Science and Technology Trends

International R&D Cooperation in Asia

JAPAN

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1. Introduction

International collaboration in science and technology is an effective way to boost research activities in collaborating countries. International collaboration specifically attracts attention in recent years because we recognize the clear evidence that international co-authorship produces academic papers whose quotation rates are higher than papers written only by authors within the same country.

International collaboration in research has, however, taken place where the level of research in collaborating countries is almost equal. This is understandable, since collaboration requires complementary partners who can each contribute. Instantly, we faced a rather difficult problem when we considered the possibility of research collaboration with developing countries, in Asia or elsewhere. This is the reason that in the past there were relatively few international collaborations between developed and developing countries, although the importance of such collaboration was stressed in the political arena.

2. Initiative of the Prime Minister's Council

People sometimes ask researchers to be creative. However, policy makers also have to be creative when they consider new programs.

Japan's highest council for science and technology policy, the Council for Science and Technology Policy (CSTP) chaired by the Prime Minister, acknowledged this problem when its expert members published a document named "Toward the Reinforcement of Science and Technology Diplomacy" in April 2007 and proposed the concept of "science and technology diplomacy", initiating cooperation between science & technology and diplomacy. It was a highly creative idea to foster international collaboration. In a nutshell, the CSTP sought the effects of synergy by utilizing science and technology for diplomatic purposes and utilizing diplomacy for the further development of science and technology. CSTP organized a working group focused on this issue and, in May 2008, it finally endorsed an official document also named "Toward the Reinforcement of Science and Technology Diplomacy". It described the need to strengthen science and technology cooperation with developing countries for resolving global issues in the areas of the environment and energy, bioresources, disaster prevention and infectious diseases.

3. Relationship of Science with Diplomacy

Although I wrote that this was a creative idea, the relationship between science and diplomacy has a long tradition. In what is now the United Kingdom, the Royal Society created the post of foreign secretary in 1723, much earlier than the post of Foreign Secretary of the government, which was established in 1782. In the latter part of the twentieth century, science was sometimes utilized by superpowers to maintain their status at times of cold war. When we investigate the

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concept of science diplomacy, we discover that the concept itself is fluid, still searching for a precise definition. In fact, science diplomacy connotes three dimensions;

- Science in Diplomacy: informing foreign policy objectives
- Diplomacy for Science: facilitating international science cooperation
- Science for Diplomacy: using science cooperation to improve international relations between countries

In terms of the relationship between science and diplomacy, there are some interesting expressions by experts in recent years as follows;

"Science diplomacy is not the same as the use of science in diplomacy" and "Science diplomacy is the use of scientific collaborations among nations to address the common problems facing 21st century humanity and to build constructive international partnerships. There are many ways that scientists can contribute to this process" were the words of Nina Fedoroff, Science and Technology Adviser to the US Secretary of State. The former UK Chief Scientific Adviser, John Beddington, once mentioned that "a diplomat is an honest man sent to lie abroad for the good of his country" and "there is a danger of using the uncertainties in science for diplomatic and political ends".

Having recognized the history and these kinds of relevant discussions, CSTP proposed the idea to realize the synergy of science and diplomacy.

4. Arrangements within the Government

In fact, CSTP proposed that the government consider and produce a new framework of international collaboration that sought the linking and collaboration between science and technology policy and foreign policy. Consequently, it led to the collaboration between two governmental agencies which belong to different ministries: on one side, Japan Science and Technology Agency (JST) which is associated with the Ministry of Education, Culture, Sports, Science and Technology (MEXT), providing competitive research funds for science and technology projects, and on the other side, Japan International Cooperation Agency (JICA) which has a long history of working in the field of official development assistance (ODA) for the Ministry of Foreign Affairs (MOFA). This was a unique proposal in Japan, since it is not common to let two agencies under different governmental ministries work together. The idea was that the linking of the budgets from different sources was needed in order to realize research collaboration between developed and developing countries.

5. Launch of a New Program, Collaboration of JST and JICA

Upon receiving the CSTP proposal, the ministries, MEXT and MOFA, including their subsidiaries, JST and JICA, started to negotiate on how to make this proposal concrete, and finally launched the program called SATREPS, which stands for "Science and Technology Research Partnership for Sustainable Development". The presidents of the two entities, Dr. Sadako Ogata of JICA who was the UN High Commissioner in the 1990s and Dr. Koichi Kitazawa of JST, held a signing ceremony in June 2007.

There are three major features of this program.

First, SATREPS facilitates a linkage of totally different sources of funding for the sake of international joint research cooperation between Japan and developing countries. It challenged administrative people in Japan to think out of the box.

Second, SATREPS aims to address global issues with effects that go beyond borders, through projects

Figure 1 Signing ceremony between JST and JICA

that lead to research outcomes of practical benefit to both local and global society. Therefore, it aims not only to do research, but to bring the research outcomes to market, eventually to be produced and sold by the private sector or to be used in society.

Third, SATREPS is engaged in capacity development, working with developing countries to develop human resources for research and development and to develop sustainable research activities, leading to independent research capacity that can address global issues. It can contribute to resolving issues, coordinating networking between researchers and training future human resources in developing countries and also in Japan.

As obvious, the unique character of SATREPS is that it joins and coordinates functions, activities, and capabilities that were once separate, using scientific research potential as a mediator for developmental diplomacy. This is described simply in the SATREPS publicity booklet as, first, the linkage of science and technology with international cooperation, second, the linkage of meeting global needs with meeting local needs, and thirdly, linkage of Japan's capabilities with developing countries' capabilities. That is why "For the Earth, For the next Generation" is used as the attention-grabbing message for SATREPS.

6. Fields of Collaborative Research

Topics that are adopted as SATREPS projects are global issues that affect more than a single country and cannot be resolved without international collaboration. Examples include environment/energy issues, disaster risk reduction, infectious disease control and food security.

The Environment and Energy field encompasses the broad range of global-scale environmental issues and low carbon society/energy. Caused by climate change, growing population. expanding cities, and increasing consumption, there are growing needs, both locally and globally, to pursue research into technology that can resolve environment and energy problems, and to deploy the outcomes of such research. In order to reduce global emissions, it is essential that both developed and developing countries take part in the efforts to achieve a low carbon society.

Natural disasters are a constant danger in Japan, and have resulted in the accumulation of a great deal of knowledge and expertise. In addition to applying this knowledge to disasters and risk reduction in developing countries, collaboration is urgently needed to make further progress in research into earthquake/tsunami early-warning systems and high-precision weather forecasting.

HIV/AIDS, malaria, dengue fever, tuberculosis, highly pathogenic influenza, and other emerging and reemerging infectious diseases can be a major impediment to social and economic development. Efforts to address infectious diseases issues in developing countries can have a direct benefit in protecting the health of individuals worldwide. Collaboration between Japan and developing countries on research in this field contributes to the control of infectious diseases on a global scale.

Sustainable production of food and other bioresources is threatened by problems such as desertification, salinization of agricultural land, and pests, as the global population grows and climates change. In order to continue enjoying the blessings of bioresources, there is a need to facilitate collaborative research that can point the way to sustainable means of production and utilization.

7. Eligible Proposals and the Process Leading to Adoption

For a proposal to be eligible for the SATREPS program, there should already be a good relationship between the Japanese researchers and the developing country researchers. New topics are solicited every year. To file an application, a proposal from the Principal Investigator (PI) of the Japanese side should be submitted to JST, and an official request for ODA technical cooperation from the research institution in the developing country should be submitted to MOFA via the ministry or agency in the developing country responsible for ODA technical cooperation. These documents should be submitted before the common deadline and the content of the proposal should be consistent.

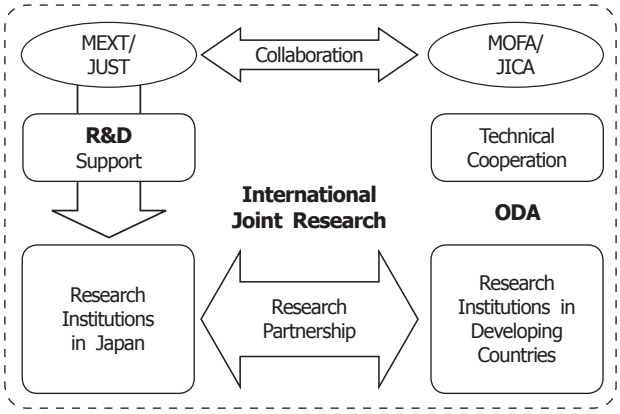

Figure 2 SATREPS Program Structure

In the SATREPS scheme, JST concludes research contracts with research institutions in Japan to support research costs incurred in Japan. In parallel, JICA provides support through its technical cooperation project framework to cover costs in the developing country. Duration of a project is in most cases five years. The annual research funding from JST and JICA for a single project is approximately 100 million JPY (about $ 1m) in total.

8. Human Resource Development Through MEXT Scholarship Program

To assist the SATREPS program, MEXT established a "Global-Issue Section" within its Japanese government scholarship program (university recommendation) for SATREPS projects. The aim of the Global-Issue Section is to develop young researchers with the potential to be future key players in relevant research in their own countries by taking a doctorate at a Japanese institution. Invitation for this Japanese government scholarship program is implemented by MEXT, and the scholarships are budgeted separately from the SATREPS budget. To be eligible for this program, a doctoral degree needs to be received within the term of the SATREPS project.

Since it is critically important to cultivate the next generation of human resources. I hope this MEXT program will be effectively utilized by partners of SATREPS projects.

9. Development of the Program

At the first solicitation for the fiscal year 2008, twelve projects were selected. Six of these projects involved partnerships in Asia: three with Thailand, two with Indonesia, and one with Bhutan. Their topics covered a diversity of the research fields.

After that, additional SATREPS projects have been added to the list, taking up between nine and twenty proposals each year. From 2008 through 2013, a total of 78 projects were adopted. Out of them, 41 projects are with Asian countries, and collaborative topics with African nations are also increasing.

The period of a research project is set for between three and five years, but mostly for five years. However, even at the beginning phase, a SATREPS project should take into account how to continue this project beyond the five years' period to bring its

Table 1 SATREPS projects (FY2008 – FY2013)

Research Areas	Region			FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
	Asia	Africa	Others						
Environment/Energy (Climate Change)	41	20	17	4	4	0	-	-	-
Environment/Energy (Low Carbon Society/Energy)				-	-	4	3	2	1
Environment/Energy (Global Environment Issues)				3	2	4	1	2	3
Bioresources				-	6	5	2	3	1
Natural Disaster Prevention				3	4	2	2	1	2
Infectious Diseases Control				2	4	2	2	1	3
Total				12	20	17	10	9	10

results to the final realization in the market or society. For this reason, stakeholders who will be eventually able to support this realization, such as next phase funding agencies, venture capital, and interested private sector entities, are welcomed to take part in a project through any form of collaboration. In this regard, a hand-over period needs to be incorporated into exit strategy plans. In the figures below, this is marked "Baton Zone", using the Japanese language term for the exchange zone or passing zone where the baton is passed from runner to runner in a relay race. Figure 3 depicts the exit strategy where the target is a market.

One example is the collaboration with Thailand in the "Innovation on production and automotive utilization of biofuels from non-food biomass" project, which started in 2009, aiming at reducing CO2 emissions with vehicle biofuel made from nonedible vegetable oil. Biofuels are already common automotive fuels in Thailand. The utilization of biofuels in the transportation sector could help mitigate global warming, but because of the risk that production of biofuels derived from grains or vegetable oil will compete with food crops, there is a demand for manufacturing technologies that exploit nonfood sources of biofuel. For this project Waseda University of Japan is cooperating with Thailand, which is becoming the automotive production hub of Asia, to develop production technologies for fuels from Jatropha, an inedible plant. The main project partner is Thailand's National Science and Technology Development Agency, NSTDA. The Japanese side is conducting engine tests and developing the automotive utilization technologies, as well as estimating CO2 emission reduction benefits through life cycle assessments. Private sector entities in Thailand are already involved in this project. Isuzu Motors Co. in Thailand contributed to the project by providing a car to drive long distances to gather data for assessing usefulness. The Thai national petroleum company is also contributing. Production at pilot plant scale (1 ton/day) is already successfully manufacturing high quality biodiesel from Jatropha oil. It is hoped that a large demonstration plant will be built after approximately ten years' time.

Figure 4 depicts a different exit strategy for public goods. Here, the target is public dissemination.

This model applies, for instance, to another partnership with Thailand, the "Research and development of therapeutic products against infectious

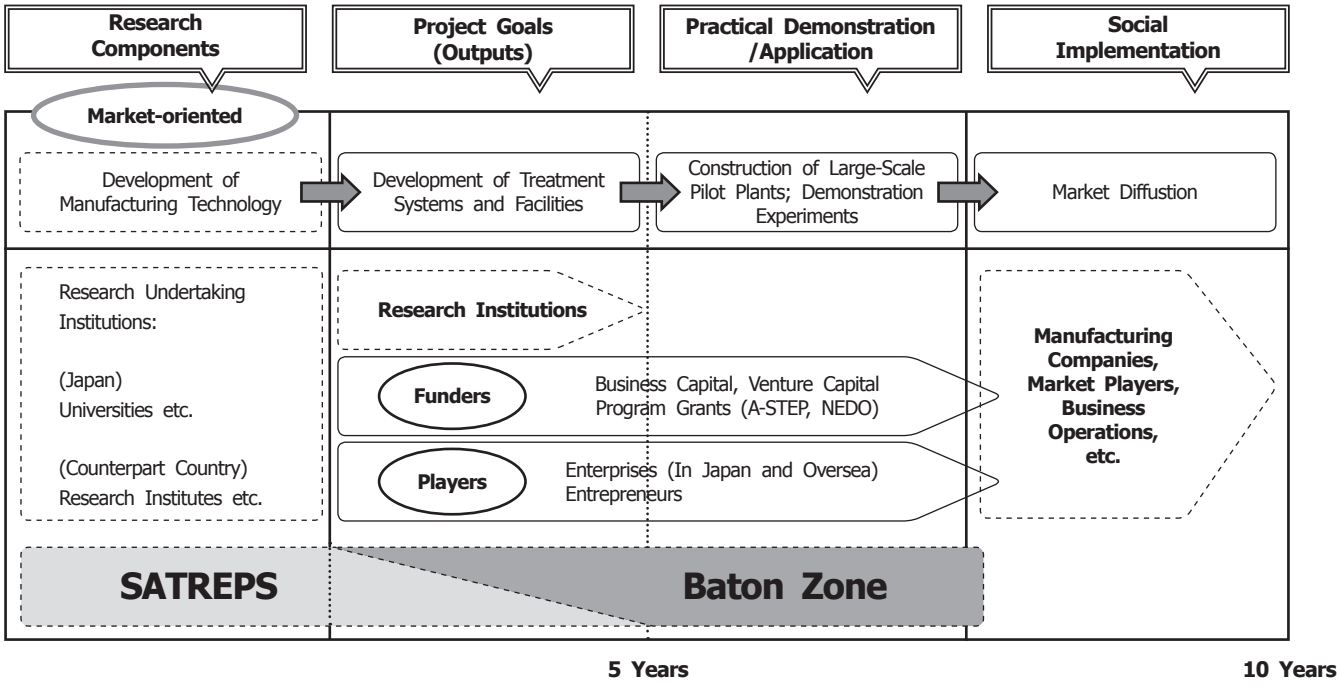

Figure 3 Exit strategy (Target-oriented): Market goods

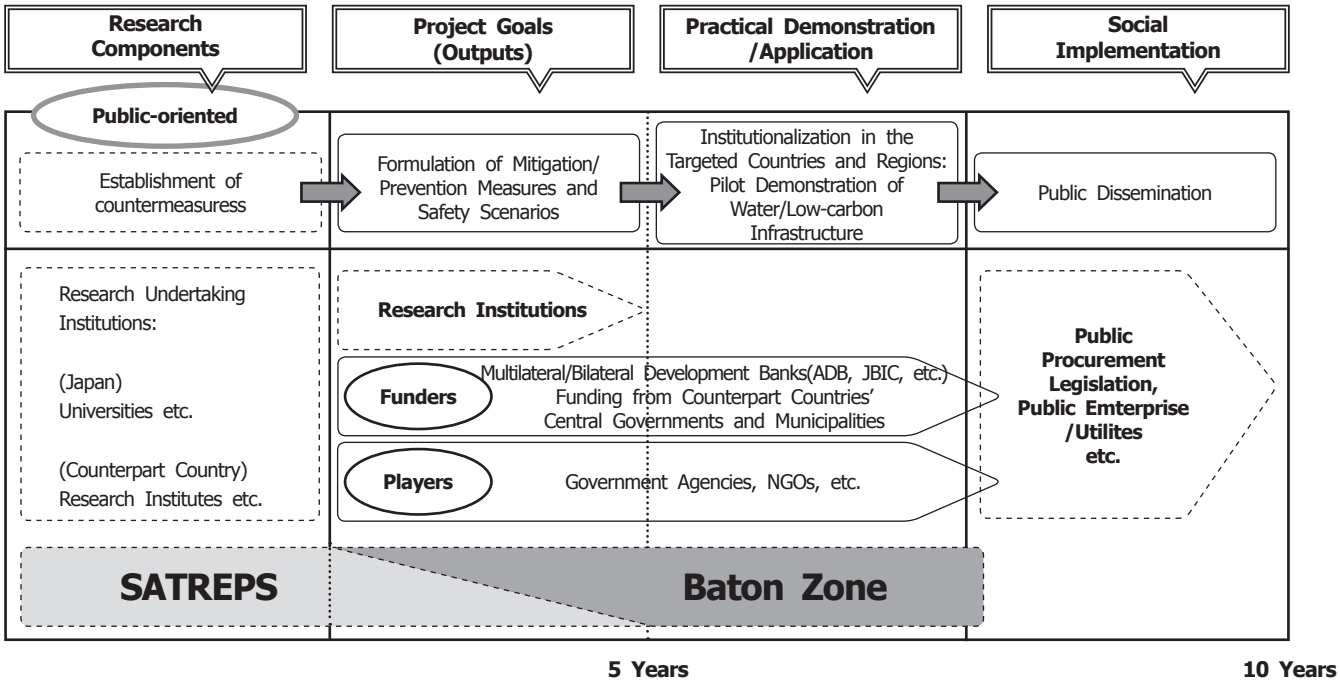

Figure 4 Exit strategy (Target-oriented): Public goods

diseases, especially dengue virus infection" project, aiming at creating drugs effective against the Dengue virus from human beings.

With Indonesia, a good example is "Pilot study for carbon sequestration and monitoring in Gundih area – Central Java Province," a project that was adopted in 2011. The mission here is to resolve CO2 emissions problems associated with natural gas production. This problem can be resolved by creating a system for carbon dioxide capture and storage (CCS) technology in which the CO2 is sequestered underground as a means of directly reducing CO2 emissions. This CCS facility, which might become the first plant in Southeast Asia if successful, is currently under development.

10. International Ramifications

The features of this program were really unique. Consequently, it influenced the US to launch a similar program in 2011, the "Partnerships for Enhanced Engagement in Research (PEER) Science" program. This is a partnership between the U.S. Agency for International Development (USAID) and the National Science Foundation (NSF). The occasion of a panel discussion at the Annual Meeting of the AAAS (American Association for the Advancement of Science) provided a good opportunity to compare the two programs and to benefit from each other's experiences.

Moreover, this topic of a new way of collaboration between developed and developing countries was also raised in the OECD (Organisation for Economic Co-operation and Development) arena. That was at the Global Science Forum (GSF), one sub-committee of the OECD's Committee for Science and Technology Policy. GSF consists of almost all OECD delegates, including Japan and Korea. It takes place twice a year. GSF delegates consist of senior government officials together with people from funding agencies and academia. GSF is operated on a bottom-up system: Topics are raised by member delegates, and if other delegates show their interests in the new proposal, then the topic will be taken up as an agenda item for studying, usually for a two-year term. A topic concerning pursuing collaboration between developed and developing countries was raised by Japan in 2008 and then taken up as a formal topic of OECD GSF, led by Japan and co-chaired by South-Africa

and European Union. The topic was "Opportunities, Challenges and Good Practices in International Research Cooperation between Developed and Developing Countries". Its rationale was as follows;

Global issues (e.g., environmental protection, energy security, natural disaster mitigation, preventing and curing infectious diseases, ensuring food security) are increasingly the subject of policy-level deliberations, both nationally and internationally. Cooperation between developed countries and developing countries is of special importance, because developing countries are often the ones most severely affected by global threats, and because they possess much of the expertise, data, and resources that are needed for finding effective solutions.

Concluding the rationale part, the report describes as follows;

The activity focused primarily on cooperative research programs and projects that:

- Combine elements of ODA (targeted at "global issues" such as the UN Millennium Development Goals) with scientific research aimed at discovering new knowledge; and
- Are intended to be true partnerships between developed countries and developing countries, involving significant sharing of responsibilities, activities, resources and outcomes.

Interested delegates offered their data about a total of twenty-nine past or ongoing programs and projects.

The final report of the GSF on this issue was published in April 2011. It enumerates important issues and options, covering the major aspects of collaborative research, notably:

- Achieving an optimal balance between the imperatives of research (bottom-up initiatives, peer review, etc.) with top-down strategic development priorities;
- Developing human capabilities, national science and technology capacity, and expertise in science policy;
- Promoting co-ownership of the outcomes; applying and tranferring results of joint research to local communities or industries in both developed and developing countries and to society in general;
- Evaluating the outcomes using appropriate methodologies and indicators;
- Coordinating and harmonising programs and projects among developed countries and developing countries.

Specifically, this report includes many hints for enhancement of international collaboration with developing countries. For instance, in terms of capacity building, it suggest that a program emphasizing individual capacity building may include:

- Development of individual, as well as institutional, capacities for designing and implementing research programs, including peer review processes, solicitation and communication with researchers
- Development of non-scientific skills that are relevant to research. In some cases, these are particularly important for young scholars in developing countries.
  - Language proficiency, especially English
  - Paper writing (from applications for research grants to publications in scientific journals)
  - Communication with policy makers (e.g., policy briefs)
  - Communication with the general public and the media
  - Personal career development
  - Research management (organisational, financial, personnel, etc.)
- Scholarships (for higher education, including for studying abroad) for students of both developed countries and developing countries)

After having publicized the report on this issue, the GSF still continues the work to seek to refine and expand the earlier findings by taking a detailed look at an important scientific domain, namely, the area of climate change adaptation and biodiversity. Two workshops have already been held in Singapore and in South Africa, and I am looking forward to some constructive recommendations in this regard.

11. Conclusions

The world of the 21st century is changing. The change derives from factors such as globalization, population growth, climate change, environmental degradation, and the quest for better life. Each

country is therefore facing new issues nationally and internationally. Asian countries are also facing critical issues, which sometimes can only be solved by collaboration with other countries.

Japan recognized that there were enormous mutual benefits in collaboration with countries in Asia, and outside Asia, in the field of science and technology. The issue here is that we need to devise appropriate tools to exploit them. The new way of collaboration was a clever idea, utilizing the linkage between science and technology and development aid. From our experience since 2008, we have seen that "SATREPS" is operating successfully. This new program also had an impact on the new program in the U.S. and in discussion at the OECD level.

People are often inclined to think within the box. Social systems are usually structured rigidly and are not easy to break it down. However, the world's financial and even human resources are limited. People in the government or funding agencies need to be clever and create brilliant new systems or improve current systems to pursue more social benefits for the globe through creative collaboration among nations, especially between countries in Asia. I am confident that we are clever, and convinced that we will be able to do this.

12. References

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