Expanding the range of participants and a new role for experts

Interaction between Science, Technology and Society

Report of R&D Focus Area: Science Technology and Humanity

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INTERACTION BETWEEN SCIENCE, TECHNOLOGY AND SOCIETY

Report of R&D Focus Area: Science Technology and Humanity

Research Institute of Science and Technology for Society (RISTEX)
Japan Science and Technology Agency (JST)

Science, Technology and Humanity

Summary

Chapter 1. R&D Program: "Interactions between Science, Technology and Society"

The achievements of science and technology (S&T) now have a large influence on daily life, being widely utilized throughout society. At the same time, S&T has changed under the influence of society. This raises questions about how S&T can generate economic and public values that match demands by our society. In response to this situation, RISTEX conducted a R&D Program, "Interactions between Science, Technology and Society" (FY2007-2012), in the R&D Focus Area "Science, Technology and Humanity".

Program Goals:

1. To create an open network of people involved in dealing with problems that arise between S&T and society, not only drawing from universities and research institutions, but also from political, industrial, legal, administrative and other societal sectors.
2. To assess how and what has changed, what issues have arisen as a result of the interactions of S&T with society, and to produce solid outcomes (i.e. policy proposals, development of methods, system innovations and experimental exercises) which can be implemented into society.

This R&D focus area has been developing a new style of program management, which has been named a 'hands-on' (interactive and collaborative) style. Its key characteristics are (1) maintain collaborative and outcome-oriented relationship between the program managers and project teams; (2) encourage social implementation of R&D results; (3) constructive interaction with, and intervention to project activities, which could even lead to a review of project goals, or a reorganization of the project team; and (4) yielding synergy effects through knowledge/view exchanges among projects. As well as this, through these interventions, program managers can receive feedback from project teams, which could include the finding of new. In this manner, RISTEX has tried a new approach to support R&D in order to solve problems in society.

Chapter 2. Deepening the interactions between S&T and society

The two goals of this program are providing solutions to problems in our society, and addressing issues on the transformations of S&T. Furthermore, we aim for what we call "social implementation" of R&D results, which would apply and extend them to address specific social problems. 'Trans-science' defines fields where scientific questions can be raised, but science cannot provide a full answer on its own. S&T fields that are difficult to implement into society involve trans-scientific issues, and therefore require examination into the interactions between S&T and society.

All 12 projects in this program address a variety of trans-scientific issues including nanotechnology, ICT, medicine, food safety, and global environment. What these projects sought and practiced through their R&D was a "wider participation" and "a new role for experts".

Chapter 3. Results of the R&D Focus Area: Findings through the efforts for social implementation

The practices and results of projects in this R&D Focus Area are quite wide-ranging. For example, with "wider participation", the actors, which include local people, stakeholders, and journalists, it was possible to discuss and address social issues by taking one small step forward from their standpoints, increasing their relation to society. In particular, when citizens participated, they were able to become less dependent on experts.

In regards to "a new role for experts", we found an increasing need for experts to think together with stakeholders and resolve issues on site. At the same time, we realized there was need for a code of conduct for stepping-forward in

order for experts to avoid trampling outside of their specific area of expertise. Another finding was that social literacy in experts improved after participating in a project with citizens on a regular basis.

To summarize, the projects in this program have, by and large, found a wider range of people, and designed 'fields' (such as mechanisms, rules, systems, and space) in which they could work collaboratively towards a solutions. Each project succeeded in gathering participants by respecting individual motivations and providing them with fields customized to suit them. In some cases, continuous collaborations and networks were achieved.

As a result, what respective projects tried to do was to build expertise, validity, legitimacy and trust, all of which have been difficult in the conventional decision-making frameworks with a wide variety of participants. It should be noted here that project members do not need an observer standing 'outside of society, they need a person who is involved.

Chapter 4. Summary and Recommendations

Based upon the results of those 12 projects, we can summarize this program's outcome and recommendations as follows.

1. Making the connection between Science and Technology and Everyday Life

Given the rising complexity and uncertainty in science, technology and society, it is important to involve more people concerned with the issues , and link expert knowledge on science and technology with 'common sense = knowledge in life' in local environments, to ensure our decisions are more effective and open.

The role of universities as a foundation for wider involvement is significant. Universities are required to (1) develop partnerships with firms, governments, non-profit organizations (NPOs) and the general public, and (2) develop human resources capable of trans-disciplinary dialogue and collaboration.

2. Encouraging Experts to take a step forward

There is a need for experts who are able to collaborate with a variety of people by finding solutions to complex and uncertain issues, not staying in their area of expertise, but rather taking a small step forward while duly keeping the limitation of their discipline in mind.

It is necessary to establish institutions which could evaluate and encourage experts to take a step forward.

3. Learning from Pilot Projects on Social Challenges

Wider participation and activities by experts who have taken a step forward is still in its infancy. Therefore, it is necessary to carry out various pilot projects to address social challenges. In particular, we should constantly provide spaces for collaboration between these new experts and diverse stakeholders, as well as anyone concerned with practical issues in our society.

Pilot projects on social challenges have been downplayed to date, and their success is not promised, but we need to embark on them, with a long-term perspective so that we can keep learning from our experiences, including possible failures. Not only universities, but academic societies, industries, and non-profit and non-governmental organizations should also develop new pilot projects to find solutions for public issues.

4. Building up Trust through Continuous Response

All 12 projects in this program involve an element of experimentation. Success of such experimentation largely depends on how trust is created among the participants in a modern society, especially following the 2011 Great East Japan Earthquake (earthquake, tsunami, and nuclear accident.), where the lack of trust in policy-formulation on public problems was often criticized.

Trust is never obtained solely from expert knowledge. Taking into account the complexity and uncertainty associated with social issues, continuous dialogue among a wide range of stakeholders and those people concerned is essential.

Foreword

Yoichiro MURAKAMI　Area Director

The origin of science

Science and technology have become indispensable to today's society. While technology has played a significant role of advancing the world we live in for a long time, only recently has science been used to do the same. It is important to view the two as separate components, which is why they are described as "science and technology", not "science & technology" nor “ST” in this introduction., In its origin, science was never intended to be used to find solutions to society's problems. Since its birth in the 19th century, science was simply a way for scientists to fulfill their own curiosity. In other words, the scientists of the earlier generations had no intention to use their work for society. One could say that scientists had given no thought to producing results for society or asking the public to fund their research. It was not until the 20th century when it became popular for government and private groups to fund scientific research, but even then the purpose was not to invent something useful. It was because science was recognized to be just as widely practiced as art and literature, and it was only expected to support it financially. As an exception, it should be noted that organic chemistry had made a contribution to Industry in the latter half of 19th century to make artificial manure and dyes.

A transformation in Science

Around the time of World War II, things began to change. At the time, organic chemistry was considered to be the first field in science to advance. Around 1935, a chemist and university instructor named Wallace Carothers was invited to join the research and development division at DuPont, where his knowledge and skills were put to use to create something the company had been trying to invent for a long time - a man-made fiber surpassing silk. Carothers did not disappoint, and today he is credited with inventing nylon.

Another much larger scientific project was carried out during the height of the war. This was the Manhattan project. National government recruited researchers specializing in nuclear research, and combined some of the best minds and research in the world at the time to develop a massive war weapon to be used in an attack. By late 1944, US President Franklin D. Roosevelt was confident this project would be a success, and he had asked the team leader Vannevar Bush to think of a way about how government could maintain research of that style once peace arrived. Roosevelt never saw the finished plan as he died in April 1945, but Bush’s report, “Science – the Endless Frontier”, is still regarded as the most fundamental scientific literature about science and technology and national policy today. The institutionalization of the National Science Foundation (NSF) in the United States in 1950 was also a result of this report.

A new relationship between Science and Society

The way in which the national government and industry, two massive organizations that shape society, have freely used the products of science and technology to fulfill their goals is a signature of modern society. It was a time when science had started to really become useful to society, just like technology. As a result, today it has taken on many shapes and forms. First, science and technology have indirect control over human life because life itself, from before birth through to after death, is connected to science and technology. Advances in medicine, such as assisted reproductive technology or

organ transplants would not have been possible without advances in scientific research. As well as medicine, government and industry have found ways to implement research into people's daily lives through communication, recreation, and transportation, all while retaining full control. The average person however, does not always believe that his or her own decisions have determined the way in which their lifestyle has evolved. In fact, it is not an acceptable situation in democratic societies. The issues that surround the future of science and technology have only begun to become clearer in the 21st century.

Who bears what responsibilities

Secondly, in regards to scientific research, particularly as described in the second section, it is evident that some scientists are not used to the idea of society using their research as a service. Becoming more and more involved with society involves, scientific research becomes entangled with social issues such as legal or ethical issues, all of which scientists have not needed to deal with until recently. Similarly, society itself has had little experience with how to deal with such issues. Another unavoidable risk is that if the social service side of science gets too much attention, there will be no room left for more traditional pure science.

Thirdly we need to consider whether it is fair to only keep government and industry as the groups who are allowed to use science or technology. Until recently, there was no bridge connecting science or technology services directly to the user, a member of the general public who desires a particular lifestyle. But on a local level, it is more than possible to picture this happening. How to make this a reality is a new issue that needs to be addressed.

Who participates and who takes responsibility

In other words, the aim of this program has been to encourage collaborations between a number of different sectors of the public in order to find ways in which people in the future can address issues on both the science and technology side, and the society side. Today, with the end of this program in sight, it would be difficult to say we deserve to pat ourselves on the back for all the work we have done to fulfill our goal. However, we can confidently say that the time and effort spent by the people involved in this program deserve credit, and that through it all; our activities have been a wake up call for some parts of society.

About this report

This report describes the results from the 12 projects chosen for this program. Through the description of projects, the report also gives real world accounts on the theoretical structure concerning the relationship between science and society, the current situation and ideal situation in regards to research as a way to solve social issues, and issues and challenges about implementing research into society. We hope this report can be used as both a positive and negative resource for not only politicians and public administrators facing similar problems, but also for academics interested in the area, and people who are currently going through these problems.

We also hope that members of the media can come to understand these issues, and take them into consideration when reporting on them in the future. For those members of the public and young people, a website is currently being constructed which will include easier to follow explanations of the report（http://www.ristex.jp/science/）.

Either way, we hope this document will not be filed away as a ‘report’. If it can be of some use to people in the future, we believe it would have served its purpose.

Content

Column Content

Chapter 1：

The ‘Interactions between Science & Technology and Society’ Program

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◆ Program Goals

Science and technology (S&T) exerts a tremendous force in the entirety of knowledge. As a result, the human environment today is filled with man-made objects. Human action is both aided and limited by such man-made objects, and we are approaching a condition in which the entirety of human life, from birth to death, is subject to artificial processes. One might even say that many of the things that used be bound by nature are now gradually becoming subject to human will. Yet despite our science and technology-oriented society, human behaviour, the principles and codes of conduct that govern it, and our social systems, have not changed greatly from when they were bound by nature.

As the social role of science and technology becomes greater, there is a greater demand for normative research on human beings, lifestyle, and society.

Science and technology achievements are spread out through modern society, and have a profound influence on everyday life. It is important to have a clear understanding of the interaction between S&T and society, since the next issue will be to utilize both science and society in a balanced way, or let each transform itself. Active participation of everyone involved, both from science and society, are essential in addressing these issues, but we must first decide who these people are exactly. One arrangement could be to have science and technology experts to represent science, while society would be represented by government and industry officials from sectors where there are strong connections between S&T and society. Finally, members of the public, who are primarily non-specialists in science and technology (i.e., citizens and consumers) would also be present. It is also important to acknowledge the media as an influential participant linking these individuals together. To resolve the serious issues between S&T and society, it is necessary to clarify who should participate and in what role, as well as the types of methods and systems that would be used to find solutions.

A particularly pressing issue is how appropriate assessments and decision-making will be made in regards to research and development in science and technology in the future, and how these results would be implemented by society. Another significant issue is how science and technology knowledge will be used in problem-solving processes for social and political issues.

While science and technology become increasingly influenced by society itself, it is necessary to address issues about how it will create things beneficial to the economy and the public, all while maintaining its intellectual and cultural values from the 19th century.

Based on this awareness, RISTEX has launched the 'Interactions between Science & Technology and Society,' an R&D focus area to study the various issues of S&T and Humanity, focusing on the theme of interactions between science & technology and society.

Program Goals:

1. To create an open network of people involved in dealing with problems that arise between Science & Technology and society, not only drawing from universities and research institutions but also from political, industrial, legal, administrative and other societal sectors.
2. To assess how and what has changed and what issues have arisen as the result of the interactions of Science & Technology with society, and to produce possible outcomes (i.e. policy proposals, development of methods, system innovations and experimental exercises) which can be implemented in society.

◆ Program Objectives

The most important aspect of the 'Interactions between Science & Technology and Society' program is its focus on resolving social problems that arise between S&T and society. This does not mean finding solutions to specific social problems, but rather seeks to establish methods and systems necessary to resolve such problems. In particular, the R&D focus area's objective is to create components to fill in the blank areas of public communication regarding social problems that arise between S&T and society — dialogue (deliberation), cooperation, and organizational foundations (places). Furthermore, the program is based on the progression from research and development to 'social implementation in order to resolve social problems'.

Another major distinguishing characteristic of this R&D focus area is that it carries out a different style of research compared to academic research conducted at universities and research institutes. Because science and technology has become more advanced and complicated, the R&D projects selected for this program address problems that cannot be resolved by traditional disciplines. We looked primarily for projects involving collaboration between different fields, allowing various methods to be used in its research. In other words, the R&D focus area targets issues that have, for example, had difficulty obtaining funding or other sorts of research grants within existing academic research systems, in hope that it will pave a way for research and development in areas concerning the interactions between S&T and society.

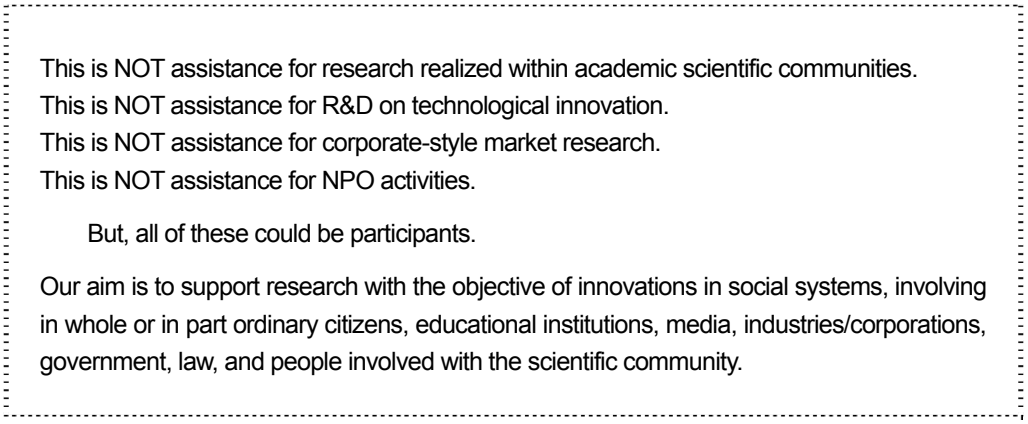

Fig. 1: Program concept and main points in the selection of R&D projects

The following 12 projects were selected based on the information above about issues to be addressed.

Table 1: R&D Research Project

	Project	Project Director *		Length
FY2007	The Nagahama Rules for Genome Epidemiology Studies Open to the Community	Keiko AKASHI	Section sub-leader, Nagahama City Health and Welfare Division Health Promotion Section	5yrs
	Innovation and Institutionalization of Technology Assessment in Japan: Dealing with Nanotechnologies	Tatsujiro SUZUKI** Hideaki SHIROYAMA	Vice-Chairman, Japan Atomic Energy Commission Professor, Graduate School of Public Policy, The University of Tokyo	3.5yrs
	Development of a Sustainable Community Management System Introducing Energy Conversion Technology for Forest Resources	Seigo NASU	Professor, Kochi University of Technology Research Center for Social Management/ Director School of Management	3.5yrs
	Research Project on the Deliberation and Cooperation between Citizens and Scientists (DeCoCiS)	Hideyuki HIRAKAWA	Associate Professor, Osaka University Center for the Study of Communication-Design (CSCD)	4.5yrs
FY2008	Construction of a Pragmatic Scientist Community Contributing to the Stakeholder-driven Management of the Local Environment	Tetsu SATO	Professor, Research Department, Research Institute for Humanity and Nature	4yrs
	Promotion of Dialogue for Policy Making : Case of the Long-term Significant Reduction in Green House Gases Emissions	Masaharu YAGISHITA	Professor, Graduate Division of Global Environmental Studies, Sophia University	3.5yrs
	Establishment of the Social System for the Healthy Coastal Sea Environment (Creation of "Sato-umi")	Tetsuo YANAGI	Professor, Research Institute for Applied Mechanics, Kyushu University	3.5yrs
	Development of Medical Care Based on Convinced Validities from Multiple Viewpoints – Clinical Assessment through Integrated Application of Ubiquitous Vision and Conversation Analysis in a Field of Tertiary Acute Care	Tetsuo YUKIOKA	Professor and Chairman, Department of Emergency and Critical Care Medicine, Tokyo Medical University	4yrs
FY2009	Remodeling Interactive Risk Communication based on Actor' s Spontaneous Cooperation (RIRiC)	Riichiro IIZAWA	Professor, Research Faculty of Agriculture, Hokkaido University	3yrs
	Autism-friendly Society : A Search for Reconciling Coexistence with and Cure of Autism	Manabu OI	Professor, School of Teacher Education, Kanazawa University	3yrs
	Establishment of the "Science Media Centre of Japan" as an Information Hub for Science and Technology	Shiro SEGAWA	Professor, Faculty of Political Science and Economics, Waseda University	3yrs
	Legal Decision-making under Scientific Uncertainty	Tamiko NAKAMURA	Lawyer, Lybra Law Office	3yrs

* As of September 2012

** Tatsujiro SUZUKI (Tokyo University) was replaced as research representative in January 2010 following his appointment as a standing member of the Japan Atomic Energy Commission.

◆ A New Approach to Research Administration－'Hands-on' R&D Management

The aim of the research assistance currently provided by the Research Institute of Science and Technology for Society (RISTEX) is to provide a wide range of participants with the opportunity to work together to find solutions to social and public problems various regions and communities face, and for the swift 'social implementation' of their results. This framework for research and development grant is a novel approach, even by global standards. It incorporates aspects of aiming to resolve social issues, uses knowledge from both the sciences and the humanities, encourages active involvement from not only researchers but of all stakeholders, and focuses on the social implementation of the results. The Japanese government finalized its 4th Science and Technology Basic Policy in August 2011. The latest plan acknowledges that previous policies 'had not necessarily utilized [scientific knowledge] to resolve social problems effectively,' and makes a radical shift from policies that emphasized individual field, to a problem solving approach. In that respect, RISTEX's efforts to apply 'science for the benefit of society' into the real world were already set before this policy change.

RISTEX shifted from the conventional 'direct control, budget allocation' style of research grants, to an 'open application and intermediary' policy in fiscal 2007. The 'direct control, budget allocation' approach incorporated academic discipline-oriented thinking into its management system. For example, academic conferences without any presentations were not considered for participation, and there was no framework that allowed expenditures to be allocated in a way that actively encouraged researchers to participate in scientific societies outside their fields of specialization. By contrast, the 'open application and intermediary' approach seeks to encourage cross-discipline research for problem-solving. Furthermore, not only has the management structure for project assistance been revised, the research areas it supports are now required to produce something with social value.

The 'Interactions between Science & Technology and Society' program on S&T and Humanity was the first R&D focus area to promote research and development under this new methodology. Without a user manual or even any particular expertise, repeated trial and error enabled RISTEX to determine the ideal form for 'open application and intermediary' assistance management.

The program management cultivated in this R&D focus area could be called a 'hands-on' (interactive and collaborative) style, different from 'guidance' or 'aid'. The characteristics of hands-on style management include the following:

- Selecting projects that showed an understanding of the program goals, and which had clear objectives that include willingness and a plan for social implementation.
- Rather than dividing responsibilities between the researchers and clients (which has the possibility of a dichotomy between the two), the project and management sides share the same goals and concept for the R&D focus area, and are conscious of creating value (resolving problems) through collaboration.
- Because management also receives constant feedback on the results of these activities, management itself becomes a collaborative activity.
- Unlike ordinary research grant where there is usually no interference in individual research activities, here, management acts as a middle person that actively interacts and collaborates. Management also provides advice on the project if necessary, such as altering R&D goals or the research structure.
- Through proactive interaction and collaboration on projects, management supports individual projects, promotes exchanges between certain projects, and has a synergistic effect.
- Overall, the program focuses on developing results to resolve issues. Program-wide meetings, site visits and other activities are carried out to encourage participation and contribution on the project side.
- Depending on the social needs and circumstances, management is ready to consider a range of responses if the situation demands it. This could include changes in the scope of activities and budgetary provision for each project.

Chapter 2：

Deepening the Relationship between Science & Technology and Society

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Various efforts have been made in the research program of S&T and Humanity to solve the problems that arise between S&T and society. This has now become an issue that should rightly be addressed at state level. In fact, Chapter 5 of Japan's 4th Science and Technology Basic Policy, approved by the cabinet in August 2011, is entitled 'Development of policies to be created and promoted together with society,' and encourages promoting public involvement in policy planning and implementation in order to strengthen the relationship between society and S&T and Innovation (STI). The Basic Policy Implementation Committee of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), which is putting this policy into effect, has been holding debates on the fundamental issues identified by the Council for Science and Technology, as well as lessons learned from the Great East Japan Earthquake. From this list of issues, the most significant ones that this program addresses are as follows:

- Due to the lack of talk between the general public and scientific organizations, do not researchers and others involved fully recognize the demands of society? Do we need researchers to not just widen their scientific learning and advance S&T, but should they also use various means to learn from society, and improve their social literacy.
- Is it necessary to provide students and young researchers with measures to help them acquire various social perspectives and ideas?
- In setting research topics, is it necessary to improve the wide and proactive collaboration between users, scientists in application fields, humanists, sociologists and others experts so that they can uncover social needs more effectively, and properly reflect those needs in their research topics.
- Is it necessary to clarify the relationship between expert advice regarding science and technology, and government decision-making? Is it important to invite opinions of scientists from wider areas? But in cases where scientists hold conflicting views, we should establish a process where all of the policy options are collected, displayed, and then used to determine the final policy.

Source: 'Basic Points at Issue' (38th) Council for Science and Technology, 29 February 2012

The two objectives of this R&D focus area are to resolve social problems, and respond to the issues involved in the transformation of science and technology. A further aim is the social implementation of the results from research and development. But what is 'social implementation'? The definition used by RISTEX is 'measures that utilize and develop the results from research and development into society to resolve specific issues in society'. The R&D results in health care, IT and food safety are strongly needed but are not always easy to implement. Problems that can be asked of science but cannot be solved entirely by science are called 'trans-scientific issues' (Weinberg, A.1972). To deal with these issues we need to reconsider the nature of relation between S&T and society.

The 12 projects that were selected for this R&D focus area covered a wide variety of research areas, but they all shared a cross-sectional and common awareness. That awareness was that in each of these areas, science and technology had not fully responded to the demands and expectations of society, and to overcome this problem it would be necessary to expand the range of participants, and influence experts to play a new role. Through trial and error they are now exploring unique ways to proceed.

Let us examine these two points in more detail.

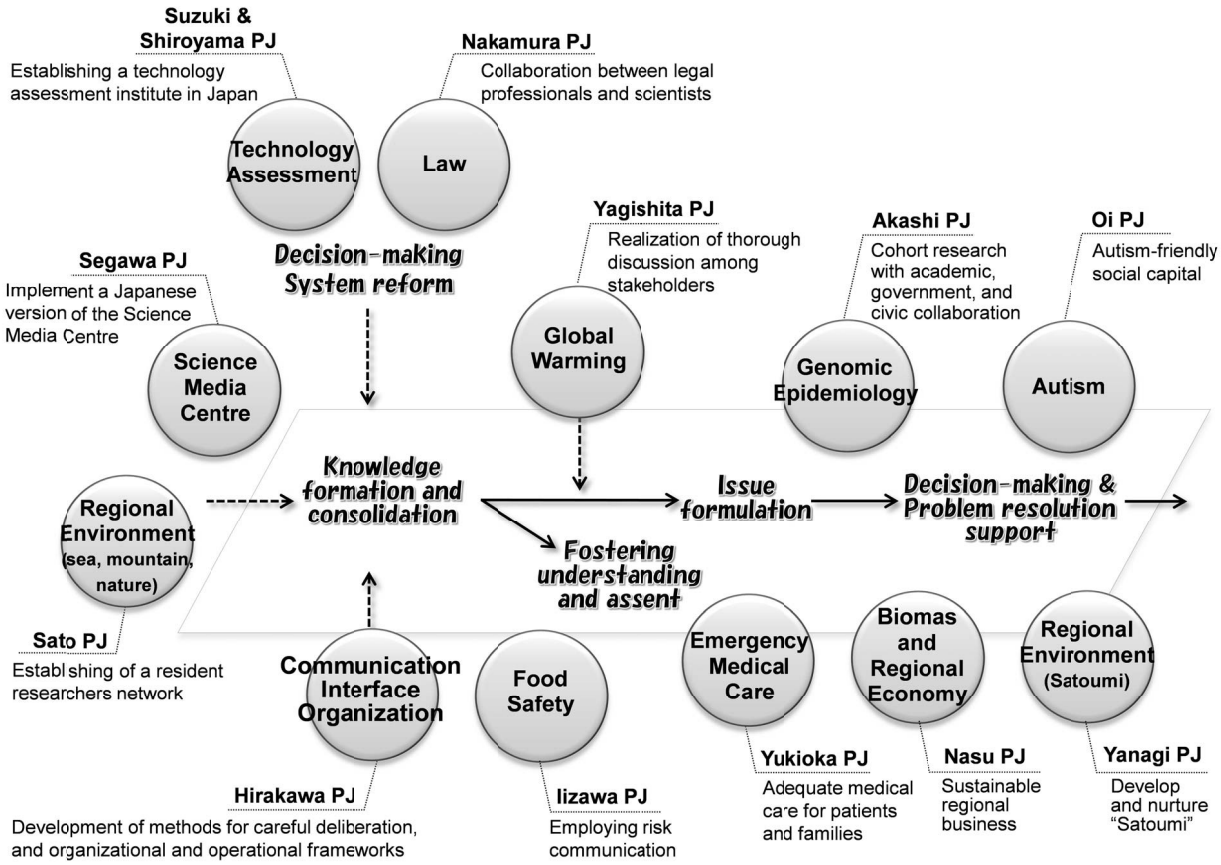


Fig. 2: Examples of the problems each project seeks to resolve, and their relationship with the decision-making system

1. Expanding the range of participants

In the course of deliberations and decision-making on specific topics — not only for science and technology — inviting non-expert stakeholders and ordinary citizens is often called 'participation'. However, using the term 'participation' runs the risk of overemphasizing the distinction between experts and non-experts, so in this context we use the term 'expanding the range of participants', and bear in mind the diversity of people participating in the deliberations and decision-making process.

One well-known example of a participation method is voting. This is the representative democracy system through which assembly members are selected. However, it is unclear what sort of beliefs individual parties and politicians have about S&T and society issues, and through their votes, citizens have no other way than to express their opinion on the policy packages political parties and politicians put forward. Public comments and town meetings provide citizens with opportunities to voice their opinions regarding specific topics or individual points under debate. However, these systems merely measure individual intentions, and are not recognized either as a means or opening for involvement in policy formation or issue resolution. Although people in organizations such as patient advocacy groups and environmental NGOs are able to participate in government councils as non-expert members, not everyone who wants to participate is able to, and the selection of participants is usually left to the administrative authorities.

But why is expanding the range of participants important in the first place? The reasons are that in a democratic society, participation of a diverse range of participants should be encouraged, the legitimacy of the decision-making process is achieved through participation, and a diverse range of participants enhances the validity of the decision because it incorporates implicit, local knowledge to which experts would not have access. However, bringing together a diverse range of participants also incurs many costs in terms of personnel, money, and time, and raises the question of whether it would produce an appropriate result. Furthermore, participants often have limited scientific literacy or interest in the issue, causing them to express opinions unrelated to the debate. Even if we consider broad participation in all manner of issues regarding science and society as compulsory, simply expanding the range of participants is not considered effective. However, gathering and incorporating a wide range of opinions while the issue is still ambiguous, and it is still at the stage when little progress has been made in terms of science and technology, social understanding, or policy development (upstream involvement), could ultimately clarify the issue, and lower the costs for its resolution. At such an upset real stage, this point, uncertainty regarding the social impact is still high since scientific knowledge is still limited, so collecting a diverse range of knowledge by expanding the range of participants would be appropriate.

Involvement during such undergoing processes helps to visualize the problem and provides a framework for social discussion, and later on it can also contribute to supporting the actual decision-making as a reference for policymaking. However, as the process nears the stage of policy formation and implementation downstream, options for applying science and technology to policy become limited, and altering the direction through participation and involvement becomes difficult because deliberations based on advanced, specialized information and knowledge become necessary, (for example, Japan's nuclear policy before the March 11 earthquake disaster). At this stage, it is difficult to come up with an effective counterargument to the criticism and suspicion that 'participation' is merely a sophisticated way for decision-makers to allow people to let off steam.

An effective response would require not only a detailed explanation for why participation and expanding the range of participants is important in the first place, but also some examples of good practice that such participation had a positive effect on actual societies. The benefits include not only the direct results of debate and decision-making through expansion of the range of participants, but also the indirect, long-term social and structural changes. The very act of establishing a participation forum of a diverse range of participants and holding discussions in the first place provides awareness and learning for the participants.

2. New role for experts

Expansion in the range of participants is one necessity; another is that the role of experts and the definition of an expert also need to change. Until recently, science and technology had been represented by experts such as scientists, engineers, and government policymakers. However, science and technology today has developed strong connections with society in a broad range of fields such as healthcare, environment, energy, and telecommunications that experts in science and technology can no longer avoid the social issues associated with their work. Furthermore, as science and technology has become bigger and increasingly complicated, the positive and negative effects it will have on society in the future are unpredictable and uncertain, meaning that a growing number of issues cannot be decided by scientific experts and policy experts alone. Larger public investment in science and technology brings social benefits, but it also increases risk, and it is necessary for society as a whole to monitor the situation and consider the state of science and technology in the future. Accordingly, in advanced countries there is a growing trend for discussion and decision-making on issues regarding science and technology to include a broad range of participants, not only experts such as scientists or policymakers. The

Japanese government has also shown a greater commitment to such a move in recent years, as demonstrated by its Science and Technology Basic Policy development and white paper on science and technology. A new role for scientists and policymakers is now sought after.

◆ Science and Technology Experts: Step forward over the Edge

Let us first consider the experts in science and technology. Until recently, experts were only expected to provide society with specialized information and knowledge, or to provide it with things such as technology, products, and methodologies. However, now their responsibility has grown to include interacting with a diverse range of participants, collaborating with different areas of study, and even being involved in local and national policies. Therefore, change is necessary. For experts to take on this new role, they need to step forward over conventional domains. We call this 'stepping forward over the edge'.

Experts are required to step forward over the following three 'edges' in accordance with the situation or progress stage.

(1) The edge with other disciplines: Familiaring with the inter-disciplinary approach that links academic disciplines to each other. The interchange of knowledge with participants who have different expertise or interests breaks down the conventional domains of academic disciplines in which people tend to become entrenched, and allows new intellectual value and innovation to be generated.

(2) The edge with location: Possess the practical workability that connects research to problem-solving. 'Practical' in this circumstance is being involved in the activities that resolve social problems that take place outside of universities and research institutions. Such involvement would adapt the knowledge experts possess into something useful in specific situations.

(3) The edge with society: Possess the social literacy that connects research to society. It is no longer considered acceptable for experts who conduct publicly-funded research to simply explain their research to other experts in their field (their peers). In order to fulfil their responsibility of explaining their research and why they are doing it, experts need to understand the people and society as addressees of the research.

Experts in this new role will not only include conventional academic experts, but will also encompass the practical and active aspects broadly so they are categorized into the following three types:

- **Academic experts:** Those who understand the type of knowledge frameworks that regulate their activities, and who act with an awareness of their responsibility for the quality of knowledge.
- **Practical experts:** Those with an interest in how supply and demands for expert knowledge are linked to society, and who act with an awareness of their responsibility for this connection.
- **Active experts:** Those with an interest in strategies that make their ideals real, and who mobilize various intellectual and human resources based on that strategy.

◆ Policy Experts: Maintain a Suitable Distance

Then what about the policy experts who plan and implement policies? Traditionally, policy planners and implementers have justified their actions by using the information and knowledge provided by particular experts in science and technology. But because science and technology and its social impacts are more complicated and uncertain than before,

expert knowledge can no longer be regarded as the absolutely correct answer. It is necessary to make a comprehensive evaluation of the situation by expanding the range of participants, and then making the appropriate decisions. Policy planners and implementers are also required to act as participants, offering their own views and expert knowledge regarding social problems. The thing to be careful with is the interest in the issue the policy planners and implementers have when they are invited to voice their opinion about how to use the research results. It is important to maintain appropriate distance between the experts who produce the knowledge (scientists and other professionals), and the experts who use the knowledge (policy planners and implementers). There must be a degree of mutual independence in their relationship. Without this, it is easy to imagine a world where policy planners and implementers use scientists and the knowledge scientists provide for their own purposes, resulting in a mutually back scratching relationship between science and policy. This would slash any opportunity to solve social problems, and result in a major public distrust of society.

Accordingly, the new role for policy planners and implementers would be to join the diverse range of participants in the process, and declare their views and interests in the issue as a participant. At the same time they should be fully aware of the authority that comes with their decision-making role, and assess the intellectual contributions from the participants in a balanced way. To fulfil this role, it is important to ensure that these men and women have the opportunity to express themselves away from government or other institutional frameworks. It would also be important to arrange occasions for participation and debate in such a way that an outstanding authority imbalance does not come up among the participants.

Chapter 3： Results in the R&D Focus Area

– Findings through Efforts at Social Implementation

Chapter 3： Results in the R&D Focus Area – Findings through Efforts at Social Implementation

In the previous chapter, ‘wider participation’ and ‘a new role for experts’ were noted as common issues throughout the R&D focus area. This chapter presents specific results in the focus area relating to these issues giving actual examples from each project. (Hereafter, the individual projects are referred to using the format, ‘Lead Researcher Name PJ’)

1. The Power to Participate

There must be various conditions that draw diverse participants. Engaging in daily work involves detailed knowledge particular to the work and devotion to a particular task, and it also means managing work time with a busy private life. So for someone to step out into public participation requires some extra encouragement. The focus area research conducted pilot projects aim towards wider public participation. The items learned are summarised as follows.

◆ Taking a Small Step Out

To date, decision making in society has mostly been conducted by national and local government body decision makers, and by specialists who provide expert knowledge for them. Recently, however, given the complexity and uncertainty of science and technology, and of society, there has been a growing trend toward expanding the range of participants to make decision making more effective and more public. Those new participants cannot gain a sense of public service immediately. First, they need to take a small step out from their regular work roles and positions, become aware of their involvement in society, and then begin to take part in small activities for society. They will not always be called on to have the courage and resolution to take a big step out. In some cases, there may be an opportunity in their regular work where it is important to take a small step outwards. Those experts who have stepped out can bring the knowledge and experience they have gained home to their regular work, making their colleagues more aware, and giving them the energy to also step out.

In the focus area, the Yagishita PJ, for example, showed that even though there were sharp differences of opinion at the beginning, extensive dialogue with the participation of diverse experts and stakeholders helped change attitudes toward building common ground in contributing to national decision-making to greatly reduce long-term greenhouse gas emissions. Such participation is also happening at the regional level. In the Nasu PJ, which was aimed at building an autonomous sustainable regional society management system, farmers and forestry workers had originally become involved because they were looking for business merits, but soon afterwards they came to consider other industries, regional government bodies, and even approaches to regional promotion strategy, leading to an increase in the autonomous strength of the region. In the Segawa PJ, science journalists who received information from the Science Media Centre did not only get help with writing articles with scientifically accurate expressions and factual information, but they could also write articles in a balanced manner about what was currently understood, what might occur, and the varied opinions experts had on these matters.

Such experiments question the existing roles of government and journalists, and together with a wide range of participants provides expertise, validity, legitimacy and trust that are difficult to incorporate under the conventional decision-making framework.

Column 1 Proposal of a Methodology to Establish Thorough Discussions among Stakeholders [Yagishita PJ]

The Low-Carbon Society Dialogue Formation Forum, a gathering of 28 stakeholders strongly involved with climate change issues met 17 times for repeated discussions over a period of two years starting from 2009 to address the two themes of 'energy supply' and 'lifestyle' toward creating a low-carbon society (greatly reducing greenhouse gas emissions by 2050). A venue where stakeholders with sharply contrasting viewpoints could come and confirm each other's opinions and hold detailed discussions had not previously existed in Japanese society.

To establish thorough discussions among stakeholders, the first key point had been to obtain stakeholder participation. The requirements for the organiser were to show no particular opinion regarding the theme, maintain equal relations and trust with all of the stakeholders, be able to coordinate with the scientific community in regards to the theme, and be able to transmit information to politicians, government and society. The significance of the requirements became clear during the forum.

Another point was that it was undesirable for the organiser to rely on personal connections when selecting stakeholders. The selection process of the sectors, industries, fields, organisations, and groups required that the discussions be entirely open, and the final recommendation of organisation representatives should be left to the discretion of each organisation. This process had boosted trust.

Next, information and comments from experts are essential in achieving high-quality discussions. This is a sensitive process, subject to criticism as being 'biased' or against 'scholars getting paid by the government'. Therefore, providing carefully selected, neutral, and fair information is important. But what is even more important is securing the range (diversity) of information, disclosing information about collection processes and analysis methods, and if experts directly participate in the discussion, guaranteeing neutrality and fairness that satisfies the stakeholders. For example, by having multiple experts with different viewpoints provided information fairly or presented information from multiple perspectives in the form of scenarios, or in some other manner that made comparisons possible.

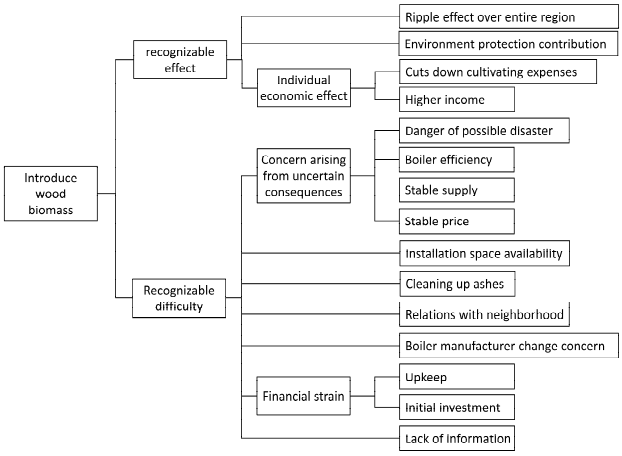
Establishing thorough discussions among stakeholders is not a simple matter. Last minute decisions to focus solely on difference of opinions can result in hardened attitudes, and the same points tend to be made over and over again. The appropriate method is to first build up trust by constantly confirming what areas stakeholders agree upon, what is commonly understood, and then approach the core dispute. To those ends, we propose the methodology (prototype) of advancing discussions in three stages. Ⅰ. deliberations as stakeholders, Ⅱ. formation of themes, and Ⅲ. thorough discussions on themes. Then, advance thorough discussions on themes in these three steps: (1) share information infrastructure, (2) confirm points of discussion and narrow down points of dispute, and (3) thoroughly discuss the points of dispute.

Today's society demands unlimited disclosure and transparency, but applying this directly to stakeholder-type conferences will result in hardened debates and a structure which highlights conflicts of opinions. To establish thorough discussions with honest opinions from stakeholders, it is highly effective to establish approaches that help go beyond superficial responses, such as the use of Chatham House Rules.

"Promotion of Dialogue for Policy Making： Case of the Long-term Significant Reduction in Green House Gases Emissions" Masaharu YAGISHITA (Project Director)

Column 2 The Importance of understanding Clusters connecting Organisations (People) – Management Science for Regions [Nasu PJ]

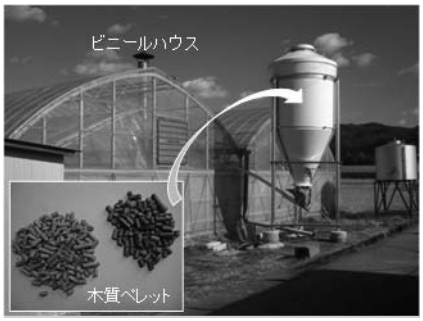
When the research began, none of us could imagine how farmers, companies, the government and researchers could relate to one other. The technology development that interested local enterprises came up with, which used forest resources for regional revitalisation, created ties among diverse stakeholders, and formed regional business and industry clusters. I gained many things from the regional revitalisation mechanism seen from my different perspectives as a researcher, a local referee, and also an investor involved with business creation. Simply put, this game was for real. In the process of researching regional revitalisation, I found myself in an environment that heightened my nerves in a way that would not have been possible if I had remained as just a researcher. I learned it is essential to understand the diverse psychological, economic, and sociological aspects of business creation, and to grasp these through the integration of disciplines. I also learned that universities and researchers have a very large role to play in regional revitalisation because the individual stakeholders do not actually have a bird's-eye view of the entire picture, even under business models where all of the stakeholders pursue their own profits and stability. The process where the stabilization of relations among organizations (people) advances is by building up mutual understanding between the government, companies and farmers.



■Understanding the participating farmers' initial understanding

Accumulating knowledge and experience stabilizes stakeholder clusters with different understandings, interests and levels of knowledge, and also stabilizes business. For one person to create a business in the region, it is necessary to consider stabilizing these types of clusters connecting industries or organizations (people). I wonder if the government is aware of the similarity businesses have internally in building up regional industrial clusters. If it is, I think regional industrial policy and administrative guidance has to change fundamentally.

What I can offer as a person who conducted research from the three standpoints, a regional referee, a stakeholder and a researcher, is to present this phenomenon and process as a universal model, a 'management science for regions', and also to inform a greater number of parties engaged in regional revitalisation.



■Wooden pellets

■Dialogue among government, farmers and citizens

"Development of a Sustainable Community Management System Introducing Energy Conversion Technology for Forest Resources" Seigo NASU (Project Director)

◆ Fostering Citizen Power

Of course, average citizens can also be participants who take a step outside to bear some public responsibility. It has been said that the average citizen has little or no interest and understanding of issues concerning science and technology, and that it is difficult to get them involved. However, focus area projects were opportunities to gain new participation, and focused on the general public. For example, the Hirakawa PJ researched people, who on average, did not have much interest in science and technology, and addressed the theme of regenerative medicine and discussed what society should examine in this area in the future. The Yanagi PJ studied the formation of satoumi coastal areas and made use of the tacit knowledge acquired and practiced in the daily life of local residents. It expanded participation from fishermen to city residents who account for the majority of the population in an effort to boost understanding and awareness. The Oi PJ aimed at creating an autism friendly society by revisiting autism as a local social problem, and held repeated participatory activities not only for stakeholders, but also for locals in order to lead to new knowledge and awareness. The Hirakawa PJ and the Iizawa PJ noted that such knowledge rooted in regional areas and local lifestyles held by local residents should be called 'living knowledge' and 'local knowledge', which have different values from scientific knowledge. A wide range of stakeholders and the general public use this common understanding in society and provide important knowledge for social issues. At the same time, their enthusiasm grows, and promoting social learning can encourage 'citizen power' to address social problems.

Citizen power is the ability to separate one's own private interests from working towards forming a better society, use common sense based on one's social and living experience, participate in public debate and dialogue, and contribute to the resolution of social problems. It is important to continuously want to learn more amid such public discussions and debates.

Even people who are not directly involved with a project can develop citizen power. Examples include participating in events sponsored by the project or the R&D focus area, and reading published reports and articles on their own project website [Akashi PJ, Sato PJ and Segawa PJ]. The focus area developed were wide-ranging transmissions to society in individual R&D and the focus area as a whole, and have boosted recognition and interest among people.

◆ Manifesting Counteracting Power

When citizen power encourages public awareness and promotes social learning, it becomes possible for the general public to participate in social issue framing, decision making, and to actually exert some impact on the public sphere. However, the existing structure of specialists with expert knowledge, and practitioners with de facto decision-making power is hard to break down, highly prestigious, and citizens have often a strong sense of dependence on this structure. To enable a wide range of stakeholders and the general public to keep their sense of responsibility, the important thing is not to completely demolish this inclination to authority and establish citizen control in its place, but rather to pursue the possibility of improving the existing structure for framing issues and making decisions by grouping together the knowledge and integrity of the public in a way that can act as a counteracting power so we can escape from the structure of dependence on experts.

In the focus area, for example, the Iizawa PJ with theme of genetically modified organisms used random sampling to elicit public participation. With a participation rate much higher than expected, the project not only illustrated the positive stance toward participation among the general public, but the quality of the knowledge gained from the public was also high, and by no means inferior to the discussions of experts alone. The Akashi PJ on genome epidemiology research drew in diverse participants. Local government bodies, medical practitioners, and also members of the public who were participating in the research, teamed up with the researchers to establish a foundation for smoothly

implementing cohort research well into the future. The Oi PJ aimed at creating an autism-friendly society was an attempt to invite autistic patients, their families and the general public to think together to come up with social guidelines for autism rather than the criteria originally set by experts.

Column 3 A Real Sense of 'Connection Power' – Building an Autism-friendly Town [Oi PJ]

'Citizens Deliberations 2012 Kanazawa' was held to consider the pros and cons of the early detection of autism. How do you give shape to something vague and uncertain? Above all, where are the people who will help with this enigma? Until the Citizens Deliberations were held, I was sometimes, no often, at my wit's end.

The Citizen's Deliberations aimed at involving diverse participants including autism sufferers, their families and also people not directly concerned, to think about autism. To those ends, various spaces were arranged for citizens to talk together including regular monthly science cafes, traveling cafes at kindergartens and neighbourhood associations, and bookstore cafes to consider autism using books. Participants gathered in these events became the core for launching the 'Association to Consider the Future of Autism' and then for the establishment of the 'Citizens Group Future of Autism Council', which conducts its own activities. Having advanced this far, however, I had my doubts and thought the participation by stakeholders might have already reached saturation, and that it would be difficult to hold 'Citizens Deliberations 2012 Kanazawa' and spread interest among people who have no direct ties to autism

■Bookstore cafe

When the Citizens Deliberations actually took place, however, it drew diverse participants with a balance of men and women and different age groups ranging from autism suffers and related parties to others who have no direct ties to autism and were attending such an event for the first time. About 30 participants exchanged opinions freely over two days. This quietly awed me.
Why was I convinced it would be difficult to attract diverse participants? This project was aimed at constructing a 'regional autism coexistence and treatment community' in the mid-scale metropolitan area Kanazawa, which has basic social infrastructure, and I assumed that 'connections' among the Kanazawa residents were a prerequisite. In fact, interest in the autism issue spread from person to person, making the Citizens Deliberations appear more interesting, and the number of participants grew.

Yet I had lived in large metropolitan areas, where there are weak connections (perhaps no connections?) among residents, for many years, and while emphasizing connections among people, I did not feel that these were real. I think that is the most appropriate answer.

I was surprised at how strong the ties among the people of Kanazawa were while holding the Citizens Deliberations, and moved at how these were utilized in the project.
The conclusions of the Citizens Deliberations were compiled as proposals and submitted to the City of Kanazawa. There are great expectations for the future of proposals that are based on connections among people.

"Autism-friendly Society : A Search for Reconciling Coexistence with and Cure of Autism"
Tadashi KUDO (Project Member)

Column 4 Using Diverse Citizen Power – From the Frontlines of Genome Epidemiology Research [Akashi PJ]

Citizen participation in the Nagahama Cohort Project – Genome Epidemiology Research began from the participation of a few citizens who later became members of a citizens committee to draft rules. This participation changed dynamically and the number of citizens involved grew greatly with the provision of research materials, establishment of an NPO, and the promotion of sound urban development associated with genome epidemiology research. Of course, there were different levels of involvement. The participants who were strongly involved took the initiative in organizing various events, including a health and wellness festival and a zero order cafe, which brought the citizens and researchers closer together. As a result, which was only natural, the local government and the researchers themselves could not ignore the citizens' expectations. While the local government and researchers originally started the project, the appearance of citizens as a strong third party created a triangle around genome epidemiology research, and this also changed the power relationship. Efforts are now proceeding through trial and error to see how this triangle will settle.

■Delivery 0 order science cafe

A questionnaire to measure the changes in citizens overall found an increased recognition of the words gene and genome, as well as a rise in the number of people who thought that the use of genetic information would be useful for the diagnosis and treatment of disease. However, the number of people who were unsure about ethical questions (worries about privacy issues and discrimination), and who answered 'uncertain' rather than yes or no had also increased. While there may be different ways of interpreting this, we viewed this positively as a sign that the number of people thinking deeply to themselves about various issues related to genome epidemiology research is on the rise. It is the increase in the number of such people that will make it possible to peacefully examine issues requiring difficult social judgments. We are proud that this project helped create such a society by establishing a framework for the active participation of citizens in research issues.

This was the first case in Japan where the general public became the core of a cohort project in various ways, and were engaged in the improvement of health. While our efforts still leave a great deal of room for improvement, we hope to propose future approaches to interactions between science and technology and society from our project base in Nagahama.

"The Nagahama Rules for Genome Epidemiology Studies Open to the Community"
Keiko AKASHI (Project Director)

2. The Social Awareness of Experts

How should experts go about soliciting people's involvement in public issues? Science and technology experts, even if they are aware of their responsibility for knowledge in their own specialized field, tend to lack interest in how that knowledge is actually used, or if it is even useful. Nevertheless, experts have a large role to play in creating 'venues' to attract diverse participants. I will now present an ideal picture for experts seen by observing the behaviour of diverse experts involved in the focus area.

◆ The Self-awareness of Experts who Step Out

One thing that became clear to people from the Great East Japan Earthquake is that there is truly a wide range of experts, and that it is not easy to understand which one to trust. Rather than experts who authoritatively and conclusively announce information, those who show that they want to think together with us (regular people) appear more sincere and reliable.

In other words, an expert who steps out is one who provides their own expert knowledge as a specialist, but when that is not enough to address the problem, they step out beyond his or her own expertise to speak and take action. At this time, it is important to explicitly state what areas are beyond the expert's field of expertise, and establish some code of conduct so that experts who step out will not become experts running amok. Moreover, the expert is expected to bring knowledge and experience gained from outside back into his field of expertise, and to change the thoughts and behaviour of other specialists.

For example the Suzuki and Shiroyama PJ conducted a social impact assessment of nanotechnology concerning medicine and food, which involved a diverse range of specialists including scientists, businesspeople, government officials and journalists. Through being involved in the project for over a year, some experts expanded the range in which they could step out as experts with responsibility, and gained a heightened awareness of projects and society. On the other hand, the Yukioka PJ, which looked into how to educate medical practitioners, thoroughly studied practitioner decision-making on site during medical emergencies, how to help patients and their families understand processes, all through which lead to a success in explaining expert knowledge which had until then been taken for granted. This made it possible for individual medical practitioners to gain self-awareness as practical experts and to boost their abilities to resolve social issues.

◆ Boosting the Social Literacy (Citizenship) of Experts

Experts work to communicate knowledge and information as accurately as possible. They also work to speak specifically and logically, include background information, methods and certainty of results. While all of this is correct, it is difficult to understand and the meaning is not often well conveyed to the audience.

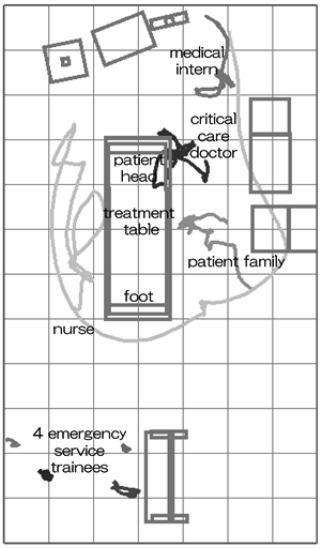
In the focus area efforts, having experts continuously engage in citizen participation activities, the Akashi PJ and Iizawa PJ achieved outstanding changes. They made experts more aware of their diverse audiences, which changed them to give explanations that are easier to understand. The Hirakawa PJ and the Oi PJ helped experts strengthen their dialogue and consultations with the public, become aware of the balance between accuracy and ease of understanding, become aware of who should receive the information, and how to make information easily understood. One could say that these projects made it possible for experts to remove themselves from their positions as experts and become as aware as the general public. This may be considered as stimulating the citizen power of experts themselves.

Column 5 Narrating Patients' Lives – Awareness of Stepping out as Emergency Medical Practitioners [Yukioka PJ]

Just as things cannot be made by simply collecting parts, the ability to act is not the same as the ability to carry out activities. Cardiopulmonary resuscitation (CPR) has been defined as a systematic combination of medical actions including tracheal intubation, artificial respiration, heart massage, and intravenous access. Its goals are for the patient to recover pulse and spontaneous respiration, regain consciousness, and ultimately rehabilitate in society. CPR is one of the most important responsibilities for emergency physicians. The 'practice boundary' for emergency physicians has grown wider as individual cases become connected to one another. Each and every patient is included in the doctor's practice boundary. The pattern of action – activity – practice also becomes visible in the practice boundary. But just as a house cannot be built by simply piling up the bricks, there is no guarantee that accumulating actions will lead to practice. Then what is it that makes the pattern of action → activity → practice possible?

Where do medical procedures and emergency physician's activities stand in the life of a patient who has experience cardiac arrest? I think the significance this question is often lost in the field of medicine. If the patient's life is saved and the he or she returns to society, that heart attack, a terrifying experience even if the patient cannot remember the details, will remain as a reminder of a challenge in life that was overcome. Although the patient feels grateful, the emergency physician feels they had just done their job, and does not have time to spare to think about the effect of their work. When the life cannot be saved, CPR is the final moment of the patient's life. The act of CPR is the last moment the patient and their friends or family share together delete space. Where this stands in the 'living boundary' of the bereaved was anyone's guess at first. But what if the 'living boundary' and 'practice boundary' could be talked about openly, and sharing stories between the two groups could increase the chances of the most basic foundations for the interactions among people?

When the 'living boundary' of those left behind and the 'practice boundary' of the emergency physician come into contact and they share their experiences, the blank parts of the patient's last resuscitation become filled with color to the 'living boundary' of the bereaved, and the 'practice boundary' of the emergency physician. Becoming aware of speaking up and sharing stories about life as an emergency physician and medical expert is not only good for patients and their friends and family, but it is also the most essential basic role for medical practitioners to be medical practitioners. This is the most important opportunity to establish a pattern of action → activity → practice. Through this four-year project, I truly felt that without this, medical practice education (as opposed to medical education) could not be realized.



■From the family entering the room to the pronouncement of death (one minute)

"Development of Medical Care Based on Convinced Validities from Multiple Viewpoints – Clinical Assessment through Integrated Application of Ubiquitous Vision and Conversation Analysis in a Field of Tertiary Acute Care" Tetsuo YUKIOKA (Project Director)

Column 6 How Scientists Changed by Participating in Deliberations and Dialogue [Hirakawa PJ]

The participation of science and technology experts (collectively referred to as 'scientists') is essential to public deliberations regarding science and technology. This project had scientists actually participating in deliberations and exchange opinions with non-specialists, and then conducted analyses on the impact of their participation and changes in the scientists themselves. Among the various activities, two examples are introduced here that had produced significant results.

One of these was the interview survey with experts in regenerative medicine who participated in the 'Deliberations Caravan 2010', an event that was organized by the entire project. These experts participated in the deliberations and joint works (drafting an agenda) with non-experts over a period of two days. They learned how little non-experts knew about regenerative medicine, and improved their social literacy. They also noticed that when engaging in broad discussions about regenerative medicine, ranging from technical aspects to medical economics and patient psychology, the scientists participated as different representatives, sometimes as experts and other times as ordinary citizens. While the significance of this discovery will require deeper analysis, scientists are experts about science, but amateurs when it comes to the discussion of science in society. I think it may become easier for scientists to participate in public engagement if they can recognize that it is acceptable to move back and forth between two viewpoints.

■At the Deliberations Caravan

The second example is the 'Cafe Common' event, where humanities and sciences researchers from various fields had exchanged opinions about the life sciences with graduate school students of Kyoto University. The researchers came into contact with a diverse range of viewpoints on science and technology, and it became clear that they wanted to participate in similar activities again. This suggested it could be possible to hold initial discussions among experts themselves regarding science and technology and its social problems, and have this function as a preparatory process toward boosting their enthusiasm for subsequent participation.

What we learned from the project activities we carried out was that scientists feel anxious, pressure, and are aware of their inabilities prior to participating, but they gain a greater urge to participate in deliberations as they gain experience. So, the themes and participants must be carefully arranged accordingly. Incorporating frequent group discussions in master's and doctorate courses and arranging venues for experts in different fields (from both the sciences and the humanities) to engage in deliberations are possible effective measures to make young scientists more eager to participate.

"Research Project on the Deliberation and Cooperation between Citizens and Scientists (DeCoCiS)"

Kazuto KATO (Project Member)

Column 7 Satoumi Creation from Japan to All Over the World [Yanagi PJ]

A main goal of the Satoumi Project was to clarify exactly what people can do to enhance the biodiversity and productivity of coastal zones. Therefore, the first step was to theoretically consider what biodiversity means.
We realised that the presence of diverse organisms in the ocean indicates the presence of diverse habitats. In other words, when the habitat is monotonous, only the organisms best suited to that environment can exist. Consequently, using artificial means to create diverse habitats should contribute to biodiversity.

The next step was to find an actual example. Artificial fish reefs are the closest example available of increasing productivity. After searching all over Japan to find habitats other than coastal fish reefs that had been altered to increase biodiversity and productivity, we were delighted when we discovered the ishihimi rock tidal weir in Shiraho Village, Ishigaki Island, Okinawa Prefecture. The reason was because it is the best possible example of human work that boosts biodiversity and productivity.

Taking the satoyama (borderland between mountains and fields) example a step further, we thought that preventing vegetation from reaching its climax could also increase biodiversity, and looked for a similar example in the ocean. We observed the eelgrass beds of the Seto Inland Sea and found there were hardly any fish on the ocean floor where the eelgrass had reached climax. However, there were many fish swarming at the edges between the eelgrass bed and the sand, and also where the eelgrass had been cut by gaps, which answered our questions.

■Ishihimi rock tidal weir n Shiraho Village, Ishigaki Island, Okinawa Prefecture (left side)
The eelgrass cutting by gaps in Seto Inland Sea (middle & right side)
Examples of keeping system that boosts biodiversity by human work, it's from fishermens knowledge

Confirmation in the field of individual ideas we had conceived, and connecting them to research results was the most interesting aspect in advancing this research project.

We were also able to spread the Japanese concept of satoumi overseas. Specifically, the satoumi concept was adopted for the recovery of shrimp ponds that had been destroyed by fish disease in the Indonesian province of West Java through the simultaneous introduction of tilapia, shrimp, seaweed and mussels in abandoned shrimp ponds. The experiment results were astounding as the ponds with the four species showed better water quality and growth than the ponds with only tilapia or shrimp. The Indonesian government, which was surprised by the results, is presently conducting satoumi aquaculture projects in four locations across Indonesia.

"Establishment of the Social System for the Healthy Coastal Sea Environment (Creation of "Satoumi")"
Tetsuo YANAGI (Project Director)

3. Creating Venues

Drawing in wider participation as well as implementing and realizing a new role for experts requires the design and construction of venues that make this possible. Here 'venues' refers to everything from frameworks and rules, to systems and spaces. Consequently, in the focus area, 'creating venues' refers to the process itself of how each project breaks into the specific conditions of the social problem being researched, and how they develop practical research activities. Some of the focus area projects [Sato PJ, Iizawa PJ, Hirakawa PJ and Yagishita PJ] mainly created physical spaces for discussions and careful deliberations, while others did not. But in all cases, the most important part about creating venues is bringing together appropriate participants discovering new ones, and finding ways to maintain venues.

◆ Gathering Participants

The first important point in expanding participation is gathering 'appropriate' participants. Many of the focus area projects [Akashi PJ, Suzuki and Shiroyama PJ, Sato PJ, Yagishita PJ, Yanagi PJ, Oi PJ, and Iizawa PJ] had already established activities, so the networks from prior activities had made it easier to invite participants, and many of the project members had come from those connections. In the cases where new projects were launched [Nasu PJ, Hirakawa PJ, Yukioka PJ, Segawa PJ, and Nakamura PJ], participants were usually determined through acquaintances of the leader and core members.

While this varies depending on the nature of the project, when it comes to gathering participants to further expand these kinds of relations, advertising for voluntary citizen participation was commonly used [Iizawa PJ and OI PJ]. In the participation of experts and stakeholders, some project bodies invited prominent local people and volunteers [Akashi PJ and Nasu PJ], some projects selected appropriate participants using certain methods such as interviews or formed working groups concerning individual issues [Suzuki and Shiroyama PJ, Sato PJ, and Yagishita PJ], while other projects assigned outsiders such as project advisors or event organizers to select the participants [Suzuki and Shiroyama PJ]. In the case of the Science Media Centre, the project gathered participating researchers by referring to guidelines prepared in the United Kingdom [Segawa PJ].

◆ Finding Participants

It is generally said that university and public research institution researchers seldom refuse to participate in such 'venues' as a member of a diverse group of participants. This could be attributed to a sense of public service or social duty. Among such experts, those who can play new roles are a particularly great force for activities aimed at resolving real social problems.

In the past, however, such experts have been scattered in their respective academic fields and regions, making them very difficult to find from the outside. In the focus area, the Sato PJ proposed a concept of 'regional-driven scientific communities' and created a new scientific community. Other projects also required ties with science and technology experts. By discovering 'experts that step out' and sharing some research and development approaches, it was possible to obtain further understanding, interest, support and cooperation with the projects [Suzuki and Shiroyama PJ, Yagishita PJ, Iizawa PJ, and Segawa PJ].

The current challenges for scientific communities are that there are few groups inside universities and academic societies that have an understanding and interest in mutual interaction with society, universities and academic societies are not conducting activities to boost understanding and interest in such issues, and there is no system where organisations will recommend individuals who have an understanding and interest. For those reasons, the project

members had to use their personal networks to locate suitable experts.

To eliminate personal ties in this identification and cooperation with experts who step out, the Science Media Centre created a researcher database. Researchers willing to speak to the general public register themselves into the database. The Centre examines the accuracy and suitability of the information provided by the researchers from a science journalism perspective, and judges the researcher's qualifications. The Centre's activities have had a large influence on experts, media and public opinion concerning scientific and technological issues that suddenly stood out as major social issues since the 2011's Great East Japan Earthquake, and also attracted international attention [Segawa PJ]

◆ Bringing Participants to the Venue

The act of gathering participants with different interests and concerns to a single location was also one of the achievements of each project. While these were not all examples of consensus formation or friendly dialogue, it is important to stress the significance of at least getting people sitting at the same table, all of who had not met before because of their differences in opinions and ranges of activities.

Depending on the theme, it was sometimes difficult to bring participants to the venue. When there were conflicts among stakeholders, it became necessary for them to understand the merits of participating, and to guarantee a process under which they could comfortably participate. For example, the Yagishita PJ promoted participation by providing a venue respecting and consistent with such varied motivations. Coming would allow participants to gain information held by other stakeholders, give them a say in public about what could not be said during normal activities, build up connections and networks, and change the mindset of antagonistic stakeholders. Another approach was to provide negative motivation by pointing out the demerits from not participating, and creating concerns about falling behind by missing such opportunities. To attract NPOs and other groups, some projects used the influence and authority of the venue to appeal to the group's desire to raise their motivation to send messages to society.

Regarding journalists, while their participation was seen at venues gathering diverse participants related to the Great East Japan Earthquake, there are still a large number of challenges remaining about how to motivate journalists to continue participating in various venues in normal times [Segawa PJ]. Often, the general public also does not have any strong motivation to participate at venues, so projects have had to attract citizens with a diverse combination of weak motivations such as, 'I am concerned', 'this is a learning opportunity', and 'it seems interesting'. Therefore, it is necessary to take serious consideration into the design of the promotional and information materials, the venue itself, the reputation and authority of the participating experts, etc. [Hirakawa PJ].

In designing a venue to address public issues, the transparency and fairness of the venue creation process increases the trust in the organizing body, and it is important to effectively utilize the private motivations and intentions of the participants.

Column 8 Gathering Participants – The Implementation of Technology Assessment [Suzuki and Shiroyama PJ]

This project was formed around the members of the Technology Assessment Task Force of the (FY2006) Special Coordination Funds for the Promotion of Science and Technology 'Multidisciplinary Expert Panel on the Impact of Nanotechnology', divided into three teams, one for medicine, another for food, and the last for energy, all of which assessed the social impact of technology (conducted technology assessment; TA). This column introduces how the participants were gathered, and includes the various devises and issues.

First, the medical team classified the stakeholders through 19 interviews, and identified appropriate members who could take part in a roundtable conference of wide-ranging stakeholders. In the food team, project members and external team advisors were associated not only with universities, but also with the Ministry of Agriculture, Forestry and Fisheries Policy Research Institute, Citizens' Science Initiative Japan, Nippon Association of Consumer Specialists and other bodies, so the members used their respective organizational contacts and personal networks. The energy team, on the other hand, had a small number of members, so they formed a full-scale collaboration with the NPO BeGood Cafe, which assisted with the planning, production, and operation of various events, as well as finding facilitators, and attracting participants.

Coordination and mutual understanding among the core members were already well established from the start, since they had had already worked together on a prior project. Vigorous advances in project activities to gather participants' lead to a rise in the number of close and continuous relations with outside participants, which then lead to new research alliances in the fields of medicine and food.

■TA Talk

In gathering participants, we learned it is important to find people with a lot of curiosity that were likely to participate continuously over the long period of time, even on a voluntary basis. To get considerate responses from them it was also important to become friendly on a personal basis to build up mutual trust. Also, such participants can help to attract new participants, making great contributions to project activities. The efforts to gather participants by the energy team were centred on the BeGood Cafe. Consequently, the majority of participants were people with strong environmental awareness. This illustrates the difficulty of gathering average citizens with diverse views. A recruitment system, 'TA Challenge', was also established to strengthen the involvement of young science and technology personnel, but there were no responses, which raised the issue of how to approach researchers spread out among their respective fields and organisations.

Participants inside and outside the project still keep in contact, and engage in wide-ranging collaborations on research, planning, and hosting of events concerning science and technology and society. I think these can be viewed as the beginning of a new generation of technology assessments.

"Innovation and Institutionalization of Technology Assessment in Japan: Dealing with Nanotechnologies" Go YOSHIZAWA (Project Member)

Column 9 The Science Media Centre Initiative [Segawa PJ]

The main activity of the Science Media Centre (SMC) is to provide journalists with information about socially controversial scientific issues and independent comments from a number of scientists about those issues. Currently, the centre sends out information by email in two different ways. If the issue is of high interest or it is urgent, the information is sent out as a 'Science Alert'. Information on any upcoming events that could become big issues in the near future are sent out as a 'Horizon Scanning' package.

SMCs in other countries offer the same services under different names, which makes this the core activity of the SMC, but it is by no means the service that creates the biggest revenue.

An interesting point is that the SMC in Japan has had to endure different problems in regards to making Science Alerts than compared to other SMCs around the world. At first, our SMC colleagues overseas could not understand why it was difficult, but after explaining things through with them during the 2012 AAAS meeting in Vancouver, their response was one of surprise. "I had no idea the Japanese environment was like that," said the New Zealand SMC representative. "That is a very interesting situation," said the Australian SMC representative. The biggest challenge the SMC faces is to find scientists who can comment on a scientific issue for the media. We overcome this challenge by calling up a long list of experts, until we can find a few who can give us their view of the issue, and have the comment checked. The success rate is low because researchers, by no fault of their own, currently work to a different time scale to the media. Where one researcher may take a week to give the SMC a perfect comment, the media is constantly reporting on news 24 hours a day. Lack of understanding of the effect of the media can also make a researcher reluctant to have their name published.

Another issue unique to Japan is its media environment. Do large media companies with a science desk and 25 to 70 science reporters need "support"? Yes. For the past two years these companies have looked to the SMC for information. However, the problem is that the media will never directly quote our scientists in their stories, preferring to interview the scientist themselves. Therefore, the SMC is a good source for expertise, but we are constantly debating about how to adapt our services to better suit Japan's environment.

Last is the funding issue. Overseas SMCs have started off and continue to work thanks to donations from its few to almost a hundred supporters. However, Japan does not share this donating culture, making it extremely difficult to find new funding. It has been difficult to get support from media companies, and the issue is still on-going about who can help the SMC.

"Forming a Science Media Centre as a hub for science and technology information"

Miho Namba (project member)

Column 10 Bringing in the Participants – The Hokkaido BSE/GM Deliberation [IizawaPJ]

At the 'Turn and There is the Future' forum held in Obihiro, Hokkaido on the topic of testing all cattle for BSE, dairy farmers, JA (Japan Agricultural Cooperatives), veterinary science researchers, epidemiologists and directors of consumer cooperatives activities departments spoke from their personal positions. The dairy farmers and JA had agreed to participate two weeks before the first meeting was held, and their participation would have been difficult without introductions from the government. While the government wanted to 'let sleeping dogs lie', the effectiveness of BSE controls was not being appropriately explained to the residents of Hokkaido. In response to this issue, the government decided to participate as an observer.

Despite the fact there was no guarantee for a second meeting, and the participants had gathered because conditions had been promised, including non-disclosure and no media participation, following the first meeting, they were the ones who began arranging the schedule for the second and third meetings. A proposal was made to invite guests, which led to inviting representatives from the slaughtering and meat processing industry, and even reporters from national newspapers. Moreover, the government observer participants were also invited to speak, although as private citizens, bringing forth diverse information.

Dairy farmers and veterinary scientists participated in the '(Public) BSE Deliberations in Hokkaido University' held in December 2010. At the final meeting in 2011, participants spoke of the need to develop a separate venue for discussions about risk, leading to an agreement on becoming a secretariat. As for government involvement, despite the fact that it would be difficult to take a leading role, the government had no issues with participating in the secretariat, based on their strength in work behind the scenes, and thus the two have stayed in loose contact. 'BSE Deliberations in Obihiro' was held in July 2012, with a scenario conference by the participants.

The 'GM Hokkaido Residents Conference (RIRiC GM jury)' was a venue for the general public to hold discussions. Here, the issue was how to gather participants who could be a miniaturized representation of society. Initially, the organising committee had an idea not to use random sampling, but instead to ask the regional PTA federation to provide advisors who could recommend individuals to participate in such discussions, but they failed to convince the General Subprefectural Bureaus, Boards of Education, and other necessary information sources.

This led to a revived proposal for gathering participants via random sampling. To mitigate the bias under RDD-type sampling of fixed telephone lines, which results in a high percentage of males and elderly people – a questionnaire was distributed to appropriate households. Out of the 3,000 people who were sent the questionnaire (including 257 which were returned because they were unknown addresses), 625 (20%) replies were received. 158 (25%) of those who replied expressed interest in participating, and in the end 16 participants (with an average age of 51) were selected as panellists, taking into consideration factors such as where they lived, population, age, and gender. The panellists participated enthusiastically over two days from 8:30 a.m. to 6:00 p.m. to study, hold discussions and summarise opinions. While the financial compensation for participating may also have been an influence, the dynamics of the general public should not be underestimated, and many people showed interest in citizen participation itself. If further implementation where to be considered, setting appropriate participation compensation is one of the issues that needs to be addressed.

■Discussions at the GM Hokkaido Residents Conference

"Remodelling Interactive Risk Communication based on Actor' s Spontaneous Cooperation (RIRiC)"

Seiko YOSHIDA (project member)

◆ Sustainability of Venues

A major issue for R&D programmes implemented at the Research Institute for Science and Technology for Society is whether there are any venues where the results could be implemented into society and where parties could resolve problems on an on-going basis after the funding period ends. To make such continuing venues possible, individual projects and the overall focus area devised and implemented some of the following four approaches: (1) have specific organizations serve as the core of activities, (2) have individuals and organizations maintain loose collaboration and networks, (3) have individuals and organizations continue independent activities and ready for quick response and coordination in case of society demands, and (4) summarize knowledge regarding methods and processes in guidelines, manuals and archives.

(1) Specific Organizations

In some cases [Segawa PJ, Suzuki and Shiroyama PJ, Hirakawa PJ], general incorporated associations (Science Media Centre of Japan) and universities (Todai Policy Alternatives Research Institute, Osaka University Centre for the Study of Communications Design) were used as the bodies to implement project results. Each project is working to expand the number of supporters to become a stable organisation administration, but it remains to be seen whether the further operating funds can be secured, and whether the expansion or replacement of core members after project completion will proceed smoothly.

(2) Collaborations and Networks

In some cases [Suzuki and Shiroyama PJ, Yagishita PJ, and Nakamura PJ], during discussion and deliberations among diverse participants at venues set by projects, experts in different fields showed mutual interest and understanding, and subsequently formed on-going collaborations and networks. While these are not necessarily limited to collaboration and networks concerning issues under the set goals of individual projects, in the long term they can be networks that promote social debate, resolving problems, and decision-making. In the environmental field, the Local Science Network for Environment and Sustainability begins a reconsideration of the traditional image of the scientific community, while at the same time is also looking for a new type of researcher engaged at the site of environmental problems [Sato PJ]. Another example involves the reconsideration of legal decision-making under the conditions of scientific uncertainty. Here, a project team including natural scientists, scholars in the humanities and social sciences, and legal practitioners worked together to identify the differences in their understandings, and were able to grasp where the problems lies more specifically [Nakamura PJ].

(3) On Demand Framework for Collaboration

Though diverse participants who interacted with one another through a project go back to their respective organizations and activities after the project is over, they continue to exchange information through project Web sites, mailing lists, Twitter and other media on a regular basis. These connections are weaker than those of collaborations and networks where there are specific activity themes and funding, but since the members are linked by their problem awareness and concerns, they can be viewed as a framework for collaboration that can respond quickly to social demands. This could be considered the most rational and efficient format for continuing venues in today's information society.

(4) Embedding into Society

While there are various approaches to expanding experts, stakeholders and citizen participation, and holding deliberations or conducting assessments about the relationship between science and technology to society, Sato PJ and Iizawa PJ compiled their knowledge of these processes into a guideline and manual, while Hirakawa PJ collected the

methods and opened them to the public as an archive (http://decocis.net/navi/). For people involved in law, Nakamura PJ arranged and presented their issues for the use of science and technology opinions in court.

These may be considered as efforts toward implementing results, in that they seek to facilitate the widespread use of project results in society.

Column 11 The Importance of Intermediary Experts – from the Threshold between the Two Cultures of Law and Science [Nakamura PJ]

All of the focus area projects carried out activities that rounded up researchers and stakeholders from diverse fields. The distinctive characteristic of this project was the composition of two worlds. Lawyers and scientists. Both have had a long tradition and social position in academia, and can be respectively considered as 'grand towers'. While communications began smoothly with mutual interest and concern, as the discussions progressed, the differences started to show in the language being used, ways of thinking, and values.

The biggest challenge was language. For example, it became clear that common phrases such as 'fact' and 'cause-effect relationship' were used in both fields, but have different meanings. The two groups gradually got into heated arguments as they scrutinized the meaning of each and every word. A real conflict emerged when the lawyers and scientists, both professionals with high-level expertise, bore in mind the argument at the bar for resolving the dispute. Those differences went beyond the discussions, and went onto slow down the administration of the project. The lawyers and scientists should have pursued a mutual understanding and compromise. At the same time, they gradually realized the need for some sort of intermediary person.

So who could fulfil the role of the intermediary? Originally, researchers in the field of science, technology and society (STS) participating in the project were assigned to play that role. STS has an inter-disciplinary nature, and is a research field that can have practical intermediary functions. That role, however, was fraught with difficulties in the conflict between the firmly established world-views of the lawyers and scientists, and could not be fully reasoned with in this project.

In regards to the focus area mission of linking science with society, this project gained valuable experience concerning the relations between law and science, and with the STS. Based on that experience, we produced the 'Law and Science Handbook' as a first step toward mutual understanding and dialogue between lawyers and scientists. The handbook, however, was not compiled with the unanimous agreement of all project members. Furious debates continue regarding various points, and the handbook will continue to be revised as a living document inside on-going research.

Approaches connecting law with science will continue to be developed. A difficult mission also remains for the people who will serve as an intermediaries at the threshold between law and science.

"Legal Decision-making under Scientific Uncertainty"

Column 12 The Collaboration of Resident Researchers – Establishment of a Local Science Network for Environment and Sustainability [Sato PJ]

There are 'resident researchers' in local communities all over Japan who single-handedly conducting research to resolve local environmental issues. If they had access to a network that would make mutual exchanges, and opportunities to learn from one another by sharing approaches at different locations, it would surely be a great help. The number of problem-solving oriented research rooted in localities throughout the scientific community could increase if the network could promote collaboration between resident researchers and travelling researchers, who want to do everything they can to resolve regional problems. Through this network, there is no doubt local stakeholders could also learn approaches to making their scientists useful. Surely, there must be a substantial need for such a venue.

With this concept in mind, 41 founders gathered in March 2010 to establish the Local Science Network for Environment and Sustainability. The network is steadily expanding, and has over 120 diverse participants as of August 2012.

In this process, many members have made use of the network resources in various ways, and have made progress in evolving research and activities. Of course, the people originally gathered by this network were those with a lot of interest in research and knowledge structures that could be used directly to solve local problems. In fact, many participants expanded their vision range to fields outside of their own specialties and concerns that were still useful in addressing local problems. In the end, a process was established whereby many 'pockets of knowledge and skills' that were useful to the community increased. The individual researchers and stakeholders acquired numerous 'pockets' and evolved them so they could implement multi-faceted and flexible responses in the field to solve problems.

The Local Science Network for Environment and Sustainability has also been a great stimulus for young researchers and graduate students who want to become resident researchers. Under a resident researcher internship launched from 2011, three graduate students are enjoying work as resident apprentices in different communities. By providing graduate students with another internship alternative, this framework is expected to lead to the development of personnel who are capable of conducting resident research.

With these results as a foundation, further detailed analysis is needed to find out how production and distribution of local environmental knowledge directly related to solving local environmental problems promotes changes in people's decision-making and behaviour, and how that leads to constructing a sustainable society. These remain to be major issues that need to be addressed. With the production and distribution of knowledge as a core, we hope to continue taking on further challenges toward building adaptive governance by a bottom up approach to resolving global environmental problems in the regional community.

■Ms. S, a humanities student who has spent her entire life with her head in piles of books, is delighted at catching a newt through the network activities. She acquired a scuba diving license after the project.

"Construction of a Pragmatic Scientist Community Contributing to the Stakeholder-driven Management of the Local Environment" Tetsu SATO (Project Director)

4. Building Trust

In establishing research groups and expanding participants, what then becomes necessary is to secure trust in the project. The focus area projects had particular problems regarding this point. First, because these were all short-term projects of 3-5 years, there were concerns about maintaining administrative structures, financial sources and personnel after project completion. While the projects were also social experiments as research and development in which mistakes are acceptable, the participants who were actively engaged did not want the projects to end with simple mistakes as their failure. Some asked for continued development after the project completion if it were possible. We realized that to resolve these problems it would be necessary to persuade external stakeholders involved in the project about the necessity of continuing support after project completion.

In fact, in many of the projects participants have maintained contact after project completion, and have continued activities such as joint efforts at securing new funding sources or introducing various research networks. Even though the projects were short-term social experiments, they can become a catalyst for collaboration in subsequent long-term social implementations. If any 'experts who step out' prepared to follow through with the issues together with other participants, rather than just regarding the social issues as research material, and ending participation once academic papers have been published, even a project which ends after a set term can facilitate social implementation [Suzuki and Shiroyama PJ, Nasu PJ, Sato PJ, Yagishita PJ, Iizawa PJ, and Segawa PJ].

◆ Who are We？

The question of who we are, who has main responsibility for the project, is inseparable from securing trust in the project. In normal scientific projects 'we' refers only to the project members, and 'we' look at the research subject 'objectively'. However, as it has been repeatedly noted, projects such as those in the focus area are characterized by the participation of a variety of people, and is not limited to the project members. What has been frequently forgotten in creating a venue for participation is that in these projects, the outside participants and the body implementing the project are connected. The social phenomena and realities that are the R&D subject not only include the participants, but also the project members themselves. The project members do not have an 'outside of society' presence, and do not look at participants through glass, controlling their research from a remote location.

In the same way, having the project members function as a simple secretariat, and work as an invisible presence behind the scenes at participation venues cannot boost trust in the venue creation, its results, or the project itself either. The members must be explicitly and continuously involved with other participants at the venues, and in other project activities, and have a full understanding of the project. In this way, participants can gain a sense of responsibility for their own words, actions, and their contribution to the project, which boosts trust in the project and its results. As seen in the next chapter, this also means that the research funding agencies that support the project cannot work behind the scenes either.

Chapter 4： Conclusions and Recommendations

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Conclusions and Recommendations

So far in this report we have presented our awareness of the issues involved in the program along with the challenges and successes recognized through the implementation of its 12 projects. Based on their results, this chapter offers several recommendations for improving the relationship between S&T and society in the future, and for utilizing science and technology. Originally, this program was not intended to address all of the issues involved in the enormous scope of the interaction between S&T and society subject, but we believe the issues that have been discovered in the course of the 12 projects, and the path to their resolution are significant matters for Japanese society, particularly following the 2011 earthquake.

1. Making the connection between Science and Technology and Everyday Life

Given the rising complexity and uncertainty in science, technology and society, it is important to involve more people concerned with the issue, and link expert knowledge on science and technology with 'common sense = knowledge in life' in local environments, to ensure our decisions are more effective and open.
The role of universities as a foundation for wider involvement is significant. Universities are required to (1) develop partnerships with firms, governments, non-profit organizations (NPOs) and the general public, and (2) develop human resources capable of trans-disciplinary dialogue and collaboration.

With the rising complexity and uncertainty regarding issues of S&T and society, there is a growing awareness of the need to expand the range of participants in order to make decision-making in society more effective and open. However, everyone cannot instantly acquire public consciousness as a participant. Just as scientists and stakeholders carefully consider and discuss the issue of global warming, or how various related parties in the community bring their knowledge in pursuit of a sustainable regional community management system, each participant takes part within the capacity of his or her day job, and it is stepping out from that position that leads to changes in the participant's attitude and actions toward society. By applying the perspective of 'common sense = life knowledge' rooted in communities and everyday life to social issues to which members of the public may have never had any direct involvement with, such as regenerative medicine, 'satoumi', or autism, ordinary citizen can function as participants. Simply put, including the general public in the process as participants raises awareness and their understanding in regards to social issues, and it is the key to cultivating citizen power. As this power grows, it provides a broad range of interested parties and citizens with the capability and system to taking responsibility, allowing them to counter the authority of experts. This opens up the possibility of supplementing the issue formation and decision-making structure for society that until recently has been too dependent on experts. It is easy to picture examples of this potential in this program, such as the high quality of knowledge among the randomly selected citizen participants, the smooth implementation of a community cohort study by a diverse range of participants, and the social determination of the diagnostic criteria for autism.

One of the promising spaces for widening of the range of participants are universities. To close in the gap between specialist knowledge as an academic discipline, and the life knowledge that contributes to issue resolution in communities, it is best to have broad participation and partnerships between universities and a wide range of non-academics including corporations, government agencies, NPOs, and the general public. Many of the projects in the program are conducted at universities to widen of the range of participants. Not only does this benefit society through local development, it also contributes to the education and research functions of a university. Collaboration with a diverse

range of participants is necessary to discover realistic methods or systems to solve complex and specific problems that cannot be addressed with a narrow perspective or specific domain of expertise. In addition to this, it would be best to promote trans-disciplinary dialogue and collaboration between a number of research groups, including researchers from different fields and non-scientists. Furthermore, from the perspective of education and supporting the career paths of students, interaction with a diverse range of people from outside academia is essential in raising awareness of problems in society. Universities should promote the expansion of a broad range of participants for the purpose of solving specific social issues, and by including students in the process, help them to reflect the significance of the things they learn at university, and provide them with the capabilities to apply these in society.

2. Encouraging Experts to take a step forward

There is a need for experts who are able to collaborate with a variety of people by finding solutions to complex and uncertain issues, not staying in their area of expertise but rather taking a small step forward while duly keeping the limitation of their discipline in mind.
It is necessary to make a system that could evaluate and encourage experts to take a step forward.

Expanding the range of participants requires a corresponding change in the role of experts, as well as the definition of what constitutes as an expert. The experts needed now are ones who provide the expert knowledge they possess, and who are willing to take a step forward to comment on for problems that this knowledge alone will not answer, duly recognizing the limitations of their expertise. Rather than calling them academic experts, experts can be called 'experts in practice' who understand how the supply and demand for expertise in society are linked together or 'active experts' who understand the strategies to mobilize intellectual and human resources in order to realize the ideals in which they believe. These 'experts who take a step forward' need to be distinguished from 'experts who charge forward', meaning those who abuse their authority and make ill-conceived remarks in other fields that are unrelated to their specific area of expertise.

'Experts who take a step forward' are found in such projects like those that assess the social impact of nanotechnology, and provide training for medical professionals. Most of these experts are aware of their role to step forward through these projects, and are working to change the attitude and conduct of other experts even in their own field. In particular, there are many experts who have consciously taken a step forward in society, and through participation in public discussions or deliberations, have been able to improve the way they explain specialized information, and heighten their own 'sense of citizen hood', gaining a sense of the public themselves.

To raise and support experts who take a step forward, a proper assessment of such 'step forward' activities at universities and academic societies is necessary. As with the project which established a new scientific community, the 'resident researcher community', it is worth noting the framework development to bring stakeholders together while actively evaluating experts who take a step forward both academically and socially. While initiatives such as this are likely to spread in the future, for the time being it is important to show consideration to university faculty so that they can acquire the time and resources to contribute to social and public activities outside of their research and teaching responsibilities, as well as for universities to respect those activities. Media professionals also need to understand the diverse sorts of experts derived from differences in expertise and type, such as those experts who take a step forward, and to interpret the information and knowledge of experts critically. Many of the university researchers involved in this program emphasize

the significance of social and public activities, and continue to work for appropriate evaluations of experts who take a step forward despite enduring old-fashioned, conservative universities or academic societies. By providing opportunities for R&D activities to experts who take a step forward, this program has also helped to raise their standing as experts.

3. Learning from Pilot Projects on Social Challenges

Wider participation and activities by experts who have taken a step forward is still in its infancy. Therefore, it is necessary to carry out various pilot projects to address social challenges. In particular, we should constantly provide spaces for collaboration between these new experts and diverse stakeholders, as well as anyone concerned with practical issues in our society.

Pilot projects on social challenges have been downplayed to date, and their success is not promised, but we need to embark upon them, with a long-term perspective so that we can keep learning from our experiences, including possible failures. Not only universities, but academic societies, industries, and non-profit and non-governmental organizations should also develop new pilot projects to find solutions for public issues.

In order to achieve expansion in the range of participants and a new role for experts, it is important to design and build 'spaces'. This includes structures, rules, systems, and physical locations. It is also necessary to ask participants who direct the projects to find new participants and to bring them to a particular location. How to maintain those spaces is another issue. All of the projects in this program feature a diverse makeup of members, and it is this characteristic that has put the principle of expanding the range of participants into practice. The majority of projects utilize a personal connection-based method to expand participation, relying on the longstanding personal networks of its leaders and core members. Furthermore, in the broad-based recruitment of participants, some projects approach and solicit local dignitaries or like-minded individuals, or select suitable participants through interviews and individual topic working groups. Others entrust the selection to outsiders. In addition, efforts to systematically find experts who take a step forward include establishing new kinds of scientific communities, or developing researcher databases such as the Science Media Centre. At the same time, when participants have conflicting interests, it is often difficult to bring them together in a single location. All of the projects recognized the motivations, intentions, and interests of each stakeholder, expert, and ordinary citizen, and therefore, designed appropriate spaces for collaboration. It should be stressed that one of the successes of this program has been getting people who had never engaged with each other previously to sit at the same table.

However, after the funding period ends, there is still the issue of the social implementation of the results from individual projects, and whether spaces to address problem resolution can continue to be designed. This program has considered four approaches for the continuation of such spaces: 1) Have general incorporated associations and universities be the focus for such activities; 2) Maintain collaborations and networks of the diverse individuals and organization assembled through the projects; 3) Individuals and organizations continue independent activities, but make arrangements to exchange information regularly, and to be prepared for any sudden assemblies or chances to work together if society requires it; and 4) Knowledge on methods and processes is compiled and archived in guidelines and manuals so it can be used in other regions or institutions. Certain aspects of these approaches are currently being put into practice.

How should we promote the creation and continuation of these spaces? Pilot projects on social challenges are

opportunities to expand the range of participants, while at the same time provide spaces for action to experts able to offer expertise on social issues. These pilot projects should be tried in a diverse range of cases, while also providing a certain degree of leeway for failure. It is also important to establish a feedback loop to learn from mistakes, revise goals, and improve measures. Evaluating results from a short-term view need to be avoided, and shifted towards the evaluation perspective of whether the results have increased the potential to bring about innovations that generate new economic or social value.

When doing so, it is important to provide meticulous and proactive assistance throughout the project period. The 'hands-on' (interactive and collaborative) management style adopted in this program serves as a good reference.

As of today, universities, research institutes, academic societies and similar organizations must bear the main responsibility for the creation of spaces and pilot projects on social challenges. These institutions are expected to establish unified and consolidated organizations for such activities through research strategies and evaluations, outreach, and communication. Activities with social and public value must also be managed properly. To accomplish this, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) should consider allowing institutions to combine their support for issues related to S&T and society.

Finally, activities for field-centric research and problem resolution need to be supported. The majority of the projects in this program took place at universities. In terms of focus on the resolution of social issues, it would be ideal that practical pilot projects produced include universities and other institutions. One reason why this has not happened is due to the weak foundations of non-profit and non-governmental organizations in Japan. The 2012 reform of the tax system for donations related to NPOs is an important step forward, but to strengthen the relationship between S&T and society, it is important to verify the effectiveness of tax system reforms, and continue with efforts to establish a foundation in order to allow NPOs and NGOs to play a fairer role.

4. Constant acknowledgement of responsibility builds trust

All 12 projects in this program involve an element of experimentation. Success of such experimentation largely depends on how trust is created among the participants in a modern society, especially following the 2011 Great East Japan Earthquake (earthquake, tsunami, and nuclear accident.), where the lack of trust in policy-formulation on public problems is often criticized.

Trust is never obtained solely from expert knowledge. Taking into account the complexity and uncertainty associated with social issues, continuous dialogue among a wide range of stakeholders and those people concerned is essential.

Building trust in projects from those involved is key to creating and maintaining spaces, to expanding the range of participants, achieving a new role for experts. Because this program comprises of research and development projects funded for three to five years, time to fully foster trust is limited. However, if the external people involved in this project are able to share an understanding of its significance, those relationships will continue even after the project has finished. There is even the possibility that they will continue to work together to secure new sources of funding, or promote various research networks. Even if a project wraps up after a certain period, instead of ending it with a result that the

social issue studied was deemed research material, and a research paper is published, if there are 'experts who take a step forward' who are prepared to continue tackling the issue along with the other participants, social implementation of the results are more probable.

Trusting the core members in a project is equally important. In terms of the social implementation of a project, and the resolution of specific social issues, an important factor is trusting the program management structure that oversees the project, and in RISTEX itself. When 'we', including everyone related to the program, continue our activities with a long-term perspective to enhance social and public consciousness, it becomes an incentive to encourage other participants to become involved in diverse spaces, and for experts to take a small step forward.

The most important reason why we were able to gain trust in the course of resolving real problems, is that rather than considering the spaces and communities as something to be manipulated or observed, we became aware participants with an interest in the party, and acknowledged our responsibility.

In regards to the downfall of public trust in Japan towards government and experts following the 2011 Japan Earthquake, we can draw the following lessons from our experience with this program.

Those involved in decision-making, the central and local government politicians, policy planners and implementers, should recognize that acknowledging responsibility as obligation to answer is necessary to regain public trust. Those involved in decision-making have a responsibility or obligation to answer environmental changes and societal demands because they have the right to decide on policy, and have discretion over it. Maintaining openness and transparency in policy formation processes for individual issues should not be an expression of tokenism, but bring about substantial results. The fundamental requirement for this is not to treat the public as something to be manipulated or measured, but as a partner for dialogue. Trust in government cannot be regained without trusting the public. The results of this program demonstrate that involving a diverse range of participants that includes the general public is vital to address complex issues full of uncertainties. There can be little expectation of restoring trust in government other than by trusting a diverse range of participants and beginning a dialogue. This also applies to restoring trust in scientists, engineers, and other experts.

In Closing

We must never forget that anyone can become a potential participant. To that end, it is important to make it easier for people to take an interest in a variety of issues, and when they do, to provide a framework allowing them to participate in the issue adapted to their abilities and circumstances. This framework needs to be maintained over a relatively long period, which will allow participants to trust the framework, participate responsibly, and continue to learn about the issue by increasing exchanges with other participants. Such participation should not be demanded from everyone, but neither should it left to a small handful of interested volunteers. A society in which a large number of people participate in activities is one in which everyone, as a member of civil society, takes a small step forward for society, and aspires to make today's society a better place.

Afterword

Tadashi KOYABASHI Deputy Area Director

This program began with the hope of getting a clear picture what kind of major transformation science & technology was undergoing in society, and identifying and resolving the issues emerging between those in society who wanted to use science & technology and those experts creating it, in order to build a better relationship. All 12 projects selected for the program had focused on some aspect of this challenge, and I believe that all of them have produced significant results. This report depicts how each project contributed to the program's main mission, and what recommendations could be made in society. Details about each project's efforts have been kept to a minimum (a full analysis of each project is available through a separate report).

There is no need to repeat the details, but the simple conclusion of this program is that for science & technology to be utilized in society effectively, it is important to involve a diverse range of people in society in the process, and at the same time to encourage scientists to take even a small step out from their field of expertise. The significant issues that now need to be addressed are how to support these two groups, and how to provide them with a 'venue' where they can collaborate.

By coincidence, on March 11, 2011, two years before the program was scheduled to finish, Japan was hit by a large earthquake and tsunami, followed by the Fukushima Daiichi nuclear power plant accident. Following the triple disaster, public trust in most expert organizations plummeted. This phenomenon was similar, or perhaps even worse than the BSE outbreak in the United Kingdom in the 1990s, which recorded drops in how much the public trusted their own experts. Currently, one of the issues Japan is attempting to resolve is to regain the public's trust in its experts. Although this was not one of this program's original goals, we felt like we had something to offer, and tied it in with the results obtained by each project.

In finishing this report, it is difficult not to think about the magnitude of the effect 3.11 had on the country. We would like to emphasize how much each project tackled the disaster.

Immediately after the earthquake, information was flying in from different directions, but the Segawa project's Science Media Centre played an important role in filtering the information, collecting opinions from various scientists, and sending all of this information out to the media, making the SMC a trusted source for information.

Also, the 4th Stage Science & Technology Basic Plan that was about to be approved by cabinet before the earthquake was amended to include issues such as regaining public trust in science & technology, explicit mentioning of untouched technology assessments in Japan, and the importance of public involvement in policymaking. The Suzuki, Shiroyama, and Hirakawa projects were already investigating all these issues.

Another interesting point is that fundamental changes were made to energy and environment policies. A diverse range of participants, many of them different from the usual experts, were invited to take part in year-long deliberations, and even a public debate (including public comment, town meetings and Deliberative Opinion Poll) was held to discuss the situation about energy in Japan in 2030. These examples show that big changes are happening in the relationship between science & technology and society.

Unfortunately, these moves made by the Japanese government were not a result of this program's achievements or efforts. One of the reasons is possibly because the government found themselves stuck in the chaos, and made their move without enough preparation or even understanding what their new proposals meant. Another way of putting it may be to say that the government was being narrow-minded. Hardly any government ministry other than our own was aware of our program, and I believe none of them had any interest in it prior to the earthquake.

Even so, the Yagishita project jumped right into preparations for a public debate shortly after 3/11, and even though time was limited, took part in the Deliberative Opinion Poll being run by the government. I would like to take the opportunity to point out that this team was able to use the skills it acquired through this program to organize another public discussion at the same period of time.

In my own opinion, I believe that the significance of the issues this program had looked into had already started to become apparent around 2000. Words such as 'innovation' and 'science & technology nation' were commonly used, and developed countries had already started planning to use science & technology as a basis for sustained growth. This meant that at some point, the issues this program had set would have been obligatory addressed.

The issues this program has investigated are likely to become valuable resources for future investigations into risk communication, or discussions on the public issues concerning science & technology.

This program finishes here, but there are many unanswered questions. I look forward to seeing members from each project use what they have gained through this project to develop something new.

Finally, I would like to extend my gratitude to every person who took part in this program. If it wasn't for your dedication, the results mentioned in this report would not have been found.

The editing committee, headed by the research supervisor, assistant research supervisor, and research advisors, put this report together. I would also like to thank Osaka University Associate Professor Go Yoshizawa for taking part in the committee, and putting together the text of this report. I would like to express my sincere gratitude here.

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Expanding the range of participants and a new role for experts

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