

## Part III: Concrete Proposals for Establishing the GIES

### Tateo Arimoto

I will act as moderator for the third session, “Concrete Proposals for Establishing the GIES.” I would like to invite the four contributors to offer comments on how the global issues raised during the discussions could actually be solved.

### Introduction of Strategic Proposals

#### Kazunobu Tanaka

Principal Fellow, Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST)



I will speak about effective utilization of natural energy. Japan's technical capabilities can be applied to overcome the natural energy utilization issue. Japan is scarce in natural resources, but it can become an exporter of cutting edge technologies.

Another goal is development of energy supply systems using the natural power of solar and biomass energy, or renewable energy as key energy sources for a low-carbon society for the future. The expected achievements are utilization of natural energy with high energy conversion efficiency, and realization of a balance between reducing greenhouse gas emissions and securing an energy supply in the world.

Three things are required for this purpose: an international taskforce to discuss technology systems and joint projects to promote the spread of natural energy technology; a research alliance in technology mechanism with a view to focusing investment development of groundbreaking alternative energy technologies; and creation of a network of designated model eco cities in each country geared toward unique local cultures and lifestyles, providing a springboard for international projects.

Japan should take initiative towards a low-carbon society in a citizen-wide movement in order to promote a low-carbon society in the international arena and offer a dream to the

younger generation.

There are a number of key technologies: high-efficiency PV cells; R&D for commercialization and cost-effective manufacturing processes, imitating the photosynthesis of plants; new, non-edible biomass technologies; and utilization of aquatic and marine organisms and microbes.

#### Kunihiko Niwa

Senior Fellow, Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST)



In CO2 emissions 20% comes from the transportation sector. The goal is to reduce this, but an expected increase of cars and vehicles in emerging countries is a problem that must be tackled.

Reducing emissions by focusing on automobiles alone would be difficult; rather, we need to have a broader perspective, for instance on the optimal combination private and public transportation. This will involve city planning and creating the landscape of a country. In the international setting, three issues must be taken into consideration: a grand design for a global transportation system; monitoring traffic volumes, and exchange of environmental data; and technology to enable us to realize these schemes.

The timetable will run as follows. By 2015, propose a draft of the grand design for a new transportation system by creating an international consortium. By 2025, do a demonstrative test and finalize the design. By 2030, create a special experimental zone, and achieve worldwide adoption of new transportation systems by 2050. The situation will change as the years go by, and changes will need to be incorporated. The key technologies required are electric vehicle technology, fuel cell vehicle technology, and transportation system technologies.

**Kotaro Inoue**

Principal Fellow, Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST)



I would like to speak about water-related issues. Currently there is a safe drinking water shortage; water shortages also contribute to agricultural and food shortages. The goal is to create a world where sufficient quantities of quality water are available for life, agriculture and industry by clarifying water allocation plans, and with high-performance water processing systems.

It is possible to reduce environmental pollution and disease through appropriate treatment of sewage and wastewater. Water disaster should be minimized so that all people can live safely and healthily, surrounded by clean lakes, rivers, greenery and coastline.

An international scheme is needed to achieve this vision and the target date of 2025 for water usage plans. In addition, there should be a database to promote advances in technology for forecasting water cycles, and an international task force to address these specific projects. There should be collaborative research between those regions with water shortages and developed nation to develop regionally appropriate technology networks and systems. In Japan, the key technologies lie with universities and private companies. The public and private sectors should collaborate with each other and contribute to international society, strengthening the technology and establishing an industry that can apply such technologies.

**Kayano Fukuda**

Associate Fellow, Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST)



The goal is to promote science and technology innovation in Japan for global production of value-added food suited to consumers for a stable supply. A production platform that is appropriate to each region should be established through international allocation of tasks among technology providers and food producers. Japanese technology should be appropriately transferred to Asia, South America and Africa. By 2050, we want to transform Japanese agriculture into an export-based industry.

To this end, agricultural engineering should promote international exchange. Agricultural visions on an international, global basis should be established, as should an international framework for IP rights licensing and an international resource recycling system. Based on international collaborative research results, the expected achievement is extension of healthy life, sustainable environmental protection and enhancement of consumer trust.



## Approach of Ministries and Government Offices

**Kimikazu Iwase**

Deputy Director-General, Science and Technology Policy Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)



MEXT is in charge of education as well as science and technology, including basic and fundamental research or larger projects. When talking about sustainable development, people tend to think about physical or material types of development; therefore the world “sustainability” is preferable. How can the GIES be created, and what is the role of the public sector?

Input into the GIES should be knowledge creation. What input can the public sector provide? Evidence-based policy is needed. MEXT has projects observing the earth using satellites and systematic observation systems. Japan alone cannot observe the entire earth; an international network is needed. Based on the observed data, we have to forecast climate change. The goal is to mitigate the negative changes or adapt to unavoidable changes. We need mitigation as well as adaptation.

It is clear that business as usual will not allow for achievement of the goals of Cool Earth 50; some kind of breakthrough is needed for better conversion efficiency, innovative materials, or extension of reliability and life. The private sector cannot achieve such a breakthrough independently. A social system or institution is also needed in addition to scientific technology.

There are two levels to human resources and education. We need education for sustainable development, such that every citizen is aware of the concept of sustainability and the sense of value or ethics required of each citizen. The second level is the need for experts who can deal with the science as well as the social aspects.

In terms of international cooperation, particularly with the developing economies, we need joint research to create effective solutions rather than simply transferring existing technology by ODA. Japan wishes to transplant expertise into the developing economies as well; therefore from next fiscal year Japan will link science cooperation with ODA. There are many research institutions, and MEXT believes they should

introduce new technologies through public procurement.

**Keisuke Saito**

Director, Industrial Science and Technology Policy and Environment Bureau, Industrial Science and Technology Policy Division, Ministry of Economy, Trade and Industry (METI)



METI is often engaged with business people and companies that are conducting R&D. In the past, targets were clear and policies could be extracted from them easily, but the situation today is more complicated. Japan outsources a relatively small amount of its R&D and innovation. Companies have remarked on the difficulty of commercializing their innovations, and on the need for an improved environment. Technology innovations must be demonstrated to society to gain acceptance. Therefore METI would like to see a demonstration of GIES at the social level, and a sharing of the vision. If we first share a vision for the future of society, “international competitiveness” comes down to the issue of how we can contribute to that vision. Companies should be encouraged to do what they can do best to this end.

## General Discussion

**Tateo Arimoto (Chair)**  
Director-General, Research Institute of Science and Technology for Society (RISTEX), Japan Science and Technology Agency (JST)

**Chad Evans**  
Vice President, Strategic Initiatives, Council on Competitiveness

**Jean-Philippe Touffut**  
Secretary General, Cournot Centre for Economic Studies

**Monthip S. Tabucanon**  
Director General, Department of Environmental Quality Motion, Ministry Of Natural Resources and Environment , Thailand

**Takeshi Saito**  
Managing Director, Industrial Growth Platform, Inc.

**Yasuo Nishiguchi**  
Advisor, KYOCERA Corporation

**Masahiro Kuroda**  
President, Economic and Social Research Institute (ESRI), Cabinet Office, Government of Japan

**Yuko Harayama**  
Professor, Graduate School of Engineering, Tohoku University

**Kimikazu Iwase**  
Deputy Director-General, Science and Technology Policy Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)

**Keisuke Saito**  
Director, Industrial Science and Technology Policy and Environment Bureau, Industrial Science and Technology Policy Division, Ministry of Economy, Trade and Industry (METI)

**Mari Jibu (Rapporteur)**  
Senior Research Fellow, 1st Policy-Oriented Research Group, National Institute of Science and Technology Policy (NISTEP), Ministry of Education, Culture, Sports, Science and Technology (MEXT)

T. Arimoto



I would like to invite the panelists to make comments on the framework for international collaboration. Over time, innovation systems have moved to the national level, the regional level, and now the global level. There are multiple inputs, including knowledge or human resources, infrastructure, and capital, and then demand from the market and society. I look forward to hearing the various innovative ideas.

Y. Harayama

People are the true essence of the ecosystem; no matter how rules, organizations, or bodies, are set up, people must operate it. Economists look to human capital to improve qualitatively and quantitatively. The kind of human resources we want are people who think for themselves and take actions as an active member of society.

Japan's post-war education system is already encountering its limits. Universities are always blamed for not producing well trained human resources, but society as a whole needs to foster its people to be able to think and reason on their own and be active as social and global citizens. We need to come up with a vision of what should be and then create a social system to promote that. In order to cultivate such human resources there must be investment in technology, but also in people.

T. Saito





I work to revitalize corporations, using national funds, governing companies from a capitalist point of view and sometimes engaging as one of top managements. Technology-driven large publicly held companies tend to reduce long-term and large investment because the stock market expects profit in the very short term. Also venture capitals began decreasing long-term investment. Therefore it is significant to create mechanism by which patient risk money is provided in such industry sectors. Institutions which need long-term risk money should satisfy investor's requirements. Patient, high-quality risk money requires a focused business portfolio, strong management team which is committed in the long-term, and appropriate governance structure.

Some institutions require very long-term risk money, but venture capital has a shorter term perspective. One solution is sovereign wealth funds. Japan needs a sovereign fund, which would allow it to make contributions globally. Wise management of such a fund may be able to reduce the country's deficit. Attracting patient, high-quality risk money requires a focused business portfolio and a manager who is committed in the long-term.

#### **Y. Nishiguchi**



If the current situation continues, humans run the risk of exceeding the capacity of the globe. There is not much time left, and the globe as a whole needs to take action. Activities need to be conducted on a global scale. There are optimum solutions for each country and for each region. We need to have 100% participation in a way that is appropriate for each region and each country. The results that we create as a whole should be used as feedback.

#### **K. Iwase**

There must be sufficient input from science and technology into the ecosystem. Quality research and researchers are needed, and the needs and demands of society must also be understood. Establishing goals first and linking them backward to research is an important role of public sector.

#### **K. Saito**

As new services are made available to society, the government role on the national level will to be a sort of coordinator of rules and regulations. Internationally it can contribute to harmonizing those rules.

#### **C. Evans**

There is the concept of local versus global in terms of risk and opportunities. The discussions today have made clear that global risk is on the rise, and a global innovation response is needed. Secondly, regional economic development and innovation is still most likely an appropriate way to think, organize, and act, but how do we reconcile this global versus the local? Global urbanization is one the rise, which will have a transformative effect on the world. Megacities will be particularly susceptible to water challenges from climate change: floods, food disruptions, pandemics.

Eco-cities had been mentioned as a potential goal for Japan, but such cities have already been built in areas such as the Middle East. Japan, Europe, and the US must react to this and determine how to engage in this movement.

#### **J. Touffut**

There has been diversity in the many proposals presented throughout the day. I urge participants to maintain a certain distance from economists, not allowing them to choose innovation models for scientists.

I admire the understanding of the challenges displayed by Mr. Iwase of MEXT, saying that the ministry's understanding and approach to the issues could be a good example for Europe. Japan's promotion of open science as described by Mr. Saito of METI is also very positive and there is evidence showing it would lead to economic success; although this trend is growing in the US as well, it has not yet emerged in Europe.

Imported French water is being served on this occasion, and the energy costs per bottle is so high compared with tap water. Although consciousness of ecological issues in Japan is high, the country faces complete population depletion if current demographic trends continue. I urge Japan to preserve its human cultural and linguistic biodiversity.

#### **M. Tabucanon**

The global innovation ecosystem is both vital and profoundly challenging. The key factor to creating an innovative society is change. Three challenges stand out: decarbonising the world economy; committing to justice and equity; and conservation of life and the biosphere. Global metabolism at present is characterized by unsustainable high levels of energy use and high material throughputs. The idea of a transition to sustainability is a direct challenge to existing patterns of consumption, mostly in the wealthy countries.

There is growing disparity in access to energy as prices rise and populations increase. High energy prices will be a driver of change in the 21st century. This will drive changes in the technology of cheap carbon plastics and transport. There are also huge challenges in providing mobility, transport of goods, and housing within new boundaries of energy availability.

Technology development is critical to decarbonisation. The need for low energy, low cost, but comfortable dwellings for the world's urban poor is a vital challenge. The potential negative impacts on land rights and food production of

the poor of first generation bio fuels have been recognized. The second generation fuels are more hopeful, although the energy costs may not be positive. Hydrogen offers a means to maintain existing transport systems, but with a huge energy cost. The challenge is to put together chains of debate and action to link citizens, governments, and business consumers, regulators and producers. It is important to find innovative ways to finance the transition to a low carbon economy and maintain the metabolism of the world economy. Public-private partnerships are likely to be important. Carbon taxation has a major role to play in ensuring that the costs of production come to reflect the carbon density of manufacturing, transport, and sale. In measuring innovation, all stakeholders need to identify their needs and set up goals and vision.

**M. Kuroda**



There is a common understanding that innovation is indispensable, but innovation includes technological innovation as well as innovation in social systems. What GIES proposes is to communicate by interactions between fields. We must define what innovation is and how to measure it at the outset. When there is innovation, does it really lead to economic growth and economic prosperity? Measuring innovation in the international arena requires a common type of measurement system or framework. Japan has yet to incorporate US and European discussions on innovation management. In establishing GIES, specific measurements and assessments of innovation ought to be considered.

**T. Arimoto**

Japan is behind Europe and the US in terms of measuring innovation.

**Mr. Koji Omi**

Sustainable development is the major issue for humans. The solution will require promoting peaceful usage of both nuclear fission and nuclear fusion, while meanwhile tackling the associated safety issues. Nuclear energy will provide electricity which can also be used for fuel-cell automobiles, important given the current extremely high cost of oil. At present, oil producing companies attract large amount of money, while oil consuming countries bear the cost. Alternative energies to oil, including nuclear fusion and nuclear fission, must be utilized.

Energy must also be made available for the transportation sector. Continuous efforts and innovation must be made to achieve technological developments and a social and political framework that will respond to that need.

**T. Arimoto**

I would like to open up the floor for comments and questions.

**Floor**

What challenges are there in supporting creative human resources? Innovation pools within companies are closed. Opening these close pools is a major challenge for creating the innovation ecosystem.

**Floor**

What are the limits of PV energy? What is its potential to exacerbate climate change? In terms of nuclear energy, as Mr. Omi mentioned, it will not be feasible if there is no solution to the issue of radioactive waste. In Japan nuclear energy is losing popularity due to criticism of fuel recycling and a series of mistakes and failures in plant operation. Therefore the amount of training on the topic available in universities is decreasing. Long-term investment is needed in human resources in this area.

**Floor**

Much of the discussion of “global” innovation during the day’s discussions has in fact referred only to Asia, Europe and North America, to the exclusion of Africa or Latin America. It is important to note that highly mobile human capital is not coming from the developing countries; the brain drain happens from the developing countries, which has a direct impact on the innovation processes. At the previous STS Forum it was shared that 50% of the innovation that was taking place in R&D in the US was actually done by non-US citizens, many from developing countries. Meanwhile, developing countries are struggling with the issue of innovation and what kind of institutional mechanisms are needed to insure innovation and new product development.

**T. Arimoto**

Would the panel members on the stage please respond.

**Y Harayama**

Educational processes are rarely one-way, but involve exchange of information and mutual learning between the parties involved. The term technology transfer often used to describe relations between industrialized and developing countries implies a simple one way transfer, but in fact it should be thought about in broader terms as a collaboration, both in technological and social knowledge.

**Y. Nishiguchi**

Supporting creative individuals is important, but at the corporate level my research shows that there is very low utilization of researchers. The mechanism of how innovation with science and technology can be made useful to the society is very important and lies in the fundamental matters of the questions raised.

**Floor**



I would like to raise the issue of addressing BRIC markets. Some Japanese companies are already serving the South African market, and Japanese companies are increasingly turning to BRIC markets in order to grow. Japanese companies need to rethink their notions of conventional markets and look at the real emerging markets.

**T. Saito**

Speaking from my experience in the IRCJ, human resources and chemical reaction in the organization are important, but there is a tendency in organizations to look inward when trying to sustain an organization. Innovation works in the opposite way. In order to be outward-looking, mindset, incentives and creation of chemical reaction in organizations are important. Resources that go for external innovation should be rewarded. Companies came to the IRCJ because they were having difficulty in breaking down their organizations on their own. Not only the market mechanism, but also rules and governance that allow organizations that cannot develop innovation to be broken down are needed.

**C. Evans**

I do not mean to exclude regions other than Asia or Europe from discussion in considering innovation. In fact, Innovation America findings show that innovation is increasingly consumer-driven, and the trend from the US perspective is that most consumers of US innovation and US goods come from the rest of the world. The US private sector is especially attuned to opportunities abroad, including collaboration in the development of new products and services. Experience has shown that it is not possible to exactly replicate innovation models, as there are different social logics in different areas. Nevertheless there are certain common threads, which GIES has an interesting opportunity to begin to understand.

**J. Touffut**

I agree with Mr. Evans, but disagree with Dr. Kuroda and some of the underlying themes of the entire discussion. The premise of the discussion assumes that innovation, whether science or industry led, is the only way out of the looming crisis. This may not be the case. If we continue to think in the anthropocentric manner of economists, the model we propose is not likely to differ greatly from the US model. It is important to think differently, in terms of biodiversity. South Africa is a key example of a nation rich in biodiversity that is caught up in the Western economist ways of thinking about wealth. We run the risk of losing this wealth by failing to appreciate it.

**M. Kuroda**

I do in fact agree with Dr. Touffut. Neoclassic economics focus on the economic perspective in a simplified manner, considering them homogeneous, when in fact the world is large and contains diverse social systems. Economics should be reorganized, and the reorganization should involve discussion with people from other disciplines. In addition, system innovation and the development and enhancement of technology should be in line with consumer needs. It is necessary to reflect on whether Japan's universities meet in their educational curricula the needs of the university consumers, and whether bureaucrats really work for the

fulfillment of user needs?

**T. Saito**

While bio fuels have reached a certain level of development, there is a need to share additional information. Energy use in each sector should be considered, including solar and nuclear energy, although waste-related, safety, and security issues need to be resolved.

**K. Iwase**

Regarding the issue of human resources and international collaboration including Africa, we need to promote their international mobility both to and from Japan.

**M. Tabucanon**

All stakeholders and all regions have to be involved in the formulation of innovation, and that the needs and financial means of the majority of people in the world should be considered.

I am aware that Dr. Kuroda agrees with me, but wanted to highlight certain underlying contradictions. My thanks to all participants for the high level of debate throughout the day.

**C. Evans**

I sense a high level of creativity each time I visit Japan. I am optimistic for Japan's future.

**T. Arimoto**

New keywords from this meeting will be incorporated into the GIES concept. Science and technology investment and knowledge must be increased; human capital is important, as are creativity, education, and measurement. Cross-border sectoral partnerships have been promoted, but must be expanded. Finally, social values and economic values do not exist separately; social economic value, a merging of the two, is also important.

When you return home, always think about and be aware that you live in a global society, and think about policy and corporate strategies in your daily lives.