Human Fertilized Embryos"(Public Notice No.3 of MEXT and MHLW in 2019,) "Ethical Guidelines for Research of Assisted Reproductive Medicine that Creates Human Fertilized Embryos" (Public Notice No.2 of MEXT and MHLW in 2010) and "Guidelines on the Handling of Specified Embryos" (Public Notice No.31 of MEXT in 2019.) For research using human ES cells, the government is working to ensure proper implementation based on the "Guidelines on the Derivation of Human Embryonic Stem Cells" (Public Notice of MEXT and MHLW No. 4 of 2019) that was amended in April 2019. Regarding "Ethical Guidelines for Human Genome/Gene Analysis Research" (Public Notice No.1 of MEXT, MHLW and METI of 2013) and "Ethical Guidelines for Medical and Health Research Involving Human Subjects" (Public Notice No. 3 of MEXT and MHLW of 2014) MEXT, MHLW and METI are conducting studies to review the consistency of the guidelines in the light of the progress of

research while ensuring proper implementation of research pertaining to the guidelines.

B. Securing safety in life science

Recombinant DNA technology can result in new combinations of genes that do not exist in nature. Therefore, concerning living organisms obtained through use of the technology, the Act on the Conservation and Sustainable Use of Biological Diversity through Regulations on the Use of Living Modified Organisms (Act No. 97 of 2003) provides regulations necessary for ensuring biodiversity. For gene recombination experiments related to COVID19, in particular, the government is working to establish timeliness and safety in consideration of their importance. In addition, following issuance of the Ministry of Environment's policy on the handling of organisms obtained by genome editing technology in February 2019, relevant ministries and agencies are developing and disseminating a list of matters to pay attention to regarding the handling of such organisms.

C. Efforts for the proper implementation of animal trials

The Act on Welfare and Management of Animals (Act No. 105 of 1973) stipulates that animal trials be conducted in accordance with the 3Rs (Replacement, Reduction and Refinement). Based on this act, the Standards Relating to the Care and Management of Laboratory Animals and Relief of Pain (Standards for Care and Keeping) (Public Notice of the Ministry of the Environment (MOE), No. 88 of 2006) was enacted for animal experiments. Based on these guidelines, MEXT, MHLW and MAFF have implemented similar basic guidelines¹ for research institutes that fall under their jurisdictions, in order to ensure proper care for animal trials.

(2) Efforts for development of systems for artificial intelligence research

The Cabinet Office jointly with relevant ministries and agencies discussed basic principles concerning ethics, etc. which should be considered in AI technologies, and medium- to long-term R&D on AI and their utilization, which are common to industry, academia, private and public sectors, at the Meeting to Discuss Principles of Human-centric AI Society held in April 2018 and the succeeding Meeting on Principles of Human-centric AI society. As a result, the "Principles of Human-centric AI society" was decided by the Meeting to Promote Comprehensive Innovation Strategy in March 2019. In addition, under the framework of the Conference toward AI Network Society established in October 2016, MIC comprehensively studies social, economic, ethical, and legal challenges in promoting AI networking. MIC published the Draft AI R&D Guidelines for International Discussions (2017 Report) in July 2017, which covered matters that AI developers should pay attention to. In August 2019, the ministry published the AI Utilization Guidelines (2019 Report), which described the matters that AI users need to be aware of when they use the technology. Based on these guidelines, the government promotes international discussion on AI at UNESCO², G7, G20, and OECD³.

¹ Basic Guideline for Animal Trials at Research Institutes (Public Notice of MEXT, No. 71 of 2006); Basic Guideline for Animal Trials at Research Institutes Under Jurisdiction of MHLW (Public Notice by the Director of Welfare and Science, MHLW, 2006); and Basic Guideline for Animal Trials at Research Institutes Under Jurisdiction of MAFF (Public Notice of by the Secretary-General of Secretariat of Agriculture, Forestry and Fisheries Research Council, MAFF, 2006).

² United Nations Educational, Scientific and Cultural Organization

³ Organization for Economic Cooperation and Development

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Public Attitudes Regarding Science and Technology

The Fifth Basic Plan states that for science, technology and innovation (STI) to meet social expectation, STI needs to gain the understanding, trust and support of society.

In order to understand the public attitudes (interest, understanding, trust, expectation, anxiety, etc.) regarding STI, the National Institute of Science and Technology Policy (NISTEP) of MEXT has been conducting the internet research project: “Public Attitudes Regarding Science and Technology” since 2009. Concerning interest in science and technology, male respondents have been more likely to answer “I am interested in news and topics related to science and technology” compared with female respondents, since 2009 (Figure 1.) Overall, the number of these respondents has tended to decline in recent years (Figure 1.) The recent survey in March 2019 asked the public image and impression of the super smart society “Society 5.0” that the 5th Basic Plan aims to realize and recognition of new technologies (e.g. IT, AI, robotics.) The result shows that recognition of the Internet of Thing (IoT) increased compared with the 2016 survey regardless of gender and age (Figure 2.)

Internet survey has problems including poor population representativeness, large deviation and double bias¹ of response. Undoubtedly it is qualitatively different from public opinion polling. However, because regular implementation of public opinion polling is not easy in reality, Internet survey is found useful for setting working hypotheses through a prior survey to prepare a certain body of evidence for implementation of public opinion polling. Public Attitudes Regarding Science and Technology has been carried out as an Internet survey from the very start, prioritizing regular implementation and convenience for flexible survey just after an earthquake and other disasters.

Method: Internet research design

- (1) Total number of respondents: N= 3,000
- (2) Age of respondents: 15-69
- (3) Same number of samples for all age groups (from 10s to 60s)

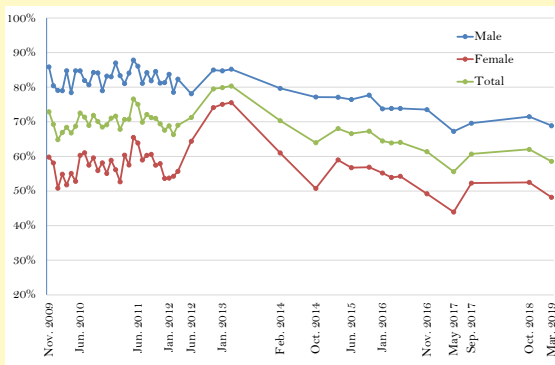


Figure 1 Changes in the percentage of respondents who are interested in news and topics related to science and technology

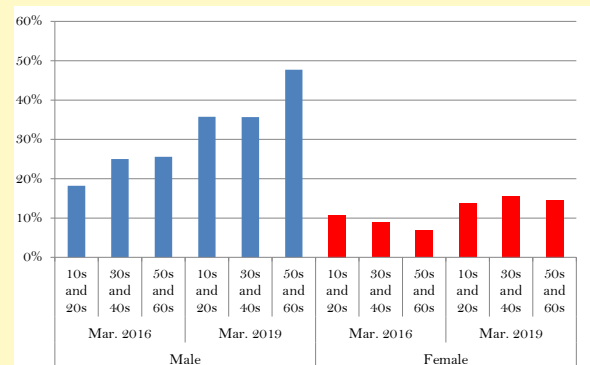


Figure 2 Changes in the percentage of the respondents who know the meaning of Internet of Thing (IoT)

Source: Created based on NISTEP survey material 282 “Public Attitudes Regarding Science and Technology: Society 5.0”

¹ There are bias that arises when respondent population is formed (because respondents are collaborators of the Internet company, it is not necessarily random sampling) and bias of actual respondents (because collaborators of Internet survey choose questionnaires according to their interest, the respondents can be interested in the topic more than other people.)

Section 2 Ensuring Research Integrity

Securing of the integrity of research is essential for researchers to build trusting relationships with various stakeholders of society. Researchers and research institutions including universities need to bear it firmly in mind that tirelessly addressing research misconduct is the way to respond to society's trust in STI and increase STI's driving force.

For promotion of fair research activities, MEXT works to ensure system development and other efforts by research institutes based on the Guidelines for Responding to Misconduct in Research (decision by the Minister of Education, Culture, Sports, Science and Technology on August 26, 2014.) In addition, the ministry has been supporting research ethics education provided by research institutes in cooperation with the Japan Society for the Promotion of the Science, Japan Science and Technology Agency and Japan Agency for Medical Research and Development.

In order to prevent inappropriate use of research funds, MEXT conducts surveys of implementation status based on the Guidelines for Management and Audit of Public Research Funds at Research Institutions (Implementation Standards) (revised on February 18, 2014; Decision of the MEXT Minister) to establish a system for the appropriate use and management of public research funds at research institutions.

In addition, the Ministry of Economy, Trade and Industry (METI) is addressing this issue based on the Guidelines for Responding to Misconduct in Research (revised on January 15, 2015), and the Guidelines for Responding to Misuse of Public Research Funds (revised on January 15, 2015). Other relevant ministries and agencies are also addressing the issue based on their respective guidelines, etc.

Relevant ministries share information on researchers involved in misconduct cases and suspend their access to any competitive research funds provided by ministries in accordance with the Countermeasures against Misconduct in Research Activities by the Competitive Research Fund (revised on June 22, 2017) (agreement in the Liaison Committee of Ministries and Agencies Concerned with Competitive Funding).