REGIONAL COLLABORATION IN SCIENCE AND TECHNOLOGY IN ASIA
THE INTERNATIONAL POLICY DIALOGUE

Sains dan Teknologi

அறிவியல் மற்றும் தொழில்நுட்பம்

Science and Technology

科学与技术

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PREFACE

Introduction

This is a record of the International Policy Dialogue on Regional Collaboration in Science and Technology in Asia held on December 15 and 16, 2011, at the National Graduate Institute for Policy Studies (GRIPS), Tokyo.[1] The Policy Dialogue was co-organized by the Takeda Foundation, GRIPS, the Japan International Cooperation Agency (JICA), the Japan Science and Technology Agency (JST), and the Engineering Academy of Japan (EAJ), and supported by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Cabinet Office, the Ministry of Economy, Trade and Industry (METI), and the Ministry of Foreign Affairs (MOFA). The Policy Dialogue involved two workshops (I. Regional Development of Human Resources and Brain Circulation; II. Regional Collaborative Research and Research Infrastructure) and an International symposium to discuss the general merits and interests of an Asian regional collaboration based on the discussions at the workshops.

The Policy dialogue enjoyed the participation of 10 representatives from science and technology community, profit and non-profit sectors, and governments of 9 Asian countries including India, Indonesia, Singapore, Thailand, Malaysia, Laos, the Philippines, Korea, and China. In addition to Asian participants, representatives of the National Science Foundation Tokyo Office and the Delegation of European Union in Japan also joined the dialogue. The Workshops were held with 31 participants from overseas and Japan, and 33 observers. The workshop explored various challenges and possibilities of regional collaboration in science and technology including the regional development of human resources, the facilitation of the free movement of young researchers and students, promotion of innovation in the region by complementing essential conditions of technology, human resources, and grants within the region, multilateral collaborative research, and the development of international open innovation research centers in the region. The workshops produced fruitful suggestions which are summarized in the discussion paper.

The International Symposium on the regional collaboration in science and technology in Asia had more than 130 civil participants. The Symposium enjoyed the participation of such eminent figures as Mr. Masaharu Nakagawa, Minister of MEXT, Mr. Kenzo Oshima, Advisor of JICA , Dr. Masuo Aizawa, Executive member of the Council for Science and Technology Policy of the Cabinet Office, Dr. Dong-Pil Min, former President of Korea Research Council for Fundamental Science and Technology, and Mr. Yoshio Akamatsu, Senior Managing Executive Officer, ITOCHU Corporation.

Mr. Nakagawa discussed the international rankings and competitiveness of Japanese universities, and the Japanese initiative of regional collaboration in science and technology in Asia as a means of integrating Japan into Asian economic growth... Mr. Oshima talked about JICA's efforts of international cooperation in science and technology and its future challenges as a representative of one of the co-organizers of the International Policy Dialogue in Science and Technology in Asia. Dr. Aizawa explained the 4th Basic Plans of government's science and technology policy based on the issue-driven method. Dr. Min discussed the trend of brown economy based on fossil fuel to green economy based on renewable energy, and the necessity for the development of appropriate technology. Mr. Akamatsu explained Itochu's human development systems and placed stress on the development of global human resources. After the opening remarks and keynote and invited speeches, the symposium organized a panel discussion and the Asian representatives discussed the challenges and possibilities of human resource development, regional collaborative research and research infrastructure with civil participants of the floor. The essence of the discussion is summarized as "Overview" by the Secretariat of the Policy Dialogue.

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[1] The International policy dialogue is supported with a grant from Strategic Funds for the Promotion of Science and Technology program, MEXT.

The discussion paper and the overview have been endorsed by all the participants of the workshops and the panel discussion of the International Symposium on Regional Collaboration in Science and Technology inn Asia.

Secretariat of the International Policy Dialogue on Collaboration in Science and technology in Asia

Discussion paper

The discussion paper is a summary of what was discussed at the workshops. Based on the discussion paper, we will plan themes for the next international policy dialogue or take some actions to implement what was suggested.

- The majority of the workshop participants agreed upon the necessity of regional collaboration in science and technology in Asia.

- It was pointed out that it is necessary to develop some frameworks to facilitate the free movement of young researchers and students across borders within the region in order to promote the regional development of human resources. Such frameworks would involve the special arrangement of visas and support of transportation costs for young researchers and students. The development of an international fund through public-private collaboration was suggested as a possible mechanism to facilitate the free movement of young researchers and students across borders in the region.

- However, it was also noted that the free movement of young researchers and students across borders might cause brain drain from one country to another, and lead to a maldistribution of human resources in the region. Some measures need to accompany the framework for free movement to attenuate the maldistribution of human resources in the region.

- It was pointed out that there is a severe shortage of medical professionals, including doctors and nurses, in the rural areas of some countries that provide medical professionals to foreign countries. It is necessary to adopt certain measures to balance the domestic and international provision of medical professionals in such countries.

- It was pointed out that the linkages between universities and industry, and between universities and government should be strengthened to promote human resource development in the region. For certain countries there are distrust and misunderstanding between universities and industry, which are mostly due to communication gaps. It is necessary to strengthen communication between universities and industry.

- It was pointed out that there are ever growing markets in the region, and that that will promote more innovation, but it is necessary to fulfill the basic needs of such areas including water supply, sanitation, and transportation infrastructures to allow people to participate in the growing markets. It was also pointed out that it is possible to complement the essential conditions of innovation, such as technology, human resources, and grants, within the region.

- It was pointed out that Japan has a vast accumulation of intellectual property and knowledge in science and technology, and that Japan should take the initiative to attenuate the area specific challenges that Asia faces by utilizing its intellectual resources.

- The e-ASIA Joint Research Program has been introduced as a new mechanism for regional collaborative research. Its features involve multilateral collaboration with matching funds.

- It was pointed out that it is necessary to develop certain grant mechanisms that can cross borders. SATREPS, a JICA-JST joint research program for regional collaboration in science and technology, has been introduced as a model project whose grants can cross borders. However,

it is usually quite difficult for national funding agencies to make cross-border grants, although it is possible for NGOs organized through public-private partnerships to make such grants. DNDi (Drugs for Neglected Diseases initiative) is an international NGO established by Médecins Sans Frontières (Doctors Without Borders) and has been introduced as an NGO that supports international collaborative research and development by making cross-border grants.

- It was pointed out that it is necessary to develop international open innovation centers through collaborations among academia, industry, and government to promote innovation, human resource development, cultural exchange, and brain circulation. The Tsukuba Innovation Arena, TIA, has been introduced as such a center. A joint research center between Tiajin University (TU) and the National Institute for Material Science, NIMS, has been introduced as the first strategic overseas base with the provision of space from TU and grants and researchers from both TU and NIMS.

Overview

The overview is a summary of what was discussed at the panel discussion of the International Symposium on Regional Collaboration in Science and Technology in Asia. The overview also suggests what we should discuss at the next policy dialogue

- The participants in the panel discussion have unanimously recognized the importance of regional collaboration in science and technology in Asia.

- It was pointed out that it is necessary to share goals of regional collaboration in science and technology in Asia. It is suggested that the goals of regional collaboration should be based on common Asian roots and thinking.

- It is essentially important to address basic needs of developing countries including water supply, sanitation, electricity, food, diseases, natural resources, and energy thus allowing a vast number of people to participate in economic activities.

- It was suggested that appropriate technology plays a vital role in addressing local needs and that regional collaboration in science and technology will facilitate the development of appropriate technology by complementing necessary technology, human resources, and funds.

- It was also suggested that it is necessary to develop some frameworks to facilitate technology transfer and to allow access to necessary intellectual properties in order to help develop appropriate technology.

- It was confirmed that it is essentially important to make region-wide efforts for the development of highly-skilled human resources. At the same time, it is recognized that in many countries, young generations lose interest in science and technology.

- It was suggested that it is necessary to develop some mechanisms to involve young generations in science and technology by organizing meetings with clear and very excited subjects, and inviting young participants.

- It was also suggested that it is important to give incentives to faculty members so that they will benefit from teaching foreign students.

- It was pointed out that the perspective of innovation is expanding and it is necessary to develop regional and global innovation ecosystems as well as to strengthen national innovation systems. It will be necessary to redesign new types of innovation systems and funding mechanisms in consideration of the expansion of the perspective of innovation. It would be beneficial to collect the current regional and global collaboration systems and programs and study the mechanisms of collaboration and funding systems in order to design new types of coherent and compatible innovation systems and funding mechanisms.

- It was suggested that Japan should take the initiative in creating momentum to develop some framework to address regional and global challenge as the Asia Pacific Water Forum created by former Prime Ministers Hashimoto and Mori.

PART 1 WORKSHOP I
REGIONAL DEVELOPMENT OF HUMAN RESSOURCES AND BRAIN CIRCULATION

Chapter 1 INTRODUCTION

Chitosi Miki

First of all, why is collaboration in Asia so important? Because, the sustainable development of the countries in the region depends on how they cooperate with each other. The development and stability of each individual country is related to the development and stability of the entire region. Also, the region shares many common problems including the incidence of natural disasters, and environmental and energy issues. Finally, many countries in the region need structural changes in industry ranging from technology catch-up to innovation. These are some points that I'd like to point out before we start the discussion.

There is another point we should keep in our mind. Many people have different ideas about human resources, and we should clarify what kinds of human resources should be addressed before we start the discussion on human resource development. Are we going to discuss the development of high level human resources such as professors or top level researchers? Or, are we going to discuss the issue of engineers in industry? Are we going to discuss the development of PhD students or master course students? We should be clear about what kind of human resources we will address.

Brain drain is a very important problem in Asia. There are many factors that cause brain drain from Asia including poor research infrastructure, poor working conditions and poor budget for R&D. The slide shows the flow of students in 2008. Many students leave Asia for the United States or European countries. There are not many Asian students who go to other Asian countries. Why does this happen? It should be addressed in the discussion.

Now I'd like to introduce AUN/SEEDNet as a model for the regional development of human resources. AUN stands for ASEAN University Network, and SEEDNet stands for Southeast Asia Engineering Education Development Network. AUN/SEEDNet is a kind of university consortium in Asia that comprises 19 leading ASEAN universities and 11 Japanese universities. AUN/SEEDNet was implemented in 2001 and has a 10 year of history. The core program is a postgraduate degree program (masters and doctoral course program) for university staff. AUN/SEEDNet has a collaboration program with industry to develop linkages between universities and industries. The AUN/SEEDNet program has produced many alumni, and recently started a new facet to support the alumni. As part of the program for alumni, AUN/SEEDNet held a seminar on disaster prevention. AUN/SEEDNet has a special program, called the sandwich program, in which students from Asian countries can study in other member institutions. During the last 10 years, the AUN/SEEDNet program has educated more than 800 academic staff, and more than 700 collaborative research projects have been undertaken. This has provided many chances for communication and the development of networks. For example, through SEEDNet, Myanmar has been able to develop good communication network with Thailand, Laos and Vietnam even while formal diplomatic communications are difficult. Additionally, we have started an international academic journal, the ASEAN Engineering Journal, which provides another good platform for communication. Phase 2 of AUN/SEEDNet will conclude in 2013, and we are now discussing the next step of AUN/SEEDNet to strengthen the relationships among ASEAN countries. Currently, we are discussing a graduate school consortium as a target for the next phase. New goals will include contributions to the advancement of industry in Asia, addressing common global issues, and strengthening the capacity of member institutions by forming an academic network in Asia.

Chapter 2 Challenges and directions of the S&T human resource development in Thailand

Paritud Bhandhubanyong

The Technology Promotion Association of Thailand (TPA) was started some 38 years ago. This is also the start of human resource development in science and technology in collaboration between Japan and Thailand involving the Japan-Thai Economic Cooperation (JTEC), Asia Bunka Kaikan (ABK), Associaion for Overseas Training Scholarships (AOTS) and other organizations. We have a school for Japanese language as well as other languages. We face many challenges, but I will focus on one of policy, the proper alignment of national agenda and budget support as to where the focus should lie: on science and technology or on industrial support. Global challenges that we face include the economic crisis, climate change, resource crisis, green economy, and ITC.

Thailand's R&D expenditures in 2007, which haven't changed much now in 2011, accounted for about 0.2% of GDP. For comparison, this figure is about 0.63% for Malaysia, 2.5% for Taiwan, 3% for Japan, and 3.4% for Finland. When we focus on the ratio between public and private expenditure, public spending is greater than private in Thailand. In developed nations, however, private spending is much higher than public spending on R&D. Thailand needs to tip this balance in the future. If we look at the national innovation index, South Korea is about 2.55 whereas Thailand is 0.35. In terms of the global competitiveness index, Singapore is #1, of course, and Thailand ranks 26th. Thailand's R&D lags far behind with spending of only 0.2% as compared to 3% in developed nations, or 1% in China and South Korea. Thai and South Korean R&D spending used to be comparable in the late 1970's and early 1980's, and then Korea took off. China spent around 21.4 billion on R and D infrastructure.

The next problem is the direction of science and technology development. How to create a sustainable competitive advantage, how to gain the greatest benefits from technical advances, how to create value added services and goods for Thai industry. Of course Thailand has many factories. After the recent floods, many people realized that about 60% of global hard disk drives are produced in Thailand. Also, there are a lot of automotive factories in Thailand. Now Japan Victor Corporation is sending their Thai engineers to train Japanese workforce in Japan in production technology. This reflects the capability of Thai engineers and technicians that, given the right investment, the right training and management, they are in comparable with the Japanese or global level of competency. However, when we compare the S&T development of the nation in general with that of Korea, they are much higher than we. The level of Korean S&T development has increased continuously since 1950. In 1970s, it was still comparable to Thailand, but after that Korea has developed high tech industry while Thailand has been struggling low. Thailand needs to advance its original brand manufacturing and original design manufacturing with intellectual property rights and branding, which will provide higher value added products. Currently auto parts manufacturing is developing in Thailand. But Thailand needs people for development. In developed countries, the ratio of R&D people in the business sector is much higher than that in the non-business sector, but in Thailand, about 80% of R&D persons are in the non-business sector. The good news is that the private sector has started to invest more in R&D in the real sector e.g. cement and construction materials, food processing, etc.

The third challenge is the alignment of science and technology with human resource development. We have many research organizations, the National Research Council of Thailand, a national innovation agency, a national research fund, and public and private institutions, but the problem is how alliances are formed to combine all of these organizations. We need cooperation

toward commercialization. Among the things needed are an alignment of the national agenda and budget with human resource development in science and technology, tax promotion, a mutual recognition agreement for international collaboration, free flow of the labor force, a platform for collaborative research, a patent pool, 2+1 language ability (Thai, English, and another language). We'd like to build a critical mass from junior high school to postdoctoral fellowship.

Geographically, Thailand is located in the strategically important location, that is, the middle of Asia. The population of this area encompassing India, China, Bangladesh, Indonesia, Philippines will be about 4 billion in 2050. This will provide a big market and big area for development. What Thailand needs is human resource who will carry out research and development to survive in the future. The future of the country depends on people literate in science and technology.

Chapter 3 Development of health care professionals in the Philippines

Susan Y. Mabunga

The Philippines over the years has become globalized, and has established for itself a niche as a supplier of health professionals, specifically, nurses. We have also seen the migration of our doctors, mostly to the United States. According to the statistics of our nurse deployment from 1994 to 2003, most of them go to Gulf countries, as well as to the UK and Ireland. This created and is still creating a big problem for the Philippines since so many of our nurses and doctors are outside the country, and there is now a severe shortage of doctors in rural areas. I think this is also true for Indonesia. In 2005, about 15% of Philippine nurses were employed locally while 85% were employed internationally. Despite this, we still have an oversupply. This was described by our former chancellor as the "paradox of inadequate absent health care professionals in many economically depressed regions in the face of overall oversupply of such professionals."

We suffer greatly from the inverse care law, which tells that the availability of good medical care tends to vary inversely with the need of the population served. We have very specialized doctors, but they are in the cities, and there are very few doctors in rural areas. Midwives in government service are mostly overworked and their facilities are understaffed. Most of our health care professionals are in the private sector with very few in the government sector. In terms of U.N. Millennium Development Goals (MDG), we are doing quite well except for universal primary education and maternal mortality rate. We will not be able to reach our MDG for maternal health unless we really look into our deployment of nurses and midwives.

The problem of inverse care has been shown to have three root causes: the dominance of free market forces where demand triumphs over need; capacity for training determines the quota of students rather than the sustainability of graduates entering the workforce; and the absence of training programs with a strong emphasis on public service and the common good over public gain. To address these problems, several solutions were adopted or have been proposed. There is a human resource plan adopted by the Department of Health. Unfortunately, the way the master plan was devised has been questioned because it uses the population ratio and an arbitrary standard for manpower vs. the population. There has also been a reorganization of the Department of Health in which a Health Resource Development Bureau has been established. It has been proposed that there should be stronger regulation and implementation of existing policies on all aspects of the production of health human resources. The identified push factors why our health care workers migrate include salaries, working conditions, professional development, career opportunities, payment systems, and so forth. One proposal is that these factors be strengthened to encourage health care professionals to stay in the country. The University of the Philippines is a national

university and has implemented a return to service agreement in which all of our students will agree to serve in government institutions for the next 2 years. But the Philippines have many private universities that educate nurses, and this kind of return to service agreement can't be forced on these private universities. Recently we have begun to see the return of some of our professionals who have been abroad for a long time, and have seen them contributing to new types of research such as a rapid diagnosis test for dengue fever. I think the challenge is how very complicated technologies can be made into simple platforms that can be used by non-technical users in the field. This is one area in which we believe a lot of collaboration can take place. It is also necessary to address the issues of the global market and the production of health care professionals to meet that market, but there are many implications in terms of the type of education that must be provided. Demographic and epidemiological variations among countries require reflection on what subjects should be emphasized in schools. Despite this, the global market is a reality that cannot be ignored. The need to maximize available resources within the region, and to optimize development, training, and utilization of highly trained personnel is apparent. This is an area where regional collaboration can be explored, not only in the movement of health professionals, but also in identifying challenges in science and technology. This is how I see the challenge, and I think research in science and technology will play a very major role in looking at how we can be globally competitive while, at the same time, serving the community that we are supposed to serve.

Chapter 4 Ecosystem to nurture entrepreneurs – experience from an Indian BOP business

Vijay Babu

We all realize that most research and development happens in one of two ways: the first is in institutes, universities or large corporations, which set up research and development labs; the other form of research and development is conducted in an entrepreneurial manner in which someone tries to innovate in order to come up with something new. It is a well-recognized fact that developed countries have a lot of institutes that do phenomenal work in research. Of the twenty top universities rated in terms of research are all from the US, Europe, or Japan. For example, MIT and Harvard in the US, the University of Tokyo and Osaka University in Japan, and Cambridge University in the UK are well recognized in this form. However, there have been many stories of entrepreneurship that have also resulted in great innovative products and solutions. One of the very well-known examples is Sony Corporation, which came out with innovative products in the 20th Century, thereby creating large research opportunities and large technology innovations through the route of entrepreneurship. In this forum, I will be sharing our experiences with entrepreneurship.

We believe that there are four major requirements for the creation of an entrepreneurship ecosystem. The first requirement is to create or see a market for an opportunity to be established. For example, when a country grows rapidly, there is a great opportunity created for various new products and services, which enables entrepreneurs to come up with ideas to grow that particular opportunity. This was seen in Japan and the US in the 20th Century. Now, emerging markets such as India, China and other Southeast Asia economies have been growing rapidly in the last couple of decades creating opportunities for growth in these countries. The bottom of the pyramid opportunities that we see in these emerging economies create environment for entrepreneurs to look at new ideas to grow. For example, we have developed a low cost, low power consuming ATM, predominantly for the rural market. This is a product focusing on the rural segments of emerging economies to resolve some of the problems that are specific to these economies. Emerging

markets create a large opportunity for entrepreneurs to thrive.

The second important requirement for entrepreneurship is the ability to take risks. Typically, entrepreneurs end up taking large risks in terms of technology as well as business. They may not have the budget to invest or to sustain an opportunity or sustain research for a long time. So they take a big risk in terms of identifying an opportunity and trying to convert it into a successful business. An environment that allows such risk taking to be supported or to be encouraged is very important for an entrepreneur to succeed. A typical example would be in the Bay Area in the Silicon Valley in the US where you would find that people who start a company are well respected and there is a lot of excitement around them, which provides the kind of support and the will to win in such an environment. Today we notice that in many emerging countries, including India, there is a lot of support and a lot of excitement. You see people wanting to take the risk, wanting to start something, and wanting to grow a new business.

The third very important aspect for entrepreneurship is the availability of knowledge expertise. In general, the product developed by the entrepreneur is something new, not available in the market, and it requires a lot of research or ideas to be converted into a product that is successful. Many times, such technology expertise is available around institutes or research labs that have been developing similar products for many decades. Such expertise may not always be available in a developing country. Even though an entrepreneur has a core technical ability to solve a problem, he still needs an expertise which enables to build a product fast and innovatively. We believe that partnerships with universities in well-established and developed countries could be of great support to entrepreneurs who are trying to build something innovative in developing countries. In our case, even though we had a team that had the will and the excitement and the expertise to build something new, we still used the services of expert consultants from the US to strengthen the innovation in our product. If such expertise was not available, it would have been very difficult for a company like ours to come out with an innovative product. As a matter of fact, when Dr. Ohto from the Takeda Foundation visited us, he was surprised to see 5S (Seri(clearing), Seiton(organizing), Seiso(cleaning), Seiketsu(standardizing), Shitsuke(training & discipline)) programs being implemented in our manufacturing set up. 5S program is a quality control practice developed in Japan and introduced to India. That is one sort of consultancy or support that we gain from a country like Japan where the expertise and the quality processes would enable other countries to build products to the same level of quality that is seen in Japanese products. These kinds of collaborative support from Japan or other developed countries will actually enable emerging economies to build products that are as good, and can succeed in the market.

The fourth equally important need for an entrepreneur to succeed is the availability of funds in the form of venture capital investment or any form of investment Here again, venture capital funding is something that comes most often from countries like the US or Euro countries where such support systems are well established. We were funded by venture capital firms based on Europe and the US, which provided us with the funds required for creating an innovative product for the Indian market.

So these four aspects are essential for the creation of an ecosystem for entrepreneurship. We believe that there is a great opportunity to collaborate within the Asian region in these four areas, thereby enabling R&D in our region, which will also make it possible to avoid brain drain. There are cases of Indian people who had left India for higher studies or for opportunities in the US or Europe, saw the opportunities for growth in India, and came back to set up entrepreneurial companies. With these experiences, we believe that entrepreneurship could actually be a very good form for enabling great research and development to happen within the region, and with very good collaborative support across the region. Thank you.

Chapter 5 Campus Asia: A trial of Japan-China-Korea trilateral university cooperation in credit sharing

Masahiko Hara

This year, the Ministry of Education, Science and Technology (MEXT) launched two types of global collaboration schemes. The Campus Asia (Collective Action for Mobility Program of University Students in Asia) program is categorized as Type A involving collaboration schemes among three countries: Japan, China and Korea. Type B schemes are designed for exchange programs with US universities. In 2009, the Tokyo Institute of Technology (TIT) started a regional collaboration program called the Asian Science and Technology Pioneering Institutes of Research and Education (ASPIRE) with four universities: Tsinghua University, KAIST (Korea Advanced Institute of Science and Technology), Hong Kong University of Science and Technology, and the Nanyang Technological University of Singapore. Based on the experience of the ASPIRE league, TIT proposed a Japan-China-Korea triangle collaboration scheme, and proposed the implementation of the scheme as the Campus Asia program. The Campus Asia scheme approved 10 university projects including those at TIT and the University of Tokyo. The triangle scheme of TIT involves the implementation of collaborative research in science and technology and the exchange of students among TIT-Tsinghua University (China)-KAIST(Korea). TIT also proposed a project for a Type B scheme, and the project has been approved. Now TIT has platforms for exchange with both Asian and US universities, and would like to establish a scheme for sharing credits and degrees with Asian universities as well as extend our collaborations to US and European universities.

The key word of Campus Asia is “quality assurance”. Quality assurance is very important for credit sharing. At first, we should consider variations in qualifications for credits and degrees among the member universities. For example, the starting month of the academic year is April in Japan, but March in Korea. The semester periods also differ among the member universities. It is very difficult to share credits and degrees using regular lecture courses. To avoid this difficulty, we will set up a summer school that will award credits for a four-week program. Then, if students would like to stay longer, say for three months, we will set up an intensive lab experience course as an independent course. If students can stay longer, perhaps half a year, we will provide lectures in English. The summer school will have Japanese and culture courses in the morning and advanced technology courses discussing nanotechnology, energy, advanced materials, and green science in the afternoon. We are now preparing this summer school to be held at TIT and KAIST. The total number of exchange students will be around ten.

The first meeting of the 10 Japanese universities participating in the Campus Asia program was held yesterday, and it was decided that we will form a monitoring committee for quality assurance that will draw up policy guidelines within the next two or three years for research and student exchange among the three countries. Then, after three to five years, we would like to extend these guidelines to universities in other Asian countries. Yesterday’s discussion also involved the next step for a joint degree program. A joint degree is not allowed in Japan, but KAIST would really like to set up such a program where one degree would be awarded with the signatures of two or even three universities. Although joint degrees are not allowed in Japan, if we can guarantee quality assurance over the next few years, we would like to extend our Campus Asia project to a joint degree program. At present, participation in Campus Asia is limited to Japan, Korea and China, but MEXT would like to extend this program to the ASEAN countries starting next year.

Chapter 6 Global human resources that companies want to develop

Yoshio Akamatsu

ITOCHU Corporation is unique in its operation as a general trading company in the world. We have been engaged in domestic trading, import/export, and overseas trading of a vast range of products covering most of the business segments you can imagine. Today, business investment for various segments on a global scale has also become a core business. The company has grown to become a global corporation with 130 bases in 68 countries. This global business network was initially developed in order to distribute so-called “made in Japan” products to every corner of the world. But, today, it is China that is distributing made in China products to every corner of the world. We do not have our own technologies or production or manufacturing facilities; therefore, our most important resources are human resources. There is less expectation for growth in the Japanese market as compared to the past because of the decreasing population of Japan. On the other hand, the global market is expanding led by the emerging countries. Therefore, the key for our sustainable growth in the future is to define the world as our target market. We must reconfirm that our future operations should be more globalized. ITOCHU Corporation is a global company, but there is a question about whether we are really globalized or not. In the past, the main players who conducted our businesses were Japanese employees. They were a little more globalized than ordinary Japanese, and were dispatched all over the world as expatriates to manage our overseas locations. However, for us to survive in the future, it is inevitable to create new types of business with a global perspective. To achieve this, we are in need of human resources, in other words, talents who are professionals at a global standard.

We have established global talent enhancement centers (GETCs) in New York, London, Singapore, Shanghai, and Tokyo. Our headquarters, the GETC in Tokyo, acts as the center of the system. We have developed various measures to promote talented employees capable of acting with a global perspective. Our ultimate objective is to continuously develop global level talent who can lead the ITOCHU group as management executives regardless of nationality, race, gender, or age. Measures are promoted in each of four categories: recruitment, compensation, appraisal/assignment, and training in the form of a career development program.

Of the four categories, the greatest stress is placed on training and development. In our headquarters (HQ), we have a lot of programs for training and development. Our business is based in HQ and we make most decisions there, and that is where our business model is developed. Therefore, we invite our overseas colleagues to headquarters, and we provide them with such programs. We have one program called the Global Executive Program, which is an intensive competitive leadership program for candidates for future executive positions in both headquarters and overseas offices. This is a program to secure management executives for our company in the future. Another program is the Global Leadership Program for core talent at the management level in overseas offices to focus on the group business strategy and necessary business skills for the expansion of overseas business. A third program is the Global Network Program for people who joined ITOCHU in overseas offices. We invite them to Japan, and let them become familiarized with our businesses and system. Another category of program is a HQ U-Turn Rotation Program in which overseas personnel spend 1 or 2 years in Japan to develop enhanced capabilities of overseas staff in order to build the platform for the overseas business process and the skills of overseas staff. They work with us and learn through day-to-day operations for two years. These are examples of our global training programs.

However, as you realize, ordinary Japanese staff members are not necessarily globalized. To

break through this fact, we have to provide language training for our junior staff. The first training is in English. Even though Japanese have studied English for more than 10 years before joining us, we have on-site English language training for our junior staff. Basically, we send our employees to the US and let them stay there in small towns and concentrate on English lessons. Another language program is a multi-language program in which, like most Japanese companies, we put an emphasis on Chinese. So after the completion of the English training, we send our staff to China to learn Chinese. However, we are globalized and other third languages such as Russian, Spanish, Portuguese, etc. are also needed. So not all staff is sent to China; some are sent to other countries for language acquisition. At HQ, junior staff can learn a lot through on the job training, but the language acquisitions programs are very important. That describes our global training programs.

Chapter 7 Discussion

Seetharam Kallidaikurichi E

I will make a comment and also ask a question for clarification. First, the topic of this workshop is so relevant and so appropriately chosen. The presentations cover a wide range topics including the concept of setting a network of university research, the movement of health care workers from one country to the rest of the world, the ecosystem of entrepreneurship showing how innovation can happen outside the established research centers, and all the way to a private company building human capacity. My first comment and question are related to the architecture of global economic trends today. Leaving aside the current economic downturn, we have achieved a lot in terms of the movement of goods and technology to every part of the world. We move finished goods ranging from food and consumer goods, and so on. These days money can flow from one part of the world to another at just the touch of a button. However, when we talk about human capital development, we still have a huge barrier for the free flow of people because of our immigration policies and restrictions in various countries, and there has been little progress made in that area in the last 50 years. So the numbers we are talking about here are still, in my view, very small, in the hundreds and thousands compared to the hundreds of millions of people who want to move. Compared to the movement of goods and finances, the movement of people is still very small. Even in terms of travel, the number of people is small. In a country like India, maybe only 20 million people are traveling.This is very small compared to what we want to achieve, even within Asia. So my first question is how are we able to facilitate the movement of people? ASEAN has shown some good examples of the movement of people without visas. Would you want to start with a free flow of science and technology innovation? It may sound elitist, but would you want to have an Asian technology visa arrangement to move freely if you are a scientist or technology expert? People want to be able to meet. For example, we want to meet at today's conference. Can we have that free flow of people facilitated? Some countries have succeeded well at this, for example, the European countries and US, where they allow scientists and so on to immigrate into their countries. Some other countries did not pursue that policy, including Japan. Now with this collaboration, is there any re-think of allowing people to move? I am seeing Singapore pursuing this policy actively. They allow qualified people to easily come to live, although it's a very small country. I don't have the answer but I would like to hear views.

Muhamad Jantan

I don't think that student mobility is very much of an issue, because in the ASEAN region, I think they use the equivalent of the Erasmus Mundus Programme so that students can move around quite easily. I think the critical barrier is probably the mobility of professionals. For this, one of the major issues will be the recognition of qualifications. The higher education systems in Asia are so varied that it is very difficult for a corporation in one country to evaluate the qualifications of a

potential candidate. Possibly Europe has gone one step further in that respect. I think ASEAN tried to harmonize the higher education systems. I think there was a forum in 2010 to address the issue of how the qualifications of professionals can be recognized within the region. But this is only in the initial stages.

Vijay Babu

I'm not aware of any special means by which mobility is made simpler for professionals. Typically in the venture capital industry, it's more the mobility of funds from one region to another in which you would have a venture capital fund set up in the US or, for that matter, in India, that would invest in regional companies. But to add to what was shared, I suspect that with professionals it still tends to be the standard visa process, which probably works pretty well, at least for movement that takes place within a week's time. It's not that someone can travel immediately, but, from what I'm aware of, I suppose that movement is not restricted nor is it constrained in any form. Therefore movement can happen pretty easily. For example, most of us have come from elsewhere for this conference, and none of us faced difficulties in traveling. So I am not so sure that it's a constraint today. Perhaps if someone wants to stay for a longer period of time, that could be a bit difficult, but not for normal mobility. This is probably sufficient for most requirements.

Susan Y. Mabunga

I was thinking that we would like to have them travel to countries where science and technology is more advanced, bring back what they learn, and develop it further so that the research field is strengthened. But, eventually, that should create its own system. For a developing country such as the Philippines, one challenge is how we translate the very high technology in developed countries into something simpler that can be used in our less technically advanced environment. I mentioned Dengue fever. There is a diagnostic tool available involving PCR technology, but used to be very expensive. Some scientists were able to simplify the process so that it became usable by an ordinary midwife. We need that kind of translational research.

Barbara Rhode

The EU has created an accelerated visa procedure for scientists and researchers. This is called the "scientific visa package". It applies to 25 EU Member States except for DK and UK. There are different procedures for short term stays (up to 3 month) and longterm residence. It does not include students but allows foreign scientist in the EU also to travel to other EU Member States for conferences or meetings. A researcher is defined as: a third-country national holding an appropriate higher education qualification which gives access to doctoral programmes, and who is selected by a research organisation for carrying out a research project for which the qualification is required. The scientific visa is based on a hosting agreement. This is meant to assist universities, research institutes and companies where research is performed in getting the researchers they would like to have. This scientific visa certifies that this person is a qualified researcher and that the host institution has the required funds for his or her work. So the host of the researcher takes the responsibility and gives the assurance that everything is according to rules , and then there will be a quick visa issued. You can look it up the conditions on the web under EURAXESS Scientific Visa Package. It has taken some time to establish, countries needed to agree on common rules, but today you can entre with one permit a space of 25 countries.

Paritud Bhandhubanyong

As far as I understand in terms of the mobility of professionals, there will be a free flow of professionals within the ASEAN region beginning in January 2015, when we start the ASEAN Economic Community. There is a scheme called the Mutual Recognition Agreement that was

signed by all the ASEAN countries to provide a mechanism so that professionals, engineers or medical professionals, nurses, or other professionals can move freely to work in ASEAN countries without the problem of a visa. However, we need an agreement concerning the qualification certification of professionals. For example, for engineers, we need some sort of standardization of the program or level of professionalism so that these people can move and work freely in any ASEAN country. The problem will arise when we talk about ASEAN +3 or +6, which include developed nations. In that case, visa problems and other problems will come up.

Yoshio Matsumi

I think that a free and greater movement of people in the science and technology fields and also in the business community will become unavoidable in the days of a flat world, globalization, and TPP. Therefore, I think that the agenda of this session is extremely important. In order to encourage more movement of people, we have to provide them with the development of human resources, talent development, and brain circulation. In order to develop human resources and encourage brain circulation, international collaboration among universities is, of course, very important. But I would like to stress an importance of a more active role of the business community, corporations, in human resource development, as Mr. Akamatsu discussed very eloquently in his case. We are now in this session discussing human resource development in science and technology, and this afternoon we will be discussing R&D infrastructure. Why are we discussing these issues? I believe we are doing so for innovation for nations and society. I don't mean technology innovation, but I rather mean a creation of new social economic value. For that innovation, one of the most important players is industry, business firms that are involved on a day to day basis in the marketplace and society. Therefore, I would like to conclude my comment by emphasizing an encouragement of the participation of the business communities of Asia, as well as the US and EU, in this forum, and we should really encourage their more active role in human resource development with the clear objective of innovation.

Tatang Taufik

In my opinion, I think that mobility needs to be thought of as not a stand-alone policy instrument because it could worsen the brain drain phenomenon. For example, when ASEAN endorses free movement without visas, countries such as Malaysia and Singapore will have an advantage over countries such as Indonesia because Indonesians would rather work in countries such as Malaysia and Singapore. Brain drain will worsen in Indonesia, and especially in certain areas of Indonesia. Therefore, there needs to be some other policy instruments to balance this kind of free mobility. Secondly, with respect to human capital development, I think that government involvement is necessary. If the science and technology community is to be made better off, then we also need to educate policy makers. For example, some time ago, Indonesia borrowed money through the World Bank through soft loans to pay for education abroad. Many students finished their master's and Ph.D. programs, but many of them now work in foreign countries including Japan, the US, etc. To some extent this was due to the level of understanding and perception of policy makers on the returnees that influenced their underutilization. So the policy makers said they would rather stop the practice of

sending students outside of Indonesia because there was no advantage for Indonesia. They don't understand that human resource development is as important for Indonesia as for other countries. What has been done by the Harvard Business School in cooperation with some of our ministries to educate policy makers is, I think, a good example. So, in the future, I think that the involvement of politicians and policy makers in this type of forum is very important because I think that it will influence future policy making. Thank you.

Chitosi Miki

Thank you. That's an interesting perspective. Next I would like to move to another interest. My interest is the linkage between universities and industry. I would like to ask Mr. Akamatsu what sort of linkage we should consider, or what type of human resources.

Yoshio Akamatsu

Before addressing that point, I would like to make a comment about the mobility of professionals. I think Japan should play a very active role in this. It's obvious that there are a lot of opportunities in Japan, but, unfortunately, the Japanese government has not opened the country. If you look at the size of the economy or at the number of universities and R&D places, Japan has the capacity to contribute to human mobility. Of course there are many barriers, including culture, language, etc., but I was very impressed by the Thai people who came to Japan after the flood. Now workers who worked in Japanese factories in Thailand, due to the factory closures, come to Japan to work and train Japanese workers, because the Japanese government allowed them visas to come and work in Japan. Once they arrived in Japan, from day one, they were able to work smoothly. This means that we have a lot of opportunities and we must overcome some of the barriers and open the country to foreign professionals, etc.

Coming back to the question asked by Dr. Miki, we have a system of employing new graduates, so normally Japanese companies employ new graduates directly from universities. It doesn't matter whether they studied economics or some other technologies. As long as they have a certain academic background, we employ new graduates and then train them. So in that sense, Japanese companies and universities are closely linked. But, after that, companies don't care much about universities. We try to contribute monetarily to R&D, but once graduates are hired, then we cut the relationship with the university. But we need to pay attention to how the universities educate their students.

Paritud Bhandhubanyong

Just one comment on the visa arrangement: I think that the arrangement between Thailand and Japan is not reciprocal because Japanese can come to Thailand without a visa, but Thais must get a visa to come to Japan. That is a problem with the Thai government that they don't negotiate with the Japanese government to get fair treatment, and I hope that we can correct it as soon as possible. But coming to the linkage between universities and industry, I think that in the past it was difficult to motivate industry to form linkages with universities, but, right now, with the triple bottom line concept, businesses would like to get good scores in terms of economic, environmental, and social factors. So right now the social corporate responsibility trend is very strong. Many private sector entities in Thailand are forming linkages with universities right now. On the other hand, many university people, especially professors, also need to adjust themselves to working with the private sector because somehow the thinking or the focus might be a little bit different in terms of timing or the development scheme. But, if we can work collaboratively, I think the benefits will be great for both universities and industry.

Krisada Visavateeranon

I am also involved with AUN/SEED-Net project, as for the last five years I have worked as the executive director at secretary office of AUN/SEED net. I have heard that SEED net project will be extended to a third phase. The frequently asked question is how universities and industries can be linked together. I think this is also a very big topic in Thailand too. University professors don't know much about how companies work because after they graduate most of them go directly to work as professors in the university, they have no experience of working in industry. Also, in universities, students only study in theoretical terms, and not in the practical matters of working in industry. TPA, (Technical Promotion Association) in Thailand has tried to solve this problem by establishing Thai-Nich Institute of Technology. The Institute aims to produce high quality engineers for Thai industry. This is a private institution established just five years ago. The main objective of this mission is to serve industry by producing high quality human resource. We start by finding out the demand of industries, and produce engineers to meet that demand. At first, we do not intend to produce engineers to work in research or in S&T. We set up a committee for curriculum development with the cooperation from industries, and sometimes we invite experts from industry to instruct the students at the institute. The students are required to work in industry as interns for four months in order to gain real world experience in industry. This is a project we learned from Japan—monozukuri instruction, the art of the Japanese manufacturing system. Our first batch of graduates were very successful with about 99% employment mostly in industry. There are more students in the second batch, they are going to graduate this year, and the employment rate is expected to be higher than the previous one. I think a discussion on how to create linkage between universities and industries is very important.

Muhamad Jantan

Generally, in Malaysia, there is distrust between industries and universities, and most of this mistrust is due to communication problems. The primary measure to overcome the barrier between universities and industries is, I think, to get people from industry to come to universities and people from universities to go to industries to spend enough time to get to understand one another. Currently the mobility between industry personnel into academia or academia into university is virtually zero. This can largely be attributed to the huge gap in salaries. In universities, promotion to professor depends on other criteria. So people in industry, where there is an established level of salaries, would have to take a huge pay cut if they were to join academia. Another step that the government is now trying to introduce is what we call an industry graduate program. In other words, people from industry do not need to leave their present positions to pursue their graduate program. In this case, they may be doing their research within the company itself, but under the supervision of a university. These are called industry Ph.D. or industry master's by research. This is quite a recent initiative, and we have yet to see if it will be successful. But, generally, trying to get industry to understand how universities work and universities to understand how industry works is difficult because of the huge communication gap.

Houmpheng THEUAMBOUNMY

I think the linkage between industry and education is very important to ensure that the students who study in this field can find the job when they graduate. Laos is not an industrial country, and the economy relies on agriculture. There are few students who study in industry field. They like to study in their favorite fields where they think they can find the job when graduated. There is high competition for getting the job, because the job positions are less than the number of graduated

students. The number of graduated students is more than labor market demand in some field, and in other fields less graduated students. To solve this problem, we need good planning for human resource development and have some intensive mechanism. That's why the linkage between industry and education is very important to urge more student study in the field and also to resolve the problem of supply and demand in human resources in labor market.

Seetharam Kallidaikurichi E

I want to ask one question based on one observation I have made over the last 20 or 25 years on the disconnect between academics, industry, and the real-world problems that we face. The example offered by my colleague Mr. Vijay Babu is actually a very exceptional example. I admire his work. He is a graduate of the renowned Indian Institute of Technology (IIT), but unfortunately, IIT does not produce many entrepreneurs. I am a graduate of IIT and I complained to my professors because we produce employees for Citibank and other investment banks, but nothing to do with engineering. Top engineers go and work in commercial banks because they have brainpower. It's a shame, though. Of course, we do have some entrepreneurs. I think that the university system is not inspiring people as to the wonders of science and technology, and how you can contribute to society.

The second mismatch I see goes to the global corporate companies. I have met people from many such companies, and, unfortunately, they completely disregard the university educational program and create their own educational program. They retrain everybody, and they're proud of it. They say, "study anything, and, if you are smart, I will teach you." They do it in India, they do it in the Philippines, they create great leaders, but there is a total disconnect with the academic system. It's a waste of time for a young boy or girl who went to university and studied so hard to have to study all over again. All of the IT companies do that. They have a college, literally, to retrain people. That creates a new type of disconnect because you're brainwashing young people to work on commercial problems, but not on real-world problems. There are real-world problems, such as how to diagnose Dengue fever, improve toilets. Who is doing this research? The top brains are working in a commercial bank, or for a global corporation, working on big money making business. The unfortunate fact is that our academic colleagues don't have that brainpower to solve these problems because they don't have the young students who can work on it. I don't have the answer as to how this mismatch can be addressed, but wherever I go, I try to speak in high schools or primary schools, hoping there may be a young Einstein there who will be inspired. We need the inspirational connect. I'm hoping that the big companies will help to inspire young people to engage in this new research. And students can come from any country to work on this; we don't need to look only at developed countries. I hope you will allow some discussion and views on this.

Chitosi Miki

This is an important point like the first point of discussion. We have had this discussion about SEED-Net. We have started a new program, a grant to promote the linkage between universities and industry. JICA provides funds with just one condition: there must be a counter-budget from industry equivalent to 20% of the amount from the government. So we recognize the importance of this type of linkage. And you are correct that most of the highly educated people will work in industry. As you say, they will usually go to a bank or to management, and that's a problem.

Paritud Bhandhubanyong

The comment by Dr. Jantan reminded me of something I tried to propose to Thai university many, many times. It's something like the Japanese RONPAKU Program, in which graduates from university, go to work in industry and have a chance to further their studies in industry. In Thailand we have the problem that when a student graduates in the field of science and technology they would go to work in a company, for example, as an engineer on a production line. Then, if he or she wants a higher position and a better salary, he or she has to study business administration, or get an MBA. Sadly, the number of people studying for MBA's with a science and technology background is very high in developing countries. So they learn the hard way that being an engineer is very good, but to get a high salary and good position, they need an MBA. That's not healthy for industry or for the country. So I think the RONPAKU Program, which allows people to continue their studies after graduating from universities, is a very effective scheme. After they've worked in industry for five or ten years, they can submit their work, and get a degree. Then after they've worked in industry for 20 or 30 years, they can go back and work in a university with the educational certification they achieved while working in the company. That is something that my advisor at the University of Tokyo did. He worked for Mitsubishi for twenty or thirty years, and then came back to work in the university. So he had experience in terms of the real situation in industry and also the theoretical ability to teach and transfer that technology to students as well. That is a very good program that I would like to see implemented in Thailand.

I think that training in the private sector is important for university graduates. When I worked in a university, I often received complaints from my friends in industry that universities do not train students so that they can work for their companies without further training. But if I train a student to work for a company, he can't work for another company. So I train my students how to find knowledge, and how to study further and solve problems.

Vijay Babu

I just wanted to add some more to this discussion of partnerships between universities and industry. Even though we are a start-up, I am happy to tell you that we work very closely with one of the universities in Chennai, IIT Madras, which has been helping us from day one, and, in fact, we pay royalties to IIT for products. My experience with this is that, typically, universities have research to gain more expertise and knowledge, whereas industries see whether there could be economic benefit obtained. This probably causes communication gap between universities and companies. We have found that universities are phenomenal at solving specific problems that industries want to have solved. Such involvement in terms of understanding each other's constraints could be beneficial. It's been beneficial to Vortex. I believe that countries such as the US have solved this the best. There are so many entrepreneurs around MIT, Stanford, and Harvard, which helped bridge these gaps very effectively. As an entrepreneur, I take a risk—I don't know whether I can survive the next two years—that a professor might not be willing to take. Dr. Seetharam and I both come from the same college. When I work with my professor, I can see the difference where I take the risk, and I may succeed or I may fail, while the professor may not want to take that kind of risk, but he's willing to take a bigger risk in terms of the research he does. He doesn't know whether he can solve a problem fully, but he still takes the risk of going spending a lot of time on the research.

Anne Emig

NSF is a basic research funding agency, and has historically rather jealously protected that role—that basic research is not applied research, and that someone else has the mission to fund applied research. That division has served us well, but it has never been entirely black and white. There has always been a small area of gray. In an era of tight budget restraints, the gray is widening somewhat as we are no longer able to use the excuse: "it's basic research; don't expect any results

for twenty or thirty years." One of the unique roles of the university is as a center of research, and we don't want universities to become the R&D arms of big corporations. But what we would like to do is to try to break down some of the barriers, the psychological barriers between university and industry. One of the strategies that we've been using for twenty years or so is a little-known program called our Industry/University Cooperative Research Centers Program. This program begins from the vantage point that industries and universities have unique but potentially synergistic roles. Industry may be interested in universities not only for the early stage research, but also as a source of talent. So, there may be opportunities to get industry interested in working with universities for a small investment if industry can gain access prepublication research and to graduate students and postdocs, observing them on the job. So with this IUCRC Program, a researcher is invited to submit a proposal for NSF funding for $35,000. But in order to qualify, they must first have at least five firms that are willing to contribute at least $25,000 to their research effort. The $35,000 is obviously a small investment: it pays a secretary's salary or a part-time graduate student. The industry then gets to have a voice in basic research that may have medium term commercializable potential, and they get to have access to some graduate students, maybe some postdocs depending on the field, who are not seeking academic employment and would like to learn how to bridge their basic research and the world of industry. That's one model. At any given time we have about two dozen of these centers working. Typically, the NSF investment is returned about twenty-fold in terms of industry investment, and there are lots of good things that come out of that.

We have a Director, Dr. Subra Suresh, who is new to the organization about 14 months ago, who kind of bridges the innovation and mobility question. Dr. Suresh is the product of one of the Indian IIT's, and he is our first non-US born Director . This is appropriate, given the high percentage of our science and engineering investigator community born outside the US. Dr. Suresh has come in at a time when we have all of these budget constraints and pressure from our legislature to bridge this divide, and he has been very effective. Being true to our mission as a basic research funding agency, he has also sought non-traditional partnerships to help the US take some of the steps necessary to transition research discovery to innovation. Through a new program called I-Corps, NSF now has a partnership with the Kauffman Foundation and the Deshpande Foundation to make small grants to support innovation training and mentorship. We make grants of $50,000, and the grantees are required to take an entrepreneurship training program run out of Stanford University, and work for six months with business mentors. The hope is then that they will then be able to compete for one of our early stage Small Business Innovation Research (SBIR) grants. So, we are working in creating the environment for innovation, providing a little bit of seed money leveraged creatively through partnerships with foundations, or, in some cases, with industry. Not every grant leads to a successful company, but we believe the model has some staying power.

Wiwut Tanthapanichakoon

Concerning the linkage with industry, I was also a senior research advisor for three years to SCG Chemicals in Thailand (SCG stands for Siam Cement Group), where they are just now starting to focus on the technology business. They would like to license in and license out their technologies, so they are interested in how to collaborate and how to make use of the patents of universities and institutions as well as industries. Last month they came to visit Tokyo Institute of Technology (TIT) and looked at some labs here and also the TIT sponsored venture businesses. I think such linkages will begin to have more impact in Thailand.

Barbara Rhode

Just a small comment about something we have observed in the European Union. We see that many countries have a structure that is not very favorable for collaborations between industry and academia because you have one ministry funding the industrial side while a different ministry funds the academic side. I think this sometimes needs to be better bridged on national levels. I think that this is a crucial, deep, fundamental problem that the European Union in its Research Framework Programme has successfully addressed , and I will describe our approach for these individual EU Framework Programme (FP7) projects later.

Chitosi Miki

Thank you all very much for the fruitful, interesting discussion. I think that you will all receive a copy of the minutes of this workshop, and I would like to propose further discussion via the internet or something. So thank you very much for attending this workshop.

PART 2 WORKSHOP II
INTERNATIONAL COLLABORATIVE RESEARCH AND RESARCH INFRASTRUCTURE Part 1

Introduction

Teruo Kishi

These days, worldwide global problems are often discussed. Science and technology has played important roles in solving most of them. However, new problems are always arising rather than being solved. In the past, each country pursued passionate research and development to assure social improvements through innovation. Innovation was an issue for each country. But now, one country alone cannot pursue innovation by itself because new technology development needs to be fused with another field. Moreover, development requires quick movement. So, in this region, active collaboration has recently been conducted not only nationally (among industries, academies, and institutes within a country), but also internationally in order to improve the speed of development. This movement is referred to as “open innovation”, and, sometimes, we need to collaborate with competitors as partners. Additionally, the different mentalities that lie in diverse cultures often bring new ideas, and this is also very important for international collaborations. So we can say that open innovation is innovation with globalization and diversity.

In Asia, each country is developing at a certain growth rate, maybe except Japan. But it is impossible to regard Asia as a uniform entity form the perspective of race, culture, education, science and technology. However, it is also true that they have a geographical advantage as they have a huge market in the neighborhood. It is necessary for Asia to develop as an area, and to do so, it is important that there is cooperation in research and development. Europe has already established the European Research Area, and this might be one of the models for Asia to follow. The Takeda Foundation has established a committee for strategies for international collaboration in science and technology, and, in 2009, a policy manifest toward the creation of an Asian Research Area was made. Since then, there have been two symposia held with various stakeholders taking part, and today’s workshops and tomorrow’s symposium will be the third such gathering. In these symposia, we are trying to develop the basis for a foundation to realize the Asian Research Area vision. Today, we have two workshops: one to discuss the education of talent, the interaction of researchers, and the exchange of personnel; the second is to discuss research infrastructure and collaborative research. This is the second workshop, and I would like to discuss collaborative research and research infrastructure to find ways for neighbors to realize open innovation in the Asian Area.

I also would like to introduce some of the Japanese trials. Japan has already proposed the e-Asia Vision, the East Asia Science and Innovation Area. Director of JST, Mr. Nakanishi, will introduce this plan later in this session to describe an infrastructure that will lead to open innovation. TIA-nano, the Tsukuba Innovation Arena Nanotechnology, has been established in Tsukuba Science City in Japan, and will be introduced here by Dr. Nakamura.

I would like to introduce two more important key terms about infrastructure and collaborative research in addition to “Open Innovation”: They are “COE”, Center of Excellence, and “networking”. It is important to have various kinds of COEs in each Asian country that possess cutting edge facilities and excellent researchers, and to share results of the research with all the countries in Asia. Networking among COEs, and individual scientists will become very important. I will show some examples of networking in Asia. I specialize in nanotechnology and material science. In the field of

nanotechnology, ANF (the Asia Nano-Forum) was established about ten years ago, and researchers from 15 countries hold forums every year. In the field of material research, the World Materials Research Institute Forum was set up in 2005, and the Materials Research Institutes of forty countries, including ten in Asia, take part in this Forum. These are typical examples of networking, and they enable researchers to have interaction with other researchers and encourage future collaborative research.

Again, I would like to express my sincere thanks to you all for joining this workshop. I hope that we will have a good discussion this afternoon. Thank you very much for your attention.

Chapter 2　Challenges and directions for the sustainable growth of Asia

Seetharam Kallidaikurichi E

For this particular session I have three points to make, which I hope will be useful for the discussion to come. When Dr. Ohto of the Takeda Foundation came to invite me and discuss with me about this particular international policy dialogue, and to suggest that I share my thoughts, I felt very highly honored because I had the privilege to study in Japan and learn many things from Japan. Before that, during the last few years while I have been in Singapore, I have had the privilege to also interact with many senior colleagues, some of whom are here, such as Dr. Arimoto, who came to discuss with me and find out how Singapore is doing research collaboration and creating new research infrastructure. I had the special opportunity to actually set up such a new institute in the National University of Singapore. From that angle, I will share my thoughts.

When I first went to Singapore, the president of the university, who is a medical doctor, was the champion of Singapore's task force, which acted to resolve the SARS epidemic in that country. He worked together with Taiwan and Hong Kong, and he was the director of the health service's agency in Singapore at that time. He created various new ways of converting the SARS episode, and he received a gold medal from the government. Since then, when he became the president of the university in 2008, he organized three round table sessions, just like today, and each session had a particular theme. The first session was to look at global macroeconomic and social trends, and their meaning for Asia. So I will share my thoughts in the same thread with you.

Looking at Asia over the last ten or twenty years, the population has grown significantly, and more so in the developing countries. This is where the young people are. Unfortunately, these countries still struggle with basic problems such as drinking water, lack of sanitation, and very poor infrastructure. Somehow, we don't pay serious attention to this. However, this is a problem that we need to solve because if we don't solve this problem, the overall economic development of the world will be slowed down. People who don't have access to water and sanitation cannot enter the economic market of the world. Who will buy the mobile phones and the iPads? These people will not be able to participate because their incomes will be very low. This was the first discussion that we had, and the timing was very good because it was 2009, the time of the Lehman shock and the global crisis, when everyone was feeling worried about the economic downturn, and Singapore was trying to figure out what to do about it. So I want to stress the point that solving the problems of developing countries is not something trivial, it is crucial. If we don't solve these problems, these young people and poor people cannot support the economic activity of the developed countries and the rest of the globalized world.

The second subject that we discussed is that a new trend is being established in Asia that Asian countries have been urbanizing far more rapidly than countries in North America or Europe, and they are also urbanizing in a different way. Asian countries did not plan for the rise of these

cities, the cities happened through the globalization process. Some of these cities do not have a proper airport or seaport or proper road infrastructure. They just participated in the global business and commodity chains of global companies. Today, in many of the big Asian cities, for example, Bangalore and Mumbai, half of the population lives in slums without proper houses or facilities, which makes these cities very difficult to live in. And we cannot help them. They need huge investments in MRT, subways, expressways, and these countries cannot afford to invest in that. Even the bilateral, multilateral assistance from the World Bank, Asia Development Bank, JB cannot support it fully because the amount of money that is needed is so great that we need private investment to go in. But the governments do not have the capacity to attract private investment because they have so many problems of governance and so on. We need to address this in a very innovative way.

The third subject of discussion concerns thought leadership. Can the university (looking at the NUS as a hub) play an internationally important role in creating thought leadership to think about these problems, and eventually solve these problems? We are well placed, and, in my view, Japan has an important role to play. Japan should not think that it lies outside Asia, but feel consciously inside Asia, and feel part of the problem. Japan should take leadership to pursue the solution by providing the thought leadership. How can we make the cities of Asia become better? How can we help with basic problems such as water, sanitation, health in Asia? How can we lift up the poor people of Asia to become economically active, and how can we transform Asian society into a dynamic society? For that, I want to offer two suggestions for discussion here.

First, there is a lot of intellectual property and knowledge created by Japan in the past many years to solve the problems in world society. I don't mean creating a new camera or something, but basic things such as cleaning water, building bridges and roads, and things like that. Can we share this knowledge very quickly so that we can bring technology to find solutions very quickly? For that, perhaps we should set up an innovation fund, which I am predicting should be something like a one hundred billion dollar fund for the next ten years, and really support all these innovations to solve these basic problems: to provide clean water or sanitation or health services. All these things can provide new knowledge.

The second suggestion is that, because we are associated with a lot of universities and we have heard many discussions about university networking, we should plan to create within Asia an elite team of ten thousand people who will have free access and mobility to go around Asia, work anywhere, and solve all the problems. This would be like the Fulbright in the US where people are sent around to solve Asian problems. This would not have to be limited to Asians. Anyone from around the world could come because this is where the business opportunities will be. So please think about these two issues because Singapore is now very seriously looking at this and wanting to take these issues forward. Right now we have about 30 million dollars in the last two years with which we have created many research projects. For example, there is a project called "Asian Cities" which asks the question: what is the identity of the Twenty-first Century city? We have another initiative called NIHA, which is the NUS Initiative on Health in Asia, which looks at how to improve health in Asian countries that do not have universal health care or proper facilities. Another initiative is "Life Cycle Financing", which looks at aging societies, and how services can be provided in an aging Asia. So in our institute, we give research grant money to researchers and then connect them with industry so that we can create innovative products, rather similar to how science agencies work in many countries. But this is a university led initiative. We want our grantees to work in an interdisciplinary way across domains, and in areas that are not easy to study. Thank you giving me the opportunity to share my thoughts, and I look forward to your comments and feedback.

Chapter 3　Trial of regional collaboration in Asia: e-ASIA Joint Research Program

Akira Nakanishi, Director

I would like to present the East Asia program for the purpose of this workshop. e-Asia JRP stands for the East Asia Science and Innovation Area Joint Research Program. This program was proposed by the Japanese government, endorsed by the Cabinet Office, the Minister of Foreign Affairs, and MEXT, and JST is the implementing organization responsible for its promotion. The fundamental concept of the program is to build up the Asian science and technology community, initiate the East Asia Joint Research Program, and raise the level of science and technology in the region to realize an innovative economy and society in the region, all the while respecting and utilizing the diversity that exists in the East Asia region. This concept is still continuing. In addition, the program aims to pursue synergistic, supplemental and leveraged effects by multilateral cooperation in research activities, establish and amplify “equal partnerships” in the region, and establish and amplify “scientific management”. We assume that members of the EAS (East Asia Summit) will participate in this forum. This includes the ASEAN10 countries and the eight surrounding countries, which include Japan, China, Korea, US, Russia, India, Australia, and New Zealand.

The organizational structure of this program states that members should participate in the board meetings and on the advisory council. A peer-review panel will be established field by field for the project call, and scientists will manage the research activities. We are going to introduce the lead principal investigators and the area advisors. We anticipate that each project will involve the participation of at least three countries, which means that we are promoting multilateral cooperation. Joint decisions as to the projects selected and joint support of the projects will be the basic scheme of the program. Joint support means that each country will support its own researchers so that money will not cross borders. The main form of collaboration will be joint research by matching funds. Matching funds means each country supports its own researchers. Additional forms of collaboration include research by on-top fund, which means that if the principal investigators of big projects would like to collaborate, we will provide additional funds for research exchange; information exchange, which is always important; and we have to provide special consideration for the exchange of young researchers.

For the establishment of this new program, we organized the e-ASIA Joint Research Forum in Singapore in July of this year with the attendance of 22 participants from ten countries representing 15 organizations. We explained the concept of the program, and we feel we received a good basis for proceeding. Last October, we held an e-ASIA Joint Research Forum in Tokyo with the attendance of 30 participants from 13 countries and 22 organizations plus the ASEAN Secretariat. We discussed various details of the framework and shared our common understanding of the program. In addition to the forums, we had science talks to select multilateral precursor projects in five scientific areas: low carbon society, plant science focusing especially on crop science, disaster prevention, nanotechnology and materials science, and infectious diseases. During the talks, we identified 16 possible projects that could be carried out through multilateral cooperation. We reached a consensus that a letter of intent to participate in this program will be deposited by the end of February, and soon after that, we are going to inaugurate the e-ASIA Joint Research Program.

The concept of e-ASIA JRP was recognized at the 6th EAS (East Asia Summit) with the Chairman’s Statement: “We welcomed Japan’s initiative for implementing the e-ASIA Joint Research Program/multilateral joint research program under the concept of an ‘East Asia Science & Innovation Area’”. Our program and initiative have been welcomed by the leaders of the eight countries. We have developed an e-ASIA JRP website (http://www.the-easia.org/jrp/). Please visit

this site to obtain the documents used in the first and second forums, as well as the reports from the science talks in the five areas to learn more about the 16 possible projects in these areas.

Chapter 4 Innovation in Malaysia

Muhamad Jantan

I will talk briefly about the state of innovation in Malaysia, the challenges we face in terms of human resource development, ICT support, and our general innovation challenges. Malaysia is in fact a federation much like the United States of 13 states, but the most important feature of Malaysia is its ethnic diversity because many industrial and innovation policies are guided by this diversity. In policy development, it is necessary to include all the major ethnic groups. In terms of the economy, the GDP of Malaysia is currently trapped in the middle-income group; however, for Malaysia to move forward, it needs to move into a high-income category because we have come to this stage on the premise of manufacturing and we have lost our competitiveness in terms of manufacturing. Therefore, the only way forward for Malaysia is innovation.

The report by INSEAD provides some indicators of Malaysian innovation capacity. Globally, we are ranked #31 out of 125 nations. That may look good, but, more importantly, we do badly in a number of categories, particularly in human capital and research, institutions, and in terms of output, we are relatively mediocre. But what is most damaging is the level of innovation efficiency where we are ranked #77 out of 125. That implies that we are not efficient at converting our input into the necessary output. Compared with our ASEAN neighbors, apart from Singapore, which is ranked #2 globally, we fare well against the other major countries, particularly Thailand and Indonesia. As compared with other East Asia countries, especially Hong Kong, China, Korea, and Japan, we trail behind. Finally, as compared with the more developed nations, we suffer even worse. The hard data for indicators of science, technology and innovation are generally good. Gross expenditure on R&D is only very small, only about 0.62% of GNP in 2005, and more recent data suggest we have lagged behind even further.

There are three basic factors that impede our innovation initiative, the most crucial of which involves human capital and human resource development. Human capital development in Malaysia involves various levels. First are primary and secondary education, which are under the Ministry of Education. Next is continuous skill development. Since 2000, there has been a human resource development fund to which every industry must contribute about 1% of their wage bill. In order to recoup their contribution, the industry must send its workers for training. We have vocational training, but this is very limited compared to the university system. Tertiary education is under the Ministry of Higher Education, a ministry set up in 2007 to help move Malaysia to a knowledge-based economy. As a result of that, we have a national higher education strategic plan for 2007 to 2020. Within this there is a huge initiative focusing on moving higher education to support a knowledge-based economy.

Among the educational reforms that have taken place are two major things. The first began in 1996, when the Private Higher Education Bill was passed. Prior to 1996, all education was conducted by the public sector. However, by then the demand for higher education was so large that government resources could not fund it all, so the higher education sector was liberalized to allow for private initiatives. As a result, prior to 1996, there were seven universities, and now Malaysia has about 600 higher education institutions, of which about 80 are universities and university college institutions. This has led to greater access to higher education, and so in terms of places for higher education training, the percentage of the youth sector going to higher education is much greater

than previously. The other important reform began in 2007 when the Ministry of Education was split into two, the Ministry of Education and the Ministry of Higher Education, which was charged with looking only at tertiary education. As a result of this reform, there has been an increased focus on higher education. Even so, in terms of tertiary education, we are still lagging behind. For example, while Korea has recorded an impressive average growth in tertiary education of 4.3%, the growth in Malaysia is only a modest 1.25%. In terms of achievement in primary and secondary education, Malaysia is on par with some OECD countries, but still behind in terms of tertiary education.

So what are the challenges that Malaysia faces in terms of higher education? The lack of skilled personnel remains an issue. We have a very conventional education curriculum, with a more innovative and creative culture only recently introduced. It was only last year that it was made mandatory for all public institutions to include entrepreneurship programs, and only this year that knowledge transfer programs were introduced. We have a problem with our absorptive capacity so that increased funding does not necessarily lead to the desired results. Also, there is an education mismatch due to the weak industry-education link whereby the educational institutions do not produce the personnel to fulfill industry requirements. Therefore, the linkage between universities and industry needs to be strengthened because we still retain the academic tradition of focusing on fundamental research and very little on the translational side. Up to now, R&D has been discipline based, and researchers in public universities especially work along discipline lines. It's only in 2011 that we have introduced a grant scheme that requires greater collaboration across disciplines. For example, the long-range grant scheme requires that humanities and social sciences be included within science research funding.

Another challenge we face concerns the ICT support structure. We have the Strategic ICT Roadmap, which stretches from 1990 up to 2010. The major initiative of this roadmap is the multimedia super corridor. The plan for this MSC was started in 1996, and is supposed to include many world-class companies in multimedia applications, and support many IT initiatives within the government. However, it is difficult to say to what extent this plan has been successful because the number of companies except for Cyberjaya and Putrajaya hasn't reached the required level, a result that has a lot to due with difficulties in integrating the various ministries that oversee this plan. So the challenges facing ICT include networking, information and knowledge gaps are still a problem for SMEs, which are the targets for this ICT initiative. There is also a lack of e-business uptake, and a lack in local business innovation due to a lack of skilled workers. Additionally, there is the problem of brain drain and the fact that broadband uptake has been minimal. But an important factor is that we have many sectors within various ministries that do not talk to one another. The challenges we face are similar to those of other countries. We need to improve our capabilities for innovation, particularly our indigenous technological capabilities. Our financing for innovation is still in its infancy stage, and the amount of venture capital is very small.

Another challenge is that there isn't a level playing field in terms of competition to drive innovation because many of the companies are government-linked companies, which typically monopolize many sectors.

The last problem is that of labor mobility as was discussed this morning. We believe that our potential for collaboration lies in human capital development, for example, access to renowned laboratories, post-doctoral placements in research centers, and apprenticeships in industry leaders. For example, in the case of joint laboratories, there is RIKEN-USM that will be set up this year within USM. Also joint research projects can be undertaken. Thank you.

Chapter 5 Renewable and Alternative Energy – Development Status in Lao PDR

Keophayvanh INSIXIENGMAY

I would like to describe some of the activities underway in my institute. Recently, the Science and Technology Research Institute has undergone restructuring, so that I am now affiliated with a

new institute, the Renewable Energy and New Material Institute (REMI), which comprises five divisions working under the Ministry of Science and Technology combining eight departments, four institutes, and two cabinet offices. From 2007 until 2010, we had a Renewable Energy Technology Center (RETC) under the Science and Technology Research Institute and belonging to the National Authority for Science and Technology. From 1999 until 2007, RETC worked under the Science and Technology Research Institute and Environment Agency. So the name has been changing. REMI is headed by a Director and three Deputy Directors who oversee five divisions: the Bio-Energy Division, Alternative Energy Division, General Affairs Division, Research and Development Division, and Mechanical Engineering and New Materials Division.

One of the main roles and functions of REMI is to conduct research and development in the areas of applied and adaptive research on renewable energy technology, and traditional technology that can be used under local conditions. Also, we contribute to local and regional development by transferring technology and research results, and providing diverse academic services and consultation to local communities. We undertake human resource development by promoting and upgrading technical skills, and create public awareness on renewable energy technology. Finally, we provide services including organizing seminars, training, feasibility studies, technical consultations, and the installation of facilities. Some of the achievement activities in renewable energy that we have undertaken in the past include solar energy for rural electricity, biomass for household and institute applications, improved cooking stoves, gasification stoves, and biodiesel production.

We have some completed projects involving solar photovoltaic systems, which were introduced to Laos in the 1980's to power telecommunication systems and refrigeration for vaccine storage. In 1997, we applied solar PV systems for domestic electrification in remote regions. Between 2007 and 2009, with the support of the WISIONS Institute, we promoted improved cooking and heating stoves in the Peak district in the northern part of the country. Another complete project was one started in 1996 to develop and promote biogas utilization by the demonstration of biogas plants. In conjunction with this, more than 24 biogas digesters were installed as a pilot project in different provinces as well as in Vientiane. We used technology from China to introduce a biogas fiber glass digester into Bolikhamxay Province in a project supported by Mekong Electronic Co., Ltd. There was a biogas project supported by UNHABITAT installed in Oudomxay District.

We have an ongoing project supported by UNESCO for the application of biogas technology to waste water treatment and energy production on pig farms as an E3i model (energy, environment, and economy integration) installed in Vientiane. We also have new project proposals for which we are still seeking funding support. For example, there is a proposal for a project to promote biogas technology for wastewater treatment and energy production on livestock farms for which we are seeking funding from the Global Environment Fund (GEF). Another proposal is to apply a simultaneous cooking and energy production system for a non-electrified village with funding from WISION. We also have an application pending for the application of biogas technology to provide environmentally clean and sustainable energy for household use with funding from the GEF small grant program. Finally, there is an improved cooking stove project with funding again sought from the GEF small grant program.

Laos imports 100% of its oil for use in transportation and as household fuel. That is why we are now very focused on the use of biofuel and biomass research and development. Thank you.

Chapter 6　Discussion 1

Barbara Rhode

I just want to know whether there is any type of fund whereby one country can fund researchers from another country.

Seetharam Kallidaikurichi E

In the research that we have now started, we have consciously addressed this important need. Previously, the National University of Singapore received money mostly from the Singapore government, and the university gave the money only to professors working in the university. Of course, they need not be Singaporeans because the National University has people from many countries. Then we extended it so that those professors or researchers can partner with universities in other countries in the region. That is the second level of innovation that we did. So they may not have a lot of money, but they can partner with other universities in the region or anywhere in the world, but use that money to bring researchers to Singapore. So the money is not actually going out, not like a joint partnership.

One more innovation, which I shared with you earlier, in the Global Asia Institute is where we actually now give money to outside universities. One of the requirements for the recipients is that they come to Singapore and share their findings in a lecture or workshop, so that they get to interact. In June of next year, we will hold a major conference on thought leadership. We have awarded more than 100 researchers participating in about 25 projects, and all of them will be asked to come and share their findings in what we expect to become an annual workshop. So far, this program is small, only three or four million dollars, so it's not very big.

Paritud Bhandhubanyong

On a bigger scale, three or four years ago, Japan provided a scheme called SATREPS for which JST and JICA provide funding support, JST for the Japanese side research institution and JICA for the research team in the collaborating country. We have a joint project between Dr. Nishijima from Waseda University and AIST. In Thailand, there are three organizations TISTR (Thailand Institute of Scientific and Technological Research), NSTDA (National Science and Technology Development Agency), and King Mongkut's University of Technology North Bangkok, involved in the project, working on nonfood biomass feedstock to produce biofuel. For the Thai side, we receive about 80 million yen per year for five years, and about 50 million yen per year for five years for the Japanese side, which is very big funding support.

Akira Nakanishi

My previous responsibility was the promotion of SATREPS. In the case of SATREPS, JICA provides supporting funds for researchers in developing countries, and JST provides funds for research activities by Japanese researchers, and all of the funds come from the Japanese government. In the case of e-ASIA, for example, Thai researchers will be funded by NSTDA, and the counterpart, for example, Singapore researchers, will be funded by respective funding agencies or governmental organizations. This is the source of funds in our case.

Akio Nishijima

I am working at Waseda University, but also working at AIST. As Dr. Paritud has already mentioned, we are now promoting Japan-Thailand collaboration. Today, during lunchtime, we discussed with a representative from Laos, and we agreed to form a network among the three countries. We are already collaborating with Indonesia, and also with Vietnam. So maybe this is one of the outcomes of this workshop—we now have a five-country network concerning biomass utilization.

Muhamad Jantan

I'd just like to respond to a question. In Malaysia, there are no restrictions concerning the funding of foreign researchers. The only constraint that we have is the amount of funding available. We were lucky that in 2011, we introduced a huge grant scheme. We fund a typical project at about 15 million Malaysian, which is about five million US dollars to allow foreign researchers to work together with Malaysian researchers. The only requirement is that the principal researcher must be Malaysian. They can invite foreign researchers to join the group, and, of course, they need to justify why certain individuals are included in the group on the basis of expertise. But this is only a recent phenomenon. In terms of whether we restrict nationalities: as long as they are working previously within a Malaysian institution, there is no problem, and they can be the principal investigator and be funded.

Houmpheng THEUAMBOUNMY

In terms of research activity in Laos, we had a five-year plan for research and development to meet the government development plan but we can not implement our plan due to the limited research facilities and funds. Even if we can find some grant support that allows us to buy only materials for research, we cannot apply it because we have no research facilities available to carry out the research. So our problem right now is even if some funds are available, we cannot apply for them due to the limited facilities.

Yoshio Matsumi

I'd just like to make one comment. I think that it is absolutely desirable to have a large-scale, international open innovation R&D collaboration center, as they have in Minatec in France, IMEC in Belgium, and SUNY-Albany in the US. Unfortunately, there are not many large-scale joint R&D centers in Asia; Tsukuba Innovation Arena in Japan may be one of them, but not yet. But we have to realize that it may not be easy for one country to build a large-scale open R&D center. That is why we are here to discuss how Asians can cooperate in building a really large R&D center. I am not just talking about desirability, because we have to be very realistic. Each country has fiscal and budgetary constraints. We cannot expect governments to continue to provide huge funding. Therefore, I am trying to say that public/private sector funding will be necessary for us to build such a large joint R&D center in Asia. By public/private sector funding I mean that we have to involve deep pocket companies such as IBM in the case of the US. In Asia, this funding should involve private foundations and then some deep pocket companies. I don't have a clear answer right now, but we need to come up with some mechanism for public/private funding. Otherwise, we will not have a really large-scale, powerful open international innovation R&D center in Asia.

Mime Egami

I think that Mr. Matsumi's comment to establish Asian R&D collaboration center is very

important. Also I was impressed by the speaker from Singapore, Dr. Seetharam, that research projects with goals of solving fundamental Asian problems are very important. We have been trying several research collaborations in Asia, but if researchers of a country try to collaborate with researchers of another country in the same field, sometimes only one country obtains much better benefit or results than others. For a country that suffers from fundamental problems, there is not so much reason to collaborate if the debate concerns only the research field. But if we link activities of research, development, diffusion, and social science on industrialization, then each Asian country will contribute and have its own strengths in one of such integrated value chains. For example, Japan has many great scientists in the medical field, but perhaps the infrastructure to bring the research results to the bedside may not be good enough, even though we have a great health care system. Perhaps some other countries in Asia have better systems to bring results of medical research to bedside application. So if we collaborate together and co-manage technology and infrastructure assessment in Asia to design a seamless pathway for diffusion and industrialization in Asia, then we can form a great coalition platform. And as Mr. Matsumi mentioned, industry has a lot of reasons to participate and provide the funds to such platfrom. Thank you.

Tatang Taufik

I have some general questions for the presenters. The first is in contrast to the generalization that some of the Asian countries are aging. In a few years, Indonesia will have a demographic bonus because the younger generation will dominate our population structure. The problem for us is how to prepare the young generation to be productive and innovative. I would like to learn from our colleagues from Singapore and from Malaysia how this can be done. My second question is about government roles in innovation. How did the governments in Malaysia and Singapore develop funding support, and, especially, improve the budget mechanism? This is the biggest handicap for Indonesia in supporting innovation. And my last question is related to energy projects. Indonesia has tried some projects, but, so far, we have not been successful, and I heard from Dr. Mabunga that similar projects in the Philippines have also been unsuccessful. So I would like to learn from the Lao perspective how this kind of project could be successfully prepared.

Tateo Arimoto

I would like to hear comments from the administrative point of view because I have been involved in the making of many of Japan's science and technology policies as a government official. Normally, until recently, our funding systems have been established nationalistically because we cannot transfer real money across borders. These years we are facing many difficulties that cross borders: infectious diseases, smart cities, water, etc., especially in the Mekong Delta area. So how can our national funding systems be reformed to address new challenges? We have a lot of lessons to be learned from the history of the European activities. They have already established cross-border physical as well as virtual infrastructure. By virtual infrastructure I mean funding systems and university networks. But my observation is that they are still struggling, and I would like to hear Dr. Rhode's comments. We need collaboration among the scientific communities as well as each government sector. Each government collects money from its citizens within borders. So normally the government has to pay money, even for research activities for profit, within its borders. That's an important political factor.

Seetharam Kallidaikurichi E

I will try to be very brief. I admire the Indonesian people. I worked there for many years with the

Asian Development Bank, and I know the real strength of Indonesia. We have started a new research project in Singapore. I didn't list it because it will be formally announced in January. It is a comparative Asia study in which we are comparing India, China and Indonesia, because we believe that these are the three countries that we need to understand. Similar to Indonesia, India has a lot of young people. We want to study how, by 2030, this population will change, and what kinds of needs they will have. There is a very rich Indonesian businessman, Mr. Mochtar Riady, who has donated a lot of money to the business school of Singapore's national university. So we are conducting research into how the poverty and employment possibilities for Indonesia can be made better by understanding the demographic trends. As to your specific question about how research grants are given, I can give you a little background. Singapore doesn't just give out money from the government as research grants. There is competition at various levels. The grants that I mentioned are mostly given by philanthropic organizations, not by government sources of money. For the health project, for example, we received ten million dollars from a pharmaceutical giant that has been in Singapore for many years. The government gave a matching grant, so it became twenty million dollars. So for every dollar we raise, the government gives a matching grant. In the same way, for projects on the order of ten million dollars or so, the government proposes that government agencies will have to compete. So if there is a real problem that a university would like to research, the university professor has to work with a government agency, and also sometimes with a private company to show the value of such research in terms of job creation and economic development so that the research is seen as relevant to the economic part to the government's own long term strategy, and will also create something for industry. So if that is justified through the research proposal, then the funding will become available together with matching funds that sometimes the governmental agency will provide. But these are large sums of money. In total, they have now kept aside challenge funds for energy, for water, for social issues and economic development totally about one billion US dollars for the next five years. So it is a huge amount of money, but it will be given away in ten to twenty million dollar quantums. This means that a lot of proposals will be entertained. Twice a year, in January and July, the grant calls are announced. So if you have an innovative idea, you submit your proposal to the committee for review, and funds are awarded. This is how the system operates.

Houmpheng THEUAMBOUNMY

Since 2006, the government of Laos has tried to develop biofuel in the country. Many in the private sector have begun to plant jatropha because they know that jatropha is easy to grow under many land conditions. The first problem is that when jatropha are first planted there is a low yield of seeds. If someone in the private sector wants to develop jatropha, then the government will join. This is the first joint research project between the public and private sectors in Laos. In this project we try to list all of the processes of production such as plantation, oil extraction and proceeding to biocell production and utilization. For right now, we are involved in only some processes. For oil extraction we can buy machines and we have the technology for biocell production. The problem is that the yield from jatropha is still low in Laos, but we are trying to improve. We are also trying to find the technology to use all parts of the jatropha products. We want to use not only the oil, but also the waste from the process. We are now seeking the technology and funding to pursue this kind of research.

Joni Jupesta

Thank you very much for the opportunity to come here. I am frpm United Nations University. I have a very serious comment concerning the impact of land quality for the jatropha. When we did a study on the biofuel impact in Indonesia in 2007, there are very big deforestration issues due to expansion of the palm oil plantations. Sometimes we want to plant for biofuel, but for developing

Asia it is very important to maintain the agricultural sector (food), because this is related to job creation and poverty reduction. We cannot follow a pattern of development for Europe and the US, because Asia has different capacity. So the innovation issues in developing countries are rather different from those in developed countries, for example, when Laos and Indonesia want to plant jatropha as biofuel sources. The reason why both pursue jatropha is because jatropha is not edible and there is no conflict with food. Please keep in mind that the land they use to cultivate jatropha is the very good quality land (fertile). Usually, jatropha planted in Africa which has semi arid relative dry (not so much water). On the other hand, the palm oil in Indonesia and Malaysia is edible, creating the conflict of whether the product is for cooking or for fuel. In the case of innovation, it is necessary to integrate natural science (including agricultural science) and policy makers sitting together and thinking this issue over before they make the policy. The impact on the land is very huge after it's planted with jatropha. After you plant jatropha, however, you can't plant any other trees because the land quality will be degraded. Consider that the tropical countries such as Laos, Myanmar, or Thailand have very good land quality, so it doesn't make sense to plant jatropha in those countries. Instead, where the land quality is good, a more productive plant such as palm oil tree is preferable. Also, this palm oil couls be diversified for food and fuel purposes depending on the market prices. You can get around 4,800 liters of biofuel from one hectare palm oil tree, compared with jatropha which produces around 1,600 liters from one hectare of jatropha. When this policy is being made, it is necessary to integrate scientists into the procedure because the policy should be made based on scientific evidence. In the end, I want to emphasize that it is not clear that planting jatropha is sustainable energy due to environmental issues and impacts. Thank you very much.

Audience 2

I just heard Mr. Matsumi say that we need to have research centers for open innovation, and you recommended that the business community should come forward to achieve that. I propose that since we have Mr. Akamatsu from ITOCHU, why doesn't ITOCHU start this? Charity begins at home, correct? ITOCHU is one of the largest shousha in Japan, so I think it would be good for them to start something. Last year, I came here, and I made a proposal that was accepted by the Takeda Foundation, and I am very proud of that fact. I said that Japan should have one dedicated English language television channel, and I proposed that NHK-3 should become that channel. Later I found out from Dr. Ohto that the Takeda Foundation made such a proposal to the government. So I think that proposals being made here are valued. They're not simply armchair discussions. So the proposal made by Mr. Matsumi is valuable, and I think that business should take the lead. It doesn't have to be all business. Japan has always been supportive and the government will provide support, not only within the border but also across borders. Tsukuba is one direction, but I think you should think of something bigger in other places in Asia. This is my recommendation, and I think that the Takeda Foundation can take a big lead in this.

Norio Ohto

Thank you very much for your comment. I am interested in the development of public/private funding. There are several private foundations that actually grant cross-border such as the Fulbright Foundation and the Rockefeller Foundation. In addition, several Japanese foundations also give cross-border grants such as the Sasakawa Peace Foundation. So it is time to think about public/private funding including both the profit and nonprofit sectors. That's my comment. Thank you.

Teruo Kishi

Thank you for your comment concerning the importance of open innovation centers. This will be discussed in the latter part of this session. Dr. Nakamura will give an introduction of the Tsukaba Innovation Arena. This concludes the first half of this session. Thank you.

Chapter 7　Committed Collaboration to bring regenerative medicine

Mime Egami,

I will introduce our institute where biomedical innovation is being pursued in a multidisciplinary manner involving scientists, physicians, technicians, and people from industry. This session's title is Collaborative Research and Infrastructure, so I would like to introduce our institute, TWIns, which is a uniquely focused joint research center between two Universities. It is not like a department store, but we really specify target advanced standard therapies and fuse people under same vision, so that instead of open innovation, I describe what we do as fusion innovation. This involves the fusion of world-class sciences, tacit knowledge and state of the art delivery technologies, including industry technologies. All members join together under a visionary science leader.

We have over thirty professors from both universities, but these professors are not working separately. Each professor has a different expertise from clinical fields to science fields, and they work together as project members to pursue a goal. Our major biomedical technology, cell sheet engineering regenerative medicine, is a world-leading scientific project, and is being supported by the Japanese government. This is a fifty-fifty matching program with a budget of approximately 150 millionUS dollars over ten years. These S&T funds are provided, however there has not been enough action taken by our Government to design funding & support for international clinical application collaboration, or a seamless regulatory or reimbursement pathway, or the employment of specialists to enforce a medical platform to accept advanced therapies, such supports for system integration or analysis for industrial applications has been missing. These items are essential for affordable and cure therapy to bring patients back to society. Already very motivated Asian scientists and physicians, not always belonging to Asian universities or hospitals but from the US or Europe, are gathering to TWIns to learn & further develop this therapy before advanced countries such as EU and US fix the value chain, protocol and prices so that Asians buy the license at some expensive cost. Then we cannot deliver to all the poor people.

In this field, the Japanese New Growth Strategy was decided at the cabinet level, but the questions remain: how? who? where? Also, any achievement in the medical innovation area can be utilized for other industry technological R&D, or other industry technological R&D achievement can be used in this area. So that type of cross-section usage of such technologies has to be designed from now. At TWIns we have one credo: A passion for innovation and a duty to the patients of tomorrow. We don't just treat mice and rats; our goal is always the human patient. Because Tokyo Women's Medical University is a private university, our research center receives fifty-fifty funding from the university itself with some industry involvement, while the other fifty percent comes from the government. TWIns is a joint institute between Tokyo Women's Medical University and Waseda, which is overall a more robotics, engineering, and overall university. This is the first joint institute in Japan. In this institute, more than 400 people are working together, and the sum of the facilities are unique in Japan where medical doctors, scientists, and industry staff work together as one team. Previously, it was very difficult for medical doctors and science and engineering researchers to work together, or for medical doctors to work with industry people as equal partners. In this institute, people have to work together because we are sharing the same goal.

One of the core groups in this institute is pursuing engineering based surgery. At our institute we developed open MRI intelligent operating theater in which neurosurgery is performed by openMRI so that the brain can be monitored during surgery and we try to delete glaucoma from the brain without damaging verbal capability or other functions. This openMRI has been used to treat more than one thousand patients with a relapse ratio of less than 25% of the national standard.

Our cell sheet engineering regenerative medicine is based on , in fact, a unique technology, the so-called thermo-responsive cell culturing method. Conventional cell culture methods culture cells and then put trypsin, which damages the cells, but makes them easily removable from the culture dish. But our director, Professor Okano, invented a new type of culture dish where cultured cells can be harvested as a unit without damaging any of the adhesive proteins or cell-cell junctions. These cell sheets can then stick to an organ by their adhesive proteins with no sutures. Based on this kind of domain technology, our researchers and physician scientists are developing various applications of regenerative medicine concurrently.

I think that one more key phrase of our institute is “concurrent approach”. Our physician scientists talk between a GI surgeon, a cardiologist, a dentist or a brain surgeon to share tacit knowledge and science and different cell responses, and try to develop unique disease solutions concurrently based on domain cell sheet technology. Based on this concurrent approach, we have already started and are promoting corneal regenerative medicine, esophagus cancer regenerative medicine, cardiomyopathy regenerative medicine, and periodontal regenerative medicine for human patients. These clinical trials have been done not only in Japan, but also in France for which our marketing product application is already accepted by EMA, so within 210 business days we should be able to get a sort of approval. Not only do we use the concurrent approach to develop different clinical applications, our researchers develop basic research, cell culture & tissue engineering technologies, evaluation science & logistic technology concurrently to design advanced treatment value chain. We develop how to achieve mass and qualitative production of the dish and cells, as well as how to culture cells under the GMP standard, how to layer it, how to make the tissue, how to do the logistics, how to monitor (traceability), and how to deliver it back by proper delivery device to the patient body. Once each technology is established, it forms a treatment link in the value chain. We think that this kind of concurrent approach is essential to develop affordable regenerative medicine.

We are currently promoting a concurrent world clinical coalition to treat patients world-wide. Some of our collaborators in Europe are trying to seek FP7 or FP8, and maybe we are involved together with other Asian scientists. Compared to the old model for drug development in which the pharmaceutical company is the core driver to bring a product to the bedside, an innovative team has to be established responsible for bringing new regenerative medicine to the bedside, new industry creation. We think that development of new regenerative medicine manufacturing & logistic coalition system is the key to good collaboration in Asia. In our institute we have many scientists from Asia, and it is our mission to bring technology and innovators back to their countries of origin to save Asian patients because it is very difficult to afford expensive drugs to treat symptoms for a lifetime. But regenerative medicine can realize a cure and affordable therapy, then people can go back to work and enjoy active aging society . Thank you very much.

Chapter 8 European Research Area

Barbara Rhode

I think that this is a most interesting workshop. Also, thank you for looking at Europe as a model. These days some parts of our cooperation within the European Union are under improvement works , and we have some repair works to do, but, we are proud of the model and ready to improve. So we will be getting closer together. It remains an interesting exercise that I can only encourage you to follow. Here I have two different purposes. The first is to explain to you is how we

work and what is possible, and what could be a wider model for the benefits of regional cooperation. My second purpose is to introduce ourselves as a partner. Europe is a piecemeal of 27 countries, the nose at the other end of this same continent. We came together after World War II to make peace instead of war. Today we are also very happy to be together in globalization because the wind that is blowing right now is not always comfortable. Our research cooperation is one of our highlights, and has been successful at, along with many, many other things, keeping us together. I would like to present four different projects so that you can see how the projects are constructed.

The first project involves water monitoring, rainfalls, the impact of monsoon systems on the Tibetan Plateau. This shows how to target a project of the greatest importance, and how to get the scientific potential together to solve the problem or at least to get a solution under way. The project partners are working together to monitor rainfall because there are the big seven rivers in Southern Asia fed by these waters, and they are creating floods and droughts in the low lands, and both are very difficult situations. The goal is to set up a network of Asian and European partners. China and India are both involved, the Chinese Academy of Tibet, together with an Indian research Institute, and with Japan sitting in the middle of the project. We have brought in water specialists from Europe. Scientists from the Netherlands know how to cope with floods, while drought specialists come from Spain. Italy provides a complicated land and satellite-based monitoring system. This is one project that is being funded with approximately 4.5 million euros. We also ask our partners to contribute so that 100% is not funded by us, because you always get better results if each country has its own financial interest involved. I chose four projects from among about 14,000 projects that are running just to give you some idea as to the magnitude.

The second project is a social sciences project on nuclear safety. The aim is to achieve agreement concerning the final repository. The project is divided into work packages that are distributed to different partners. This is a genuinely European project involving countries with nuclear establishments. These are always bottom up consortia, and include Japan and the US as partners with France as the coordinator.

The next project centers on the different schools of thought regarding thin films. All of the relevant partners are pulled together to find the gaps in the science. This project includes Japan and India, but apart from them, it is a European project.

The last project is called “Facilitating the bi-regional EU-ASEAN science and technology dialog” or SEA-EU-NET for short. This is a project to facilitate collaboration, and we are asking our member states to come up with additional funding. The project includes Thailand, the Philippines, Malaysia, Laos, Indonesia, Vietnam, and Singapore from ASEAN, and the European side includes the UK, Austria , France, the Netherlands, Hungary, Germany, Poland, and as non EU countries also Turkey, and Switzerland. This project is in progress, and we pay 4 million euros, and we hope that more collaboration comes out of it.

Why has Europe tried to come together, and why are we so open? The European Union comprises 27 nations, of which each has built its own science landscape. We include very small countries such as Malta with 200,000 inhabitants; we have big countries; we have agricultural countries; we have industrialized countries. We have countries from very different backgrounds, and so you may realize it’s not always easy to work together. We believe that through collaboration we save funds and accelerate the development of needed technologies. We think that international projects influence global standardization. The programs are pre-competitive and not in the competitive field, but we think that industrial alliances can be formed that produce solutions that are more robust because they arrive through mutual understanding of different cultures and

backgrounds. This is the framework program involving 53 billion euros over 7 years. The framework is research project based, but includes other instruments.

Our Marilyn Monroe is Marie Curie. We find her very sexy. She received two Nobel Prizes, and also her husband won a Nobel Prize and her daughter won a Nobel Prize, and we think she provides a good role model for women, but also for men. She was mobile, born in Poland and working in France and we named our mobility programme after her. We have many different possibilities for exchange, as we are open to the whole world. The only country that is excluded is North Korea. We have an academia exchange program. In all projects we always have academia and industry and stakeholders involved. We have a return fellowship for weak economies, so if someone wants to come to Europe and then return, there is a system in place. We have a fixed budget for seven years, which are now coming to an end, and the financial negotiations for the next period are hitting us at a very difficult time. The next stage will be called "Horizon 2020", which will be a merger of the “Eighth FP” and our “Innovation Program”, and will realize a budget increase of 46%. This new Horizon 2020 will also include associated countries such as Switzerland, Norway, and Israel, who will are associated to the framework program. They will pay into the program, and their scientists and companies will have to recoup the money through competition and excellence.

EU Research had its start in 1983, and has been growing since then. In 2000, we decided that EU Research should not only support projects, but also collaborations because we are creating a new landscape of science and technology within Europe. All together, only 5% of the total budget that is spent in Europe is going to the framework program, but though it is a small amount, it is very effective and is reaching the top researchers and the top institutes, and also the top researchers from small countries have the opportunity to participate. It is not necessary for a scientist to leave his or her own country and work somewhere else. The budget goes to the researcher. EU Research is the most open coalition in the world and everyone is invited. We pay the bill for low-income countries. From Japan we ask for co-funding so that their researchers come with their own budget, and the same is true for the US, Canada, and Korea. To participate you need three partners from three different European countries, that is the core, and then, as you have seen, we can add from all different sides excellent partners.

Now we are coming to Japan, and I would like to echo what my colleague from Singapore has said, I think that Japan needs to play a bigger role in multilateral and international collaboration. I think that Japan is a very important technology country, and could drive Asia. As you see, we are very close partners with the US, and they participate. We also have Russia because they have undergone a very deep crisis and had an interesting science and technology basis. China is there along with India, Brazil, and South Africa. I think that we would like to see more of Japan, but we have started collaboration only recently, and we have now since this year an EU Japan Science and Technology Agreement. We are looking forward to more collaboration, and if you are interested in more information, you can find all the projects and the details of how we are organized on our website: http://cordis.europa.eu/f@7. Thank you very much.

Chapter 9 Looking to the Future: NSF and International Collaboration

Anne Emig

I think one of the messages, intentional or otherwise, will be that we take a somewhat different approach than the European Union, but that we very much welcome collaboration bilaterally or multilaterally with Asian countries. As a quick overview, we are an independent US government agency, and we support basic research in science and engineering along with science and engineering education. We fund all fields of science and

education except medicine. We don't fund anything having to do with the diagnosis or treatment of human or animal diseases. You will notice throughout my presentation that we at NSF talk about S&E rather than S&T. Although there are many interesting things that we are called upon to do, or that our research community would like us to do, we need to stay focused on our core mission, which is basic research in science and engineering. We don't fund the "T" in S&T or the "D" in R&D, nor do we fund capacity building outside of the US. Our primary function is to make grants to US universities, although we occasionally make grants to US museums or nonprofits. We run a proposal-driven, merit review-based process. There has been a lot of talk today about innovation, and I have emphasized that we fund basic research, but our merit review process focuses on two aspects of the proposal review: one is the quality of the research that is proposed; the other is the impact, and that impact may be the scientific impact but it may be societal impact as well. So we are by no means totally divorced from the innovation equation. We are staffed by scientists, and we don't operate our own laboratories. The vision of the foundation is to advance discovery, innovation, and education beyond the frontiers of current knowledge, and to empower future generations in science and engineering. Historically, we have tended to give less emphasis to the innovation equation from our vision, and focus on discovery and research, as well as on the education and training component, but this is changing these days. We are basically a seven billion dollar a year agency. We receive a bit more than 50,000 proposals a year, and have a staff of about 1400 people. Many of the themes that we see as a priority today are cross-boundary themes: cross-boundary research that is interdisciplinary, often multi-institutional, and international. The innovation aspect of basic research is a prominent theme as we aim to speed the societal benefits of basic research.

Over the last ten or fifteen years, we have invested heavily in cyberinfrastructure, the advanced IT tools to enable collaboration, and further data-intensive or simulation-driven science, which is where some of the cutting edge of discoveries lie. As a result, one important theme for us is how the power of the infrastructure we have helped put in place can be harnessed to advance science and to develop new collaborative tools.

Another theme is broadening participation in science and engineering. As a US governmental agency, this means broadening participation to groups that are underrepresented in science. For us, such groups include women, racial and ethnic minorities such as African Americans, Hispanic Americans, and Native Americans, and also persons with disabilities. Our science and engineering enterprise is overwhelmingly male and overwhelmingly white or Asian, whereas we are a society of more than 50% women and about 25% ethnic and racial minorities. We are always struggling to find ways to broaden participation.

International collaboration is an increasingly important theme for us, and shows up in various documents throughout the Foundation. Our proposal process welcomes collaborative proposals, but we have no preference for country or region, so there are no programs that call out for collaboration with Asia as a priority. We welcome proposals that are bilateral or multilateral, regional, or global in nature, and increasingly, we are seeing multilateral and regional, or even global types of collaboration. What we want to do is fund the most promising research and education opportunities or US researchers, and engage them with collaborators where the greatest synergies exist. Our collaborations tend, in principal, to be bottom up in origin.

Probably somewhere between ten and twenty percent of all our research proposals have some kind of international component. Of those, the single largest country of collaboration would probably be the UK, followed by Germany, China, and Japan, although the numbers flip around from year to year. Probably the EU as a group is by far the largest partner. Asia, because it includes Japan and China, would be a close and growing second. There are smaller scale collaborations with each individual country; for example, there is a fairly large award we have with Bangladesh that looks at the intersection of water safety and tectonics. There's a big marine biology collaboration that centers on Indonesia, but also involves the Philippines and Malaysia. We support the US side of

science collaborations. We don't care about the citizenship of the researchers, but they have to be employed by US institutions. Our goals for international collaboration are probably similar to the goals of many of us here: we want to advance the frontiers of science; we want to access the best expertise, facilities and phenomena, and exploit those synergies for mutual benefit, and leverage our limited resources. We don't have the direct goal of enhancing the US GDP or expanding the export of any one product, but clearly that's a nice impact to have. We also aim to prepare the globally engaged workforce. Traditionally, our international collaborations have been single discipline, and supported small, often bilateral, teams at one or two institutions in each country. The funding agencies have operated in parallel without much collaboration, and each side paid its own way. This process tended to limit the ability of developing or emerging country partners to participate. Looking to the future, we see a need for more interdisciplinary, multilateral, multi-national collaborations, and this is reflected in the proposals we are receiving. More of these collaborations center on network building as being as important as the research and education aspects.

Coordination among funding agencies is increasing. To allow coordination, we need shared standards of excellence in basic research. Our director is hosting a summit on merit review for heads of research funding agencies from around the world in May. We have more joint calls for proposals and new funding mechanisms in which we work with partners on coordination, or where we are partnering with other agencies of the US government or with NGOs to fill gaps that we see. In building international collaborations, we need to match research interests. Some of the challenges we face include varying international priorities and resource availabilities. It is critical for us to do what we do well, and stay true to our mission. In international collaboration, or any kind of collaboration, we are aiming to identify that type of situation where one plus one equals three or more. We do not want the effort of building the collaboration to be a net loss. So we need to achieve consensus on goals and process with sufficient efficiency to not cancel out the benefits, and with sufficient speed to sustain forward momentum. Some keys to success include staying true to the goals while exploiting opportunities at intersections. We are a basic research agency, but there are some areas where basic research and innovation overlap, or where basic research and development and capacity building overlap, and those are things we have worked very hard to exploit over the past few years. We aim to be strategic and catalytic to exploit gaps, or to avoid reinventing the wheel, or to avoid doing what others are doing well. It's important to have clear scientific benefit, and to have an open communication process with regular face-to-face contact, but also with good cyberlinkages to enhance the collaboration. And it's essential to keep your eye on the long-term goal because collaboration is never easy when you're trying to get it off the ground.

I appreciate the opportunity to talk about NSF, and I look forward to the discussion. Thank you.

Chapter 10 Tsukuba Innovation Arena (TIA) as a hub for international collaborative research

Kazuo Nakamura

Since the 1970's, the Tsukaba area has been developed as a science city by the Japanese government. The National Institute of Advanced Industrial Science and Technology (AIST) and the National Institute for Materials Science (NIMS) as well as the University of Tsukaba are all located very close to one another, and they all also have the potential for nanotechnology. So these three institutions agreed to form an open innovation platform for nanotechnology, and on June 17, 2009, the three institutions together with Keidanren (the Japanese Business Federation) made a declaration on the

establishment of TIA-nano. The current Board of TIA-nano consists of Dr. Ushioda, President of NIMS, Dr. Nomakuchi, President of AIST, Professor Kishi, Chair of the Executive Board of the Tsukuba Innovation Arena, Professor Yamada, President of the University of Tsukuba, and Dr. Chubachi, Chair of the Committee on Industrial Technology of Keidanren. The policy statement for TIA-nano states importance of 1) the creation of value toward global business; 2) working under one roof; 3) independence and spiral-up benefits; 4) networking for win-win (strengthening domestic and international networking to generate win-win collaborations); and 5) fostering the next generation. We have six core research domains: nanoelectronics, power electronics, N-MEMS, nano-green, carbon nanotubes, and nano-material safety. We are also setting up three core infrastructures: a nanodevice research foundry, nanotech open user facilities, and a networking school of nanotechnology.

Organizationally, we have a Steering Board and Secretariat under the Executive Board. Under the Steering Board are five working groups corresponding to the six research domains (carbon nanotubes and nano-material safety are combined into one working group). In addition, we have three umbrella working groups: the Networking School working group, the Intellectual Property working group, and the Under One Roof working group. The Under One Roof working group is a kind of brain function of the joint boards together with the Secretariat.

The core infrastructure of TIA-nano includes the nanodevice research foundry, which includes a super-clean room for C-MOS, a clean room for silicon carbide, and also a clean room for N-MEMS. Another part of the core infrastructure is the nanotech open user facilities. NIMS and AIST have a lot of state-of-the-art fabrications and evaluation equipment that are open for use by many researchers from various sectors.

Finally, there is the networking school of nanotechnology. Let's move on to the example of the nano-green research platform. TIA Nano-Green is an open innovation initiative. We have introduced a membership system for this initiative, and members obtain many privileges such as the free license of patents for innovations created in the open laboratories. Pre-competitive research is performed in this research platform, which is open internationally.

In R&D collaborations between TIA and developing Asian countries, the needs of Asian countries to access cutting-edge research outcomes, to join a community or network of advanced research, to establish connections with global countries, and to foster young talent are balanced with the needs of TIA to establish an attractive R&D platform where talented people gather globally, to generate technological seeds that can develop into new markets, to show the presence of Japan as a global R&D network hub, as well as to foster young talent to create win-win collaborations. Thank you very much for your attention.

Chapter 11 Joint Research Center between Japan and China: the NIMS-TU Joint Research Center

Jinhue Ye

Today I am going to talk about a full-scale joint research center between Japan and China: the NIMS-TU Joint Research Center. I am not an expert in policy or strategy; I am a materials scientist. Today I would like to share some of my limited experience in international collaboration at the practical level. Before that, I'd like to give a self-introduction because I think it will help you to understand why I am doing this work. I am Chinese, was born in China, and received my bachelor education in a major Chinese university, Zhejiang University. In 1984, I came to Japan to the University of Tokyo for my master course, and then my doctor course, and then found work in Japan. In 1991, I started

to work in the former institute of NIMS, the name was different, and now I am the Director of the Research Unit for Environmental Remediation Materials. This morning we were talking about brain drain and human resources, which are important to any country, so because I am Chinese and I have a lot of experience in Japan, to be honest, I have received a lot of offers from many universities in China, but I have spent more than half of my life in Japan. I love Japan, and would like to continue my career here in Japan at NIMS. But, of course, I am Chinese, so I would really like to do something to connect these two countries.

You may know that NIMS is a very internationalized national institute that focuses on materials science. Currently, NIMS has more than 1400 researchers, including non-permanent researchers, from all over the world. For example, from China, we have 150 researchers. Every year we have a lot of talented and motivated young people come to NIMS. They receive a very good education and experience, but then later find that they cannot find jobs in Japan so they have to go to some other country, and this is a kind of brain drain. So I was thinking that I should take advantage of my situation to try to bring these two countries together, help to solve the brain drain problem, and share resources. For such international collaboration, we needed to find a good partner, which I found in Tianjin University in China. Tianjin University is a very famous university in China, and the oldest university in China, so they have excellent students. We have had some collaboration at the researcher level up until now, and after contact at several levels, we decided to develop a joint research center between Tianjin University and NIMS within the Tianjin University campus. Tianjin University provides financial support to this research center and provides the space. For its part, NIMS should dispatch talented leading researchers in the materials science field. The joint research center has a two-layer structure where one layer is the board to determine policy and give approval and support to the activities. Another level is the steering committee, including faculty from both sides, to conduct the research themes. The main thing is that all of the research results obtained in this research center will be shared equally by NIMS and Tianjin University including patents. We had a difficult time during the negotiations, but finally we reached an agreement in September of this year. So we had a ceremony to establish the research center, and our president was very happy. We have a new laboratory for the joint research center. Right now, about 400 square meters has been assigned to the joint research center. In this research center, we will focus on innovative materials technology for the environment and energy. We now have five different materials groups dealing with these environmental and energy issues. We all know that building a framework is not that difficult, but keeping the framework effective is a very big issue. In order to make the center productive, we have established policies. Most of the group leaders are dispatched from NIMS, and also the core members from the Tianjin side are former NIMS researchers. As I mentioned at the beginning, up until now, NIMS has turned out many excellent researchers who have returned to Tianjin University. Then we invite them to join the research center as core members of Tainjin University side, so we have very good cooperation. Our future prospects for the joint research center are to become a center of excellence between the two institutions, and, after five years or so, we hope that it will become a core center of excellence between China and Japan, and eventually a leading center in materials science. Of course, we are facing challenges as well. The center is located in China, but is a joint center as well, so we face problems such as the differing operating systems. Also, we need some kind of continuous funding support. Currently, we have some support from Tianjin University, but later we will need other support, so we will need to apply for funding from the Chinese government.

Finally, I would like to describe some of what is being done in terms of experiments at the practical level. For successful international collaboration, policy is very important, but strong leadership from the top of the university or institution is very important. We also need very motivated core members, because without such core members at the steering level, things cannot go smoothly. Finally, a win-win relationship is important to both sides and to everyone involved in the

collaboration. Thank you for your attention.

Chapter 12 Discussion 2

Tatang Taufik

I have some questions for Dr. Rhode from the EU and also Dr. Emig from NSF about their funding tools. Before I was Deputy Chairman I was the ICT Director for the agency, and at that time, I was appointed as the country contact for the EU Framework 7 for ICT. At that time, I had a problem with funding support because if it is in the G to G Agreement, it is difficult for us to implement it in our country. Fortunately, at that time, the project was organized by a third country, and it was implementable because we could operate at the institutional level. But for the US, it takes longer to develop an S&T collaboration. I think that it's more a matter of the bureaucratic mechanisms on both the Indonesian and US sides. I would like to learn from both of you how to work with the bureaucracy to lessen the problem.

The second part is that there is a tendency for advanced countries to develop collaborative projects based on competition. This is a problem for countries like Indonesia because if we apply for all the competition based projects then we have a problem. For example, Indonesia is a fairly heterogeneous country, and it turns out that the universities that excel will always win the project, but those regions or institutions or universities that are still learning will have no chance of participating in EU projects.

My last question is about the development of collaboration between academia and industry in Tsukuba Innovation Arena. I would like to learn from their experience, because we are trying to develop a Technopolis project,

Anne Emig

With regard to working with the bureaucracy, we would follow a system that you referenced as being less bureaucratic, and that is institution-to-institution collaborations, so that your researchers partner with US university-based researchers, and then NSF deals with the US university. In that case, the proposal is reviewed based on the US proposal including what the Indonesian partner brings to bear. Then the US university and the Indonesian institution would work together. One other mechanism is that we have a program with the US Agency for International Development called Partnerships for Enhanced Excellence through Research, and countries like Indonesia and many of the ASEAN countries here other than Singapore would be eligible to apply for funding. In order to simplify the bureaucracy, the US Academy of Science is the implementing organization. They have once or twice a year competitions. They just closed one deadline, but they will announce the next deadline in March. So, the National Academy of Sciences is somewhat more independent and less bureaucratic.

How would the newer or less experienced universities in Indonesia be competitive? Offer something unique to the partnership. This might be the expertise of the individual researchers, perhaps access to ecological or epidemiological phenomena, unique populations, or unique languages. In our system we would be evaluating the US researcher and the strength of the partnership. Perhaps in the US system, the Indonesian universities are not so well known, so the US researcher can "sell" it based on what he or she feels is being brought to the partnership without regard to who would be best known within Indonesian society.

Barbara Rhode

I'll start with the competitiveness of Indonesian partners. We are funding consortia, so it is the management of the consortia and the integration and distribution of the work within the consortia that counts. Sometimes there is someone who is contributing something that is needed by the

project. I think that you should look into our database where our projects are displayed very transparently, and see who is contributing what, and perhaps there are partners you know, and try to get into these kinds of networks. For each project there is a new network. For each specific project there is a constellation that makes it excellent. I think that partners from all countries can get access, but it is not easy because it is peer evaluated and only about 18% succeed in getting a contract. It's very competitive, but in a consortium, there is a possibility. As to bureaucracy, I think that, in principal, if you are in a consortium, there is a kind of shared responsibility. The leader will always be in Europe, and know the procedures, so this will not be a problem.

Kazuo Nakamura

I'm sorry that I didn't mention the details of the research system of the TIA, especially concerning Nano-Green. In Nano-Green, we have a lot of research themes, and each member states a preference as to which research theme to join. Academic members and industry members are in an open lab. In an open lab there are many kinds of members from industries, universities, and private institutions, and within that open lab many interactions can take place. We accept some documents about which research theme they are doing. Based on that, we set the research theme for the open lab.

Mime Egami

Our university is a small medical university, and, therefore, I don't think it is easy to make a strategic core relationship with major industrial companies. The unique approach of our institute is that starting from 1968 or 1969, we started a biomedical curriculum for industry people to study new biomedical engineering and science technology, to gain an understanding of the medical field. This is a one-year something like an MBA course for industry people. Over the 42 years of this program, there have been more than 1800 graduates. These are not only Japanese companies, but also US Merck, Boston Scientific, and other foreign company personnel have participated. These inspired industry people are the key liaison people to link industry with research in order to think about good ideas and developing technologies, and work together with our physicians and scientists. So probably a more human driven partnership process is essential. Even if some professor has a good idea for how to work with industry, but influence from academia alone is not enough to bring technology to business. So this educational program helps us a lot.

Norio Ohto

There is one example of industry-university linkage. There is one international NGO called DNDi (Drugs for Neglected Diseases Initiative), which was established by Médecins Sans Frontières (Doctors Without Borders). They collect funds, facilities, and expertise from all over the world, and they apply their funds to research and development. There is a representative of DNDi present here today, so I would like to hear from her about this NGO. Hirabayashi-san, please explain about the expertise of DNDi and recent developments.

Fumiko Hirabayashi

Thank you very much, Dr. Ohto. I am Fumiko Hirabayashi, and I am very honored to be here to hear about all the important experiences and efforts made by different countries in the region. I am currently the head of the DNDi Japan office. DNDi is a public-private partnership established in Geneva in 2003, with a mandate to develop new treatments for neglected diseases, and also to provide treatment and necessary research capacity in disease

endemic countries. There is a lot of discussion today about fund raising for public-private partnerships. In our case, 50% of our necessary funds come from different governments, and the other 50% from private institutions with very little from individuals. Fund raising is very important, but very difficult. For many public-private partnerships, one problem at the moment is that many of them depend on a few major donors, and we need more donor diversity. As to our experience, let me share very briefly our two experiences in Asia. The first is a regional network called the Pan-Asian Screening Network, which was established with the generous support of the Sasakawa Peace Foundation in 2006, with a lot of advice from Dr. Ohto. The objective of this network was to establish pharmaceutical screening capacity in the member countries of the region. We were lucky enough to get the funding for this network; however, it is very difficult for other platforms which DNDi manages. For example, DNDi has been conducting three other platforms in Latin America and Africa, but these platforms have received very little support so far, and we still do not understand why these kinds of programs or partnerships are not attracting funding. For this kind of private, regional network, it is important for the member countries to share the vision. The languages are different, the cultures are different, and the objectives of the members participating in the projects are also different. It is, therefore, essential for the members to share a vision to keep going and to keep producing tangible results. This is one example, and also the lesson that we learned.

The second example is an ongoing, small scientific collaboration in Bangladesh where we are collaborating in the field with the University of Tokyo within the framework of SATREPS supported by JICA and JST. Our collaboration is not an officially established project, but we share the vision and are collaborating in the field to establish a special center for research and treatment of leishmaniasis, which is a neglected disease endemic in many countries including Bangladesh. We were progressing very well when the earthquake and tsunami occurred on March 11 in Japan. Many of DNDi's partners in Bangladesh and India thought that this meant the end of the project and our collaboration, or, at least, that there would be a long delay in the project implementation. But our collaborators in Japan started working immediately after the earthquake, and, in fact, there was very little delay in our progress. This greatly impressed our partners. They were reassured that their Japanese partners are very reliable and carry a long-term vision. So we are hoping that similar public/private partnerships will be established efficiently within the region with a lot of involvement from Japan in the future. Thank you very much for the opportunity to speak.

Tateo Arimoto

Let me make sure about your organization's status. What kind of entity and in which country?

Fumiko Hirabayashi

DNDi is a nonprofit organization established in Geneva, Switzerland. In Switzerland, our status is a foundation categorized similarly to the Red Cross.

Kazuo Nakamura

I forgot to say an important thing. Students are hired as research assistants by the industrial members, and that's a very important thing for the interaction between industry and universities.

Akira Nakanishi

I have an impression that EU Framework 7 program is very open to external researchers. Many Americans, Russians, Indians, and Chinese researchers have been enjoying participation in your projects with some funding. This is not familiar to the Japanese funding agencies. In the case of SATREPS, we have a partnership with JICA because the mission of JICA is to support our foreign partners, so they have the mechanism in place to fund foreign activities. In the case of the NSF, they also have a partnership with USAid to organize overseas funding issues. In addition to the

partnership with USAid, there is a partnership with the Bill and Melinda Gates Foundation, which is another way to override overseas funding issues. I am thinking that e-ASIA needs to find a good partner to help fund overseas researchers. If the Takeda Foundation had huge resources, you would make a good partner! In e-ASIA, we are planning a foundation in the first place such as the Human Frontier Science Program established by Director General Arimoto, which is located in Strasbourg, and for which participating countries are providing funds. The location of the fund is decided by the Foundation board. But that kind of mechanism is not acceptable in several East Asian countries because the funds provided cannot be controlled by the donor. Therefore, we are adapting the mechanism to a matching fund system where each country funds its own side and not the expenses of other countries.

Paritud Bhandhubanyong

In Thailand, we have a funding support program under the Ministry of Science and Technology for public funding. These funds are not increasing, but are instead either remaining constant or decreasing. There are additional funding sources for specialty fields. For example, in the field of energy, there is funding support from the Ministry of Energy, and also there is specific funding for designated projects/programs from the Ministry of Education for university professors. We are starting to provide funding support for our neighbor countries for training or for joint research with Thai researchers.

Krisada Visavateeranon

May I also add that in Thailand we also have Thai research funds that are under the Prime Minister's office, and they fund basic science and technology researchers, and also industry-oriented research. They provide funds for Thai university professors to work in joint research with industries, for which the industries provide 15-20% in matching funds.

Vijay Babu

I am sorry that I will not have too much information on interregional funding. However, there have been many public/private partnerships at the university level within India, wherein many institutes receive research funding from private organizations. But I imagine that most of the research in India would be more like applied science and technology rather than basic science, and it would mostly be supported by private institutes funding universities. There is a lot of support or collaboration with US and European institutes, but, within the Asian region, I am not aware of very much interaction.

Yoshio Matsumi

I have a brief comment. I think that we should clearly understand the importance and value of international open innovation R&D collaboration in a joint R&D center involving both industry and universities in Asia, because this collaboration will have benefits not only in science and technology R&D, but also in different areas including 1) diversity for innovation; 2) expansion of network of networks; 3) cultural exchange; 4) OJT (on-the-job training) and the education of students and researchers; and 5) brain circulation. So I think that we are talking about an extremely important issue here. Thank you.

Mime Egami

I have just one quick comment or question. Currently, if we are involved in an international project in Japan, the effort management of each researcher is very strict. This applies not only to academic scientists, but if we have some industry collaborator, for example, our collaborator companies are living in the same institute, the government wants to manage, and check the daily

record of what the industry researchers are doing. Therefore, if we want to add, for example, an Asian collaboration project to explore the project outcome, the management of the effort report to the Japanese government is quite a burden, so our director's total effort is now about 300%. If this is a project involving scientists, they can't do this. So how is each country's agency handling it?

Barbara Rhode

Yes, reporting is required. We are talking about taxpayers' money that is going out of the countries, so for European taxpayer money that is distributed across the world, of course, reporting is necessary. But I think that it is in reasonable relation to the money you are receiving. I think that you won't get any funds without reporting I'm afraid.

Anne Emig

The same is true in the US, and the challenges lie in the situation that Dr. Egami referenced where researchers and research directors are giving 300%. So you are required to report, but can you report and take funding for more than 100%? When the government or funding agency puts on more and more requirements that you will not do just the research, but that you'll mentor and you'll report and you'll do outreach and you'll look for innovative partners and all of this—obviously, we're requiring more and more for our dollar, and there are challenges there. So when you take on international collaboration on top of it, this is where we hope that the synergies are sufficient so that one plus one equals not just three, but five or something, to make the added effort worthwhile.

Teruo Kishi

Okay, thank you for your comment. The director's effort is 300%, but he is still alive.

Anne Emig

Occasionally you get researchers who say, "okay, I'm happy to work eighteen hours a day", and our response is "yes, but we can't pay you for that." So there's a kind of slave labor if you're volunteering it.

Observer (Mr.Arora)

I have a very curious question. The Sasakawa Peace Foundation or the Bill and Melinda Gates Foundation keep giving funds all over the world. How do they manage? Do they have their own criteria for how to distribute their funds? Or can any of the things you are talking about become part of the funding? I'm just curious.

Anne Emig

I will respond based only on the experience of the NSF. We wanted to build on some basic research in genomics and metabolomics to advance subsistence agriculture, but, of course, improving subsistence agriculture is not in our mission. There were some basic research areas that could enhance this, but we needed funding for the other side. So we entered into a partnership with the Bill and Melinda Gates Foundation. It took about a year or year and a half to overcome the legal challenges of a US Federal Government grant-making agency receiving grants from an outside organization without putting our government funding at risk. But, essentially, the Gates Foundation had a synergistic interest in enhancing subsistence agriculture, and was happy to partner with basic researchers who could commit their genomics, etc. The Gates Foundation, then, agreed to accept NSF reporting requirements. The Gates Foundation money was made as a grant to NSF, and NSF as an institution took on the burden of reporting results to the Gates Foundation, and the researchers only had to report to NSF.

Vijay Babu

This is in extension to what I had the opportunity to talk about this morning. In this discussion in the afternoon, we talked about various kinds of funding. I believe that funding in the form of venture capital by government agencies could be one other means of academic-industry collaboration. From my limited knowledge, I have found the Singapore government to be the best in that in terms of the Temasek Fund, which has a venture-funding arm to invest in small companies. Those kinds of funding I believe could lead to different kinds of investment opportunities and partnership opportunities between industries and governments.

Tateo Arimoto

We need a break in the conventional thought framework as well as a break in the conventional legal framework for innovation and future generations. We are facing many difficulties and issues not only within national borders, but also cross-borders: infectious diseases, etc. I am very happy that the Japanese government will support these kinds of activities and workshops. We hope to expand these activities and networks in the future for the coming generations in Asia and the world. Thank you so much.

Teruo Kishi

With that, we will close this session. Thank you very much for your attention.

PART 3 INTERNATIONAL SYMPOSIUM ON REGIONAL COLLABORATION IN SCIENCE AND TECHNOLOGY IN ASIA

The Takeda Foundation has organized a committee for strategies for international collaboration in science and technology with intellectuals from the government science and technology-related agencies, international cooperation agency, nonprofit and private organizations, as well as the members of academia so that we can offer political recommendations to the government concerning international collaboration in Asia. Also, we have held international symposiums so that we can develop understanding among the public about the regional collaboration. The Japanese government accepted our recommendation, and last year, the East Asian Science and Innovation Area concept was formulated, and various activities have taken place to gain understanding among Asian countries. However, all these efforts to collaborate in science in Asia and Asian regions have only just started. In order to make this more useful, it is necessary that the various stakeholders in the region have discussions about the philosophy of collaboration, its framework, and Asia. In the future, it will be necessary to construct consensus about collaboration among various Asian societies. Therefore, the Takeda Foundation has invited experts in science and technology from Asian countries together with GRIPS, JICA, and JST so that we can have discussions from various multifaceted perspectives concerning collaboration in science and technology, and so that we can deepen understanding as to how the regional collaboration should be carried out. Therefore, we are holding this international policy dialog. Today we will hear from representatives of the science and technology community in Asian countries about the significance of regional collaboration, and roles that Japan and Asian countries should play. I hope that you will stay with us and enjoy through the end of the dialog.

The International Policy Dialog is supported by strategic funds for the promotion of science and technology from MEXT. The policy dialogue is also backed up by MEXT, METI, MOFA and the Cabinet Office of the Japanese Government, and I would like to extend our deepest appreciation to all the ministries and the Cabinet Office for giving us this opportunity. (Norio Ohto, Director, the Takeda Foundation)

Chapter 1 Welcoming Remarks

Teruo Kishi

Good afternoon, ladies and gentlemen. I am Teruo Kishi from the National Institute for Materials Science. On behalf of the Advisory Board of the International Policy Dialogue, I would like to say a few words in welcome. Today is a busy day in the last month of the year. I am very grateful that so many people are attending this meeting. We have Minister Nakagawa here with us at the busiest time of the year for budget formulation. I am very grateful that you are here. And Mr. Aizawa, the representative of the Council for Science and Technology Policies (CSTP), is here with us despite his busy schedule as well. We also have Mr. Oshima, Advisor of JICA here with us, and he will give us a special lecture. We have many expectations for what we will be able to hear. As Mr. Ohto, the moderator, has already explained to you, the Takeda Foundation has organized a committee for strategies for international collaboration in science and technology, and in 2009, they came up with the concept of an Asia Research Area. Since then, two symposia have been held, and now this is the third one. We have thirteen experts in science and technology from nine Asian countries attending this meeting. In addition, we have two participants from National Science Foundation of the United States, and the European Research Area, ERA. We hope that we will have a very good discussion on collaboration in science and technology.

Yesterday, we held two workshops on regional development of human resources and brain circulation, and international collaborative research and research infrastructure. At the workshop of human development and brain circulation, the free movement of researchers became one of the hot topics, and we discussed means to facilitate free movement including visa arrangement and grants for travel. At the workshop of the collaborative research and research infrastructure, open innovation centers were discussed. Industry, academia and government should team up to establish a center of excellence where researchers can freely join collaborative research and create innovation. The Tsukuba Innovation Arena was introduced as an open research center and many foreign researchers are now working there. Tianjin University and the National Institute for Materials Science have begun an effort to open a research center in Tianjin University, China by sharing human resources and expenses. A regional collaboration initiative of the Japanese government, the East Asian Research & Innovation Area (e-ASIA) has been introduced. Based on e-ASIA concepts, the Japan Science and Technology Agency (JST) has been promoting multilateral joint research program with matching funds. Currently there are sixteen candidate research projects in six areas. These are just some examples of the regional collaboration, and we are hoping to establish versatile regional collaboration including researcher collaboration, culture and information exchange, networking, and cross-border grants in the fields of energy, health and life science, and living infrastructure. One thing that was pointed out to be very important was linkages between universities and industries. They need to work together in promoting innovation.

Talking about the situation in Japan, the economic growth and development in Japan have not been as good as we had expected. However, when it comes to science and technology, especially in element technologies, we are doing well. I think that there are two reasons for poor performance of Japanese economy. First, it might be related to the performance of universities. Japanese university activities may not be as good as the global level. Currently there are five ranking indicators for universities. In any indicators, the rankings of Japanese universities are continuously going done over the last ten years. For example, the University of Tokyo goes down by a rank or two every year, and after twenty years, the rank goes down by twenty, which means that it will be very difficult for Japanese universities to attract top Asian students. We have Minister of Education, Culture, Sports, Science and Technology with us, and I would like to insist that it is very important to enhance postdoctoral courses in Japanese universities. One problem is that universities often consider graduate students as workers. Another problem is that graduate students are not just students but they are researchers. In western countries, they are paid as researchers. It is not just allotment of research grants, rather they are provided with official salaries, and I hope that the Minister will consider this point.

Another point is innovation. In Japan, science and technology may be good, but innovation is not very good. This is our situation. CSTP has proposed the very encouraging 4th Basic Plans for science and technology. I have a lot of expectations in what Mr. Aizawa can achieve. We have set out various means to strengthen science and technology in Japan including the research and development enhancement and special district acts, but unfortunately they are not functioning well. We are also not good at starting up ventures, but other Asian countries are now focusing on this area. We should promote Asian Research Area concepts to enhance research and development, and create innovation in the region.

It is already getting difficult to promote science and technology with Japanese researchers alone. I worked for national research institutes for twelve years after I left the University of Tokyo, and I realized that we have to recruit human resources from all over the world to effectively conduct scientific research in Japan. I think that we are already in the world competition for talented researchers. I also think it is really important to continue this kind of international dialogue with Asian colleagues, and to implement specific collaborative projects even if they are small. We are now in our way to regional collaboration in science and technology, and it is fortunate that we can

directly hear comments and opinions from Mr. Nakagawa, Mr. Oshima, and Dr. Aizawa.

Chapter 2　Opening Remarks 1

Masaharu Nakagawa

Thank you very much for the invitation. I offer my heartfelt gratitude for being a part of this symposium. As Professor Kishi mentioned earlier, now is the last stretch in finalizing the budget. Next weekend there will be a ministerial meeting, which will be the finalization stage of the budget. At this juncture, and as the previous speaker touched upon, there is the issue of the universities. And I share the common awareness of this issue. Ever since I assumed the ministerial post, I have been considering to take a step toward the reform of the universities. The roles and budget of universities were discussed at the government's budget screening processes, and they cast doubt on the performance of the Japanese universities.　We should involve academia in discussing allotment of the university budget to enhance the performance of the Japanese universities. Public funds as well as private ones should be diversified, and we should introduce some policy measures to involve researchers in the discussion of diversification of funds. Finally, we have to admit that the Japanese universities have not been under severe and fair evaluation. The previous speaker talked about the university ranking. The university community would say that the current university ranking indicators do not reflect the real performance of the universities. But if they are not good enough, then I would like them to show me alternative evaluation systems. I would like to develop budget allotment system in consideration of results of such evaluation systems. I would like to invite industry sector as well as the university community including students in developing frameworks of the university evaluation and budget allotment systems. I was provoked by the previous speech so that I started my welcome speech with the university issues.

As Dr. Kishi said, it is really important to incorporate the energy and dynamism of ever-growing Asia into Japan and prosper with Asia. Neighboring China and Korea used to be targets of the Japanese ODA, but they do not need ODA any more. We are all equal partners, and should develop regional collaboration mechanisms to attenuate common challenges by sharing the necessary cost. By doing so, we can develop collaboration frameworks in which various Asian countries including China, Korea, Southeast Asian countries, and even India would join with pride. Based on this thought, I proposed the concept of East Asian Science & Innovation Area (e-ASIA) to develop a platform for regional collaborative research. When Japan-China-Korea Summit was held in Cheju Island in 2010, I was Senior Vice Minister of MEXT. I participated in the summit, and proposed the e-ASIA concept to the relevant ministers of China and Korea. They all agreed, and ever since various activities toward the development of e-ASIA have been conducted in many fields.

Although researchers have been identifying themes for collaborative research to attenuate common challenges, there remains the development of a regional fund. I would like to appeal to various sources the necessity of a regional fund, and make an effort to develop the regional fund as a new form of Asian collaboration.

The achievements by our ministry include a global-scale issue-oriented science and technology collaboration program: SATREPS. This is the reverse of what I have mentioned before. SATREPS combines ODA and research issues. Japanese researchers and researchers of a developing country get together and select research themes related to global issues, and then JST supports Japanese researchers and ODA supports partner researchers in the developing country. Looking at the issues of the research, they are really relevant so that the usage of the ODA is very prudent and wise, showing a good example of soft type usage of ODA as contrasted to hard type usage such as constructing bridges and university buildings. I would like to further endorse or support this direction and expand this program very aggressively.

As to internationalization, I think that it is really important to develop dynamism to open Japanese society to the outer world in order to nurture the globally oriented human resources as well as to reform universities and research institutes.

I expect that today's symposium will play a very important role in developing and promoting regional collaboration frameworks in Asia. I would like to develop new policy measures as well as promoting the university reform and development of global human resources by taking into consideration of what is discussed here. With this expectation, once again I would like to express my gratitude for the invitation, and conclude my remarks. Thank you very much.

Chapter 3　Opening Remarks 2

Kenzo Oshima

As a co-organizer, I'd like to thank the Takeda Foundation for hosting this symposium. The Japan International Cooperation Agency (JICA) has been carrying out many projects and programs in science and technology through regional collaboration and I'd like to point out a few such examples.

But before doing so, let me first note that in our part of the world, the East Asia or the ASEAN region, many economies have shown remarkable growth and development during the last ten years. These achievements in development have produced significant changes in their industrial structures – they are becoming more advanced and sophisticated, as well as more corporately active. No doubt all of these countries are aiming at a status of emerging industrialized economies sooner or later, and their governments are trying hard to create industries and enterprises that can produce higher-end products with added value. To do this, part of their effort has been directed towards human resources development, as well as expanding investment in R&D, for example developing the new energy such as geothermal, solar, biofuels, etc., and expanding expenditures for research and technological development.

Another thing to be reminded of is the fact that the Asian region is one of the most disaster-prone areas in the world. Every year we experience great damage being done to assets as well as the loss of human lives because of natural disasters. Many of the countries in the region constantly face risks from earthquakes, tsunami, and floods, and, therefore, disaster prevention and mitigation are increasingly high on the agenda of their government policies. Only recently, on March 11 of this year, a huge earthquake and tsunami disaster struck the eastern part of Japan, and since October we have witnessed unprecedented flooding in Thailand and other Southeast Asian countries. So, once again, we are reminded about the importance of prevention and mitigation of disasters. In tackling all these issues, what we need most is not just financial resources but we also need the capacity in terms of know-how and technology. In other words, we need a sufficiently broad technological base and human resources base that can support these undertakings. This very point was raised and emphasized in the previous two speeches, and on my part I also join in stressing the same point. Equally important, the experiences and knowledge that each country has developed and acquired should be shared as much as possible, and the international collaboration should be encouraged for such purpose.

JICA as Japan's premier aid implementation agency has been responsible for development activities in many developing countries through ODA. Among them the collaboration and cooperation in the area of science and technology, especially human resource development and collaborative research in science and technology have been a major focus up to today. Time won't permit me to go into much detail, but allow me to mention just two interesting examples, with which some of you may already be familiar. One is a project called the "Southeast Asian Engineering Education Development Network", known as SEED/Net, and the other is a program known as "SATREPS".

First, the SEED/Net project links engineering universities and faculties in Japan with

engineering universities and faculties in the ASEAN countries. Starting ten years ago, this project involves a networking of 19 top engineering universities from each of the 10 ASEAN countries and 11 universities in Japan – a total of 30 universities altogether participating in it. It aims to promote capacity building in science and technology education and research of each participating university; creating and strengthening an academic network among the researchers of these participating institutions. For example, one outcome of this project in the last 10 years is that 800 university teachers and researchers from the participating ASEAN engineering universities have been able to study abroad in the other ASEAN countries or in Japan to obtain higher degrees.

The second outcome is that the project has allowed the holding of many academic seminars and meetings being held in the ASEAN region, with a result that they assist the promotion of research activities among ASEAN universities. Up to present, more than 1300 scholars and researchers from participating universities have benefited from attending these seminars and academic meetings.

The third impact is the launching of the “ASEAN Engineering Journal”, which now provides a forum to present and propagate research outputs from the ASEAN region, and we are pleased to note that researchers are creating a network of their own availing themselves of this journal.

Fourth, under the SEED/Net project, the participating universities are carrying out joint research projects focusing on issues of common interests in the region, such as the Sumatra earthquake in 2004 and the Great Eastern Japan earthquake in March 2011. Researchers are now sharing information and experiences from a scientific and engineering perspective through joint research as well as by holding seminars. Also of interest is the fact that by taking part in the SEED/Net, Japanese participating universities stand a better chance of attracting excellent students from ASEAN countries, and their researchers can benefit from increased joint research opportunities with overseas researchers.

Minister Nakagawa referred to an important point which is that the Japanese side is now more firmly committed to promoting the regional collaboration with ASEAN countries as equal partners. In the past, Japan being the most industrially advanced country in Asia, we in Japan tended to see Japan’s relationship in science and technology cooperation as, if you like, a sort of vertical cooperation in the North-South context, but now we see this relationship more as equal partners, or, as a horizontal relationship in cooperation. It is increasingly clear that we see in our region a burgeoning, robust development in science and technology based on equal partnership and a healthy development of collaborative spirit.

The SEED-Net project has had its Phase I and Phase II, altogether 10 years of implementation, and as I noted we have seen significant achievements. We must now build on the assets that these achievements have produced. So in that spirit, we intend to move on to a Phase III of the project, and the authorities on both sides are now engaged in discussing what should be the main focus of activities under Phase III of the project, including the three possible areas, as follows:

One idea is to continue to support, in a more vigorous way, the human resource development and research capacity building so as to meet the requirements of more sophisticated and advanced industries in the ASEAN region. The second idea is to help them tackle sets of global issues through accelerated joint research. Finally, the third is to support capacity building of the participating universities and to strengthen academic networks among them to form an easy-to-access platform in science and technology to the benefit of all interested parties in the region.

Having said this, I’d like to briefly mention the second effort that we in Japan are making, as mentioned by Minister Nakagawa, which is a project called “SATREPS”. I believe that most of you already are familiar with it. This project focuses on a few selected sets of issues, namely the environment, energy/bio-resources, disaster prevention, and infectious diseases. JICA and JST are closely involved and are collaborating with each other in promoting the project. For example, in Thailand, Kasetsart University and the University of Tokyo are cooperating in a project focusing on

measures for water problems caused by climate change. This hopefully will result in, among others, a better understanding of what happened during the recent great floods in Thailand, and also how to deal with future floods like this. In the environmental area, the Vietnam National University and the Osaka Prefecture University are collaborating to establish a biomass energy system, which will contribute to mitigating climate change as well.

I have talked about two major programs that are being carried out by JICA, and I am pleased to note that these programs are highly valued by the Japanese participating universities as well as by the ASEAN side and the other stakeholders. We would like to promote SATREPS in cooperation with JST, and expand the SEED/Net project based on the experiences of the past. JICA is committed to contributing to the progress in science and technology in our region and to the strengthening of the regional collaboration including through SEED/Net and SATREPS. I believe that this symposium is organized at a very opportune time, and we hope to learn much from the discussions and the information to be made available, so that we can play a timely, effective and reliable role in facilitating further collaboration in this vital area. Thank you very much.

Chapter 4 Keynote Speech

Masuo Aizawa

I would like to share with you what Japan is now promoting in terms of science and innovation policies. First of all, when you want to promote innovation, you must realize that there is a major change in the situation. As a result, we integrate science and technology policies and innovation policies and promote them together. But, what is important is to take an issue-driven approach by clarifying missions and challenges rather than technological seed-driven strategy which tries to find applications of developed technologies. We call it Science and Technology and Innovation strategy (STI strategy). Based on this strategy, the Fourth Basic Plan for Science and Technology was formulated. I would like to share with you the very basic part of those concepts.

Currently, Asia is growing very rapidly, and this is a historical change. In western countries like the US and Europe, they predicted this change, and already started taking policy measures to respond to this change. In 2025, the global population will reach seven to eight billion, and two-third of this population will reside in Asia. Economic growth will take place centering on Asia. However, is such growth in Asia guaranteed or not? Are there any threats to Asian economic growth? We have to seriously consider these possibilities.

With so much growth in population, energy consumption will greatly increase, and, almost all consumptions and needs of human lives are expected to exceed the allowable limits. It will not be easy to achieve economic growth under such conditions. This is the future of the Asian situation, and we have to expect a more serious situation, if you look at the whole world. We know that Asia will be the center of many activities including economy and science and technology, but in order to realize such change, various conflicts must be overcome. We must overcome the limitations, and then we can move forward toward our goals. International competition is getting more and more serious and at the same time international interdependence is deepening. What kind of strategy should we develop under such conditions? Such a strategy should allow Asia to keep economic growth and let Japan take a leadership in Asia. We all know that the key is the science and technology innovation to solve various challenges, but we should take into consideration of such a global perspective when we develop policies for science and technology and innovation.

Japan has experienced a huge disaster of the Great East Japan earthquake of March 11. This crisis can be divided into two aspects: natural disaster and nuclear power crisis. These are the two grand challenges that we have to overcome in the future. When it comes to the nuclear power crisis, it’s not just an issue for Japan, but it’s the issue for the world. Therefore, how Japan will overcome

this issue is a point of interest and concern for the global community. It involves serious challenges that may even determine the future of the world. For Japan, first of all, we need to recover from the earthquake and reconstruct the society, and then move towards creating a new Japan. We should consider and develop policy measures against the nuclear power crisis while working on recovery and reconstruction. The energy issue is what is behind this point. We should review the Japanese government's energy basic plan and formulate a new strategy, which will be reflected in the science and technology policy. However it will take time to formulate a new energy basic plan, and we have developed the Fourth Basic Plan for Science and Technology taking into consideration expected energy reform. I would like to express my sincere gratitude for tremendous support from various countries around the world, and at the same time offer our utmost support for the floods in Thailand.

There are various crises that are threats to economic growth. In the past, avoiding these crises has been our policy that would lead to recovery and revitalization of economy. However, this policy is no longer acceptable. We should face such crises and issues and take measures against them by believing that confronting and overcoming crises and challenges will lead to a new economic growth. Japan is an advanced nation in science and technology. If science and technology do not make any contributions to solving these challenges, then what we have created in science and technology will be no use, and we will lose bases to invest on science and technology. We have pride in our science and technology. We should promote science and technology and innovation policies so that we can take leadership in overcoming various challenges which Asia faces.

The Fourth Science and Technology Basic Plan was formulated with such concepts. Considering the situation, we have changed a concept of policy making. In the past, policies were developed based on discipline. Now, policies are developed based on issues and challenges. To find solutions, all sectors and all disciplines should be gathered together. There are many crises and challenges. We prioritize them, determine in which order we will work on them, and identify specific problems to be attended. We consider and select crises and challenges with society. And how we solve these issues is the basic strategy of STI. Towards finding solutions across disciplines and across organizations, we integrate world knowledge and wisdom. And by doing so, new values will be created. Then, the solutions will be presented to society, which will lead to innovation in society. These are the steps that we should take, and these steps conform to innovation format which shows that innovation openly and globally proceeds in the world. Based on these ideas and concepts the Fourth Science and Technology Basic Plan was formulated. In the Third Basic Plan, eight disciplines were chosen as focus areas, and the goal was set to promote research level of these disciplines in the top of the world. As a result of years efforts, many significant research results have been produced in these focused areas.

However, as Dr. Kishi said earlier, science and technology have been doing well, but when it comes to innovation, we are not blooming as much as we had hoped. If innovation is created in each area, then it could have a large impact on society, and that's what we had expected. However, as was mentioned earlier, there are various issues and crises, and technology breakthrough alone could not solve confronting challenges, nor contribute to an economic growth. In the Fourth Basic Plan, we take an issue-driven approach. However, the issue-driven approach alone is not enough. We should strengthen basic research and human resource development, which are the very base of our strengths. The issue-driven STI strategy and strengthening of basic research and human resource development are two major components of our basic plan. Also, we always should consider what we are doing this for. It is for society. It is important to develop a structure that facilitates transmission of information to society, discussion with society, and sharing research results and outcome with society.

There are three major STI strategies. One is reconstruction from the great earthquake. We cannot avoid this, and it must be quickly realized. The second STI strategy is green innovation. The stable supply of energy, especially clean energy, was in danger after the great earthquake. So the

stable supply of clean energy, dealing with climate change, and construction of low carbon society are major targets of the green innovation. We have been working on the construction of low carbon society and dealing with climate change, and we have added the stable supply of clean energy as the additional target. The third strategy is life innovation. We will tackle challenges in life area including a structure of aged society, health and medical care problems in Japan. Previously, the extending longevity was the focus. Once people become sick, treatment has been the focus. But now we need to change this slightly. We need to extend a healthy and active life. In other words, the prevention of diseases needs to be the focus. That is the characteristic of the life innovation aspect of the plan. We promote the life innovation not because we suffer from problems but because we promote healthy society. Once we succeed in the life innovation, we can transfer our systems and technology to other Asian countries which have many similarities in their societies.

In order to promote STI, we need systematic changes and reform. We have various issues and problems. For each one of them, we need to prioritize the topics, find and identify the issues, and move ahead. We need to fully analyze the facts and situations. One of the last points, global activities as mentioned earlier by Dr. Ohto, will be discussed later. In promoting issue-driven STI, we should strengthen basic research and human resource development. Dr. Kishi talked about reform of the graduate school and it is also incorporated in the basic plan. In promoting STI, the government should work together with private sector, and we set numerical goals. A goal of the total investment is 4% of GDP, and the government will cover 1.０%, which is approximately 25 trillion yen for five years. Minister Nakagawa said that he will have to deal with the budget formulation for the next term. Yesterday, we held a formal meeting of the Council for Science and Technology Policies and determined a budget plan based on the evaluation of various issues and challenges. The budget plan will be submitted to Prime Minister and relevant ministers.

I would like to show you some specific examples of the basic plan. In the basic plan, we focus on promotion of talented individual scientists as well as strengthening universities. This program is called “FIRST”, which will provide 30 eminent scientists with 100 billion yen for five years. I think that it is an unprecedented scale. In order to create the leader of the Next Generation Program, we would like to particularly encourage young, female, local researchers with high potential: 329 projects with 50 billion yen for five years. Many people will recognize them if we reveal their names.

Finally, I would like to discuss science and technology diplomacy. We would like to diffuse our science and technology to Asia. Most important thing is that we collaborate with Asian partners to solve common challenges and issues in the Asian region. The equal partnership is key word. SATREPS is one of the activities of science and technology diplomacy programs, and involves projects in green innovation and life innovation fields. ODA used to be hard type cooperation such as constructing infrastructure, but they would like to shift to soft type cooperation such as science and technology or human resources. The program has been working quite well with the support from the Ministry of Foreign Affairs. JST handles funding to Japanese researchers. There are many other programs, but our basic targets are Asian countries and emerging developing countries in the world. We will collaborate with African countries in the future. This is science and technology diplomacy, and each Ministry is trying to make their contributions to implementing science and technology diplomacy.

What is unprecedented in the former basic plans is the development and international cooperation of the earth observation systems. As Mr. Oshima has said, Asia suffers from many natural disasters, and we have developed the platform to observe the globe from deep sea level to space level. We have an alliance with GEOSS (Global Earth Observation System of Systems) and Sentinel Asia (a voluntary basis initiative led by Asia-Pacific Regional Space Agency Forum). Integrated Ocean Drilling Program (IODP) has been developed in cooperation with international societies from the start. We would like to strengthen these areas of research to create a resilient society. Now we are experiencing a great change in the world history. We should move forward in

line with the global society holding a common belief that overcoming the current challenges and issues will open a future for us. Thank you.

Chapter 5 Invited Speech 1

Dong-Pil Min

I think I should present matters about Korea, and I should have prepared my talk on the basis of Korean strategy or its science and technology policies. However, I would rather concentrate on how to promote international or regional collaboration on some subject rather than discussing the global strategic plan of Korea.

Globally, our attention is oriented to the direction that science and technology need to take to encourage human beings to convert from the brown economy to green economy for the sustainability of the global future. For such a conversion to succeed, it requires the participation of not just a few countries, but the entire world, and, moreover, the diffusion of technologies to developing countries which do not own means or cutting edge R&D facilities has to take place in a significant scale. The release of greenhouse gases is one very good example that shows the urgency of global issues. The amount of greenhouse gases emitted by developing countries is increasing rapidly according to the IEA. It is estimated that emissions from non-OECD countries will comprise a little more than 60% of the total in the next two decades. The damage caused by the climate change will first impact the poor living in such countries. The UNDP has estimated that people suffering from malnourishment will increase to 600 million by 2080 due to the reduction of agricultural output. An additional 1.8 billion people will live in an environment where water will become scarce. Also, 330 million people will migrate to escape floods. Billions of poor people in developing countries are vulnerable to climate-induced risks. Development models based on carbon fuels have become unsustainable and accelerate climate change. This presents a number of problems in Asian countries in this respect, as inexpensive fossil fuels are no longer sustainable. The world economy will be forced to search for new green paths to replace the existing brown economy. To realize this globally, what is indispensable is a smooth transfer of technology, consolidation of capacity, and support of development for developing countries, and a sustained maintenance of cooperative networks. I will give a little more detail of the items that I have mentioned just now.

One of the main obstacles to overcome for technology transfer is the protection of intellectual property rights. Although the intellectual property right is a delicate issue intertwined with corporate profit, we have recently seen positive trends, including multinational pharmaceutical companies enhancing their openness towards neglected tropical diseases. The proposal made by GSK (Glaxo-SmithKline) in 2009, is a welcome breath of fresh air, as well as EPO in 2010. I would like to draw your attention to their idea of creating a technological pool. The company suggested the creation of a relevant patent pool for drugs and manufacturing processes that can be used to develop new treatments and disseminate free of charge to the world's fifty least developed countries. We can employ a similar idea for green technology development for progress of all humanity, for example, to create a global research fund, as the honorable Minister Nakagawa has already mentioned, and to establish a platform which is suggested also by Professor Aizawa. We may establish a common platform, what I would call a common technology platform, to register green technologies that can be used free of charge by developing countries, especially including Asian countries, and to readily distribute such technologies to countries that need them most. We should bear in mind that, without adequate adaptation, developing countries will face difficulties using the technologies due to a significant difference in social environment. The technology must not be overly expensive to operate in the markets of developing countries. This is essentially an identical idea to one proposed by Dr. Ernst Friedrich Schumacher a number of years ago. In his

terms, it is the appropriate technology.

No matter how efficient and functional a given technology may be, it will be useful only when it succeeds in adapting to the particular characteristics of the developing countries. When seen from this perspective, we must also consider how to invigorate not only adaptation of northern technology to the south, but also south to south transfer of technology as well. Last month we had a symposium in Seoul on the subject of Global Green Growth. But many delegates coming from African countries claimed that their needs are in the reverse order. They claimed that Growth is more important than Green, and that Green is more important than Global. This is something we should think about: how to encourage the development in their society by transferring technology. From a long-term perspective, we observe that assisting developing countries to consolidate their capabilities to independently develop necessary technology is more effective than simply transferring technologies. For this, you need the enrichment of human resources for each country. For this purpose, we must diligently provide support, large or small, and organize fora to transmit knowledge, to train and help secure a network of outstanding researchers, and to organize other programs as required by that region. The research support extended by developed countries to developing countries in many cases takes the form of data collection for articles to be authored by scholars in developed countries, which is known as the “parachute science support.” Or worse, we observe the phenomenon of brain drain where talents from developing countries are mobilized to solve problems facing developed countries. Indeed, support for research designed to strengthen the competence of developing countries should help solve problems that undermine these countries as well as developed countries. We require support for an efficient and stable operation of a network if technology transfer or support for the strengthening of competence is to result in practical efficacy. Indeed, for cooperative research support to secure practical effects, it must be provided from the perspective of a long-term partnership designed to increase the level of mutual understanding. Likewise, the partnership must entail collaboration not only with researchers from developing countries, but also with work fields such as administration and other supporting fields. I would also submit that we must take into account for each scientist, for each idea-generating person, his physical environment and his emotional environment.

I’d like to take this opportunity to explain how we Koreans prepare for the future to attract creative thinkers. As is written in the preface of this conference, the only successful example quoted here is the total policy of China to draw back Chinese scientists living abroad. In fact, Korea has suffered from this brain drain phenomenon for a long time. In the early 1970’s, we had the experience of many overseas Koreans returning to Korea to fulfill national projects, but soon afterwards, they left because we failed to provide them with an attractive environment to continue their research, and to compete with other researchers around the world. So, I think that when we mention human resources, we must consider providing an environment that is as attractive as MIT, Harvard or other prominent European institutions. That basic concern produced a national agenda called the International Science Business Belt Project, which is being implemented in Korea.

In conclusion, I would like to emphasize once again that efforts in the following direction are needed to solve global problems and to achieve a balanced future for Asia and the globe. Indeed, we need to develop a comprehensive mechanism that facilitates smooth transfer of technologies in the green technology sector, support for the consolidation of competence for developing technology by developing countries, and formation of a long-term network. For this purpose, and as a matter of priority, I would say a common technology platform should be formed in Asia that can be readily utilized by developing countries. We also need technological and financial support from developed countries for the platform, but I am very happy to learn a lot about the initiative to form a kind of platform for this beneficial exchange. I appreciate very much the Takeda Foundation and the other organizing institutes for their efforts to build the balanced future of Asia. Thank you very much for your attention.

Chapter 6　Invited Speech 2

Yoshio Akamatsu

There have been wonderful speakers giving very in-depth and insightful presentations from very high places, but I am just a representative of one company, and it is beyond me to talk about human resource development globally or nationally. However, if you listen to our strategy for human resource development in our company, and learn certain aspects of it, I will be more than happy. I think you have seen many articles about how Japanese companies are trying to recruit talented foreign people, or sending their young Japanese employees overseas, or inviting skilled people from overseas to provide training. We are in an aging society with fewer and fewer children. The economic growth is slowing down, the domestic market is shrinking and we have to go overseas to explore international markets. Our challenge is to figure out what kind of human resources we should secure under the above-mentioned situation.

In the past, we were able to recruit human resources in Japan, and send them overseas to develop business with local staff. However, we can see the limits of this business model, and we recognize that one of the important tasks we face is to develop overseas staff who can operate business in designated companies; however, it is still important to develop Japanese staff as global human resources.

ITOCHU Corporation is a sogo shousha, a general trading company. We have focused on trading for a long time, and have created a global network by exporting made-in-Japan products to every single country of the world and every single section of the global market as the industrialization of Japan has progressed. In addition to exports, we have been importing raw materials with which Japanese companies manufacture products in Japan. Our business model is based on export from and import into Japan; however, the situation is changing, and, nowadays, many products, including sundry and day-to-day goods, are manufactured in China or China-related places. So, our business model needs to change.

ITOCHU is a Japanese company, so the head offices are in Japan. In addition, we have overseas branch offices. We have 4,300 employees at the two head offices in Osaka and Tokyo where the company is registered. We also have 2,200 to 2,300 employees at 117 overseas subsidiaries. These numbers show that we have two head offices with many employees, as well as many small overseas subsidiaries with fewer employees. We develop strategies and decide business directions in Japan, and based on these strategies developed in Japan, we conduct overseas business. In addition to direct subsidiaries, we have consolidated facilities and subsidiaries in which we invest; these employ 56,000 people. As you can see, we have direct operations and the consolidated operations, and the sizes of the two groups differ significantly.

Since the Japanese society is aging with a falling birthrate, we have to expand our overseas operations. Unfortunately, it is becoming more and more difficult to recruit human resources in Japan who can operate overseas. Therefore, we need strategies and management policies that enable the training of overseas staff so that they can operate and manage our business. For us, the globalization of human resources has two meanings: one is to globalize staff at the head offices, and the other is to globalize local staff at the overseas subsidiaries so that they can operate our business in conjunction with the head offices.

Dr. Ohto asked me to identify the type of people I call global human resources. I have thought it over, and I think there are several layers. One of the basic requirements is the ability to communicate with people without regard to nationality, culture, or ethnicity. But that is not enough. He or she should be able to engage in in-depth communication in a common language, probably English. A further requirement involves the ability to engage in deep discussion, and to conduct

information exchange, research, and business development in foreign languages. It is necessary to educate staff so that they can work at the above mentioned level. Ideally, we would like to develop human resources who can organize groups, manage the company, and drive international business. In other words, we would like to develop management executives wherever they work without regard to the head offices or overseas subsidies, ITOCHU Company or Group.

Today, I would like to concentrate on how we educate overseas staff to be global human resources in our operation. We call our strategy Global Talent Enhancement, and have established Global Talent Enhancement Centers (GTEC) that are in charge of implementing global human resource development. The Tokyo Head Office houses the Global Human Resource Strategy Department and GTEC Headquarters, and the major overseas offices have GTECs. We have GTECs in North America, Europe, East Asia, ASEAN, Southwest Asia, and other districts. The difference from the conventional categorization is that China is so big that we do not regard China as a part of Asia but as its own independent category. Korea and Taiwan are categorized in East Asia. We invite candidates from each GTEC to the GTEC Headquarters in Tokyo and train them so that they acquire same level of managerial skills and knowledge of our business methods. In addition, we develop global human resources at each GTEC. The most important thing is to secure talented people. To secure talented people, recruiting, compensation and posts become very important. If we offer very low compensation or posts, we cannot secure talented people. On the other hand, even with better working conditions we cannot assure we will have better people.

When we employ staff, the next step is training them. There are two kinds of human resource development, on-the job-training and site training. To develop global human resources, we focus on site training. As I just said, there are several levels of global human resources. The company consists of very large head offices and many small overseas subsidiaries, and we would like new overseas staff to overcome the gap between the large head offices and many small overseas offices. We have developed the Global Network Program to provide new employees with fundamental knowledge about the company and its operations. There is some secondary effect to this program: local staff who work at various overseas offices come to GTEC Headquarters and spend time together for a certain period, a week or ten days, while they take training, and spontaneously develop human networks. These networks will become very useful when they return to their overseas offices, and their staff will begin to understand what it means to work globally. The next step is the Global Leadership Program to train more experienced staff with certain achievements. The purposes of this program are to level up managerial skills and develop leaders in the overseas operations. The last training step is the GEP, or Global Executive Program, which aims to develop executive officers in the head offices or group management executives for international operations. Candidates go through different training programs including business management programs similar to overseas MBA programs and things related to ITOCHU. They take time to learn about leadership, and then go on to the next step.

I would like to explain another program called the U-Turn Rotation Program, which I think is very important. This is not short-term training, but, rather, the overseas staff stay in Japan and work with the Japanese staff for 1 or 2 years. It’s preferable that they speak Japanese, but without regard to their ability in Japanese, they can work with the Japanese staff, learn how we conduct business, and make decisions or take risks so that they can move to the next step after 1 or 2 years. In this way, we level up overseas staff through on-the-job-training so that they can make contributions to our operations when they return to their overseas assignments. We also select candidates to become future management executives.

I talked about the requirement for global human resources and mentioned that one of the basic requirements is to communicate with people without regard to nationality, ethnicity or culture in a foreign language. Various people join ITOCHU, many of whom are interested in international operations; but some of them have only a vague idea of international operations, and are not fluent

in foreign languages. For those staff, we have the junior staff overseas language training program. Several years after they join the company, we dispatch them to an English speaking country, usually the US, where they stay for 4 to 6 months and acquire the language skills that I mentioned. If a junior staff member already has English-speaking ability through living previously in a foreign country, we dispatch them to another language-speaking country, usually China, because we cannot operate an overseas business without the involvement of China. We develop business in the Chinese market or in a third country market with Chinese enterprises, and our staff should become fluent in Chinese once they have acquired English ability. However, it's not just Chinese or the Chinese market that we are focusing on; we want our staff to be able to communicate well in other foreign languages as well. Therefore, we are also placing emphasis on the languages of BRICs nations (Brazil, Russia, India, and China), or the languages of emerging countries where we want to expand our markets. We hope that our staff can learn languages, and learn about the cultures and customs of these countries so that it will become easier for us to operate businesses in these countries. We still employ many fresh college graduates and educate them, and we also train overseas staff. As a basic requirement, we want them to acquire foreign language ability. I hope that I have been of help to you in understanding the kinds of human resource we, a trading company, want to develop. Thank you very much.

Chapter 7 Welcoming Remarks
Panel Discussion "Regional Collaboration in Science and Technology in Asia"

Atsushi Sunami (Moderator)

We are going to discuss the development of a framework for regional collaboration in science and technology in Asia. We already had workshops yesterday, and discussed some topics concerning regional collaboration including the regional development of human resources and brain drain, and collaborative research and research infrastructure. Based on the discussion, we would like the panelists to present their views and comments on regional collaboration. We have invited nine panelists from eight Asian countries and Japan. At first, I would like to listen to their presentations, and then discuss the two topics with the audience. The first topic is the regional development of human resources and brain drain; the second topic is collaborative research and research infrastructure. The content of the symposium, including the panel discussion, will be compiled and published by the Takeda Foundation.

Tateo Arimoto

My title is Redesigning Science and Innovation Systems for the Changing World. As discussed in the workshop yesterday, the perspective of innovation is expanding in the 21st century. Previously, innovation was pursued for profit, competitiveness, growth, and employment, because innovation has been pursued by private companies. Clearly, now innovation is pursued for well-being and quality of life, security, sustainability, and resilience of society. The horizon of innovation is expanding. The modern innovation system has been developed over the last two to three hundred years, and, now, the traditional innovation system should be changed locally, regionally, nationally, and globally as the perspective of innovation expands. Of course, corporate strategies are changing as well.

The Center for Research and Development Strategies, to which I belong, has formulated

and proposed a concept of the global innovation ecosystem. Globalization has rapidly progressed during the last 20 years since the end of the Cold War because of the swift spread of the Internet. Competition among nations has intensified as globalization progresses, and each nation has been trying to develop competitive national innovation systems. However, these national innovation systems are not an effective tool for the attenuation of regional and global challenges, and that's why we need regional and global innovation ecosystems to respond to a wider range of challenges. Regional and global innovation ecosystems include not only the public sector, but also the corporate sector because both share a lot in common. Societies and markets that receive innovation are diversified. Therefore, innovation models are also diversified from the destructive innovation that is created from the leap from conventional technologies to reverse or frugal innovation in which the original technologies developed in emerging countries are introduced to developed countries.

In 2004, Mr. Palmisano wrote a report on innovation in Foreign Affairs, which had a deep impact on the world. As Mr. Akamatsu from ITOCHU clearly mentioned today, large companies are becoming globally integrated and making profits by collecting resources, staff, information, and capital from all over the world. They try to make profits by creating social and cultural innovation, which contributes to regional or local societies, as well as creating traditional innovation such as new goods and services.

As Dr. Aizawa mentioned today, the Cabinet Office determined the Fourth Basic Plan for Science and Technology last August. They have decided to take an issue-driven policy rather than a discipline-based one, and science and technology policy is expanded all the way to innovation. The 4th basic plan involves new concepts including public participation to create social values by bridging science and society, and consideration of the legal and ethical aspects of science and technology. Technology assessment will be also necessary to evaluate the social impact of emerging technologies. It is also important to develop bi-directional communication between society and the science and technology community. These kinds of systems should be developed not only at the national level, but also at the regional and global levels.

I mentioned that it is important to expand innovation systems from national innovation systems to a global innovation ecosystem. In order to realize this global innovation ecosystem, we should consider reforming the conventional funding systems based on national innovation systems. Japan has three major funding agencies. The Japan Society for the Promotion of Science (JSPS) makes grants to traditional basic sciences. The Japan Science and Technology Agency (JST) supports mission-oriented basic research. The New Energy and Industrial Technology Development Organization (NEDO) supports research near the market. As Dr. Aizawa repeatedly emphasized, we focus on the development of technology based on needs and issues rather than based on technological seeds. Governments of other countries are also trying to reform their conventional funding and evaluation systems, which are based on the traditional national innovation systems. In the world, there are various research cooperation programs and facilities ranging from regional cooperation facilities such as CERN and the European Molecular Biology Laboratory (EMBL) to global cooperation systems such as the International Space Station and the International Fusion Energy Organization (ITER). All these cooperation systems are supported by various funding programs including e-ASIA joint Research Program, SATREPS, the Human Frontier Science Program and tUSAid related programs. But all these support systems are based on the concepts of the nation-state in the 1980s. However, players in science and technology are diversified, and include the institutions of local authorities and the profit and non-profit sectors as well as organizations of the central governments. Yesterday, Mr. Matsumi of ITOCHU proposed the development of international open innovation centers with the cooperation of public, academic, and the profit and non-profit sectors. Now is the time to redesign new types of support systems for regional and global collaboration programs

based on the overview of the traditional support systems.

As you already know, not only economic activities, but also scientific activities are flourishing in Asia. However, we cannot be happy without reservation. As scientific research flourishes, we need to establish ethics and governance in scientific research. Many companies operate local and global businesses in parallel, and traditional values are changing. We need to redesign new types of innovation systems and funding systems in consideration of such changes. As we discussed yesterday, just the development of centers of excellence (COEs) is not enough. We need connections and networks among COEs to create open innovation. It is time to develop non-traditional players who can cross disciplines, sectors, genders, generations, and borders, and help them to produce social values. We may need significant reform of universities to develop such non-traditional human resources. I think that the key words are systematic thinking and design thinking. It is difficult to integrate knowledge using discipline-based conventional thinking. The important thing is integrated knowledge.

We are trying to develop regional collaboration in science and technology in Asia. Africa would like to do the same thing. Europe takes the lead with the European Research Area. The United States has also been developing some kinds of regional collaboration frameworks. It is time to consider with future generations how all these regional collaboration mechanisms can be connected together to produce social values. Thank you very much for your attention.

Tatang Taufik

I would like to share with you our proposal to develop international collaboration in strengthening the national innovation system, of course, from the Indonesian perspective. Allow me to start with what Indonesia has been doing so that you will understand why we are proposing this. As you already know, Indonesia is the largest country in ASEAN, and the fourth largest country in the world in terms of population; but not in terms of competitiveness. There are many ethnic groups, more than 300, and there are almost 230 million people. But when we talk about knowledge production activities, we have to admit that Indonesia is still very low as shown by the number of patents granted. About 70% of the economic activities are concentrated in the Java area. Last year's survey shows that we have 202 large manufacturing companies, and only 40% have R&D units.

When we studied about the source of technology, it is turned out that about 58% comes from foreign countries, and only 30% from local academia including research centers and universities. And 29% of the technology comes from Japan being followed by European countries. I think that the main reason for this is that most of the large manufacturing companies have their principal companies in Japan. The local sources of technology are mostly research centers such as our organization, PPT-LIPI, and others. Universities contribute only about 9.7% of the technology. I think, to some extent, these figures indicate our national competitiveness. Indonesia is 4th largest country among ASEAN countries, but ranks 46th in the global competitiveness index. We are far behind Singapore, Malaysia, Brunei and Thailand so we would like to run faster than our colleagues in ASEAN. The Global competitiveness index has some categories, and Indonesia is not doing well in the categories of technology readiness and innovation.

Indonesia has a lot of work to do to improve technological performance and technological capacity. The weakest part in our innovation system lies on the framework conditions and the linkages between academia and industry as discussed at theyesterday's workshop. Also there are some general issues and challenges including the shift of the development paradigm from natural resource-based development to knowledge-based development. We need more innovation and entrepreneurial activities. We have to improve our partial sector approach to a more systematic holistic approach. The government also needs to improve fragmented policy

instruments and develop a more integrated and coherent approach.

Recently, the Indonesian government has determined eleven national priorities including the encouragement of cultural development, creativity, and innovation. I think that the government should adopt a policy of strengthening the innovation system based on the periscope study, and then a study conducted by our agency in 2004, and then the long-term development plan to support knowledge-based economic development. There was also a national coordination meeting in 2008, and at that time, our proposal on the innovation policy framework was approved. The mid-term development plan was also adopted. This April, the President established a National Innovation Committee along with the National Economic Committee. Also in April, the President issued a master plan for the acceleration and extension of Indonesian economic development until 2025. This is a sort of new paradigm in our knowledge-based development, which is the innovation system master platform that will increase and enhance competitiveness, and strengthen social cohesion. Our agency, the agency for the assessment and application of technology, acts like its counterparts in Finland and Sweden. We would like to play a more strategic role in contributing to strengthening the national innovation system.

We have proposed to the government six agenda items concerning strengthening the national innovation system. The six agenda items include 1) developing and adapting strategic responses to global events and challenges, 2) strengthening knowledge institutions and science and technology supports, and enhancing absorptive capacity of industry, 3) developing synergetic collaboration for innovation and its diffusion, and increasing knowledge-/technology-based services, 4) fostering innovation culture, 5) developing and strengthening integrated efforts of innovation system and industrial cluster development, and 6) developing and adopting strategic responses to global changes and challenges. The first item has already been adopted by the government, so we hope to strengthen our cooperation with other countries. This is the strategic initiative that we proposed in the white paper for the national innovation system. The white paper itself has not yet been approved, but will be approved at the end of this year or, at the latest, the beginning of next year.

We have 5 strategic initiatives to strengthen the national innovation system. The first is to strengthen regional innovation systems. The second is to strengthen the techno-industrial innovation systems. The third is the development of an innovation network including cooperation within the country as well as international cooperation. The fourth is technopreneur development, and the last is strengthening thematic pillars. This is an example of what we are doing this year in cooperation with some regional governments to strengthen the innovation system. In addition, we encourage those who participate and have commitment in developing innovation in the region. We provide appreciation in the form of an award, Indonesian Innovation Awards.

I think that in general most Asian countries face similar challenges in relation to a national innovation system. First, there is a changing economic landscape in most Asian countries, and then there is the matter of increased wealth and quality of life, but not everywhere and not for everybody. The third is different innovation cultures and political response. I think that the responses of Singapore, Malaysia, and Thailand differ from the responses of our government in science and technology development, because the cultures and political systems are different. Weak and less connected national or regional systems of innovation pose a potential threat leading to the knowledge divide, and the economic divide, and this has already occurred in Indonesia. Some regions of Indonesia are lagging behind and some regions are moving faster. The next problem is serious environmental degradation in some cities and regions due to urbanization and industrialization. We still have problems in terms of food, energy, water and natural disasters.

To sum up, I would like to propose the following. First, I think we have to have shared goals in science and technology collaboration through strengthening national and international

innovation systems in Asia. Our objective is to learn and share ways to improve our national innovation systems, to identify best practices, and to find ways to transfer knowledge and experience in order to foster innovation and enhance competitiveness in the region as a whole. Next we need consensus on at least two things. First is we need to find a common platform, which is related to innovation policies or agendas including how we improve innovation financing from the government and developing risk capital in the market; and the second, how to develop an innovation culture in each country as well as across borders. Also, we need consensus on how to strengthen the innovation network. We propose inter-governmental or inter-organizational cooperation on policy setting on innovation and business or techno-entrepreneurial development, capacity building in science and technology organization, human resource development, mobility, and exchange including policy makers. We propose the joint knowledge management; for example, we can develop a cloud computing system to support an innovation system network. We need specific collaborative pilot projects. We need to develop an open learning system, first by developing open coordination and shared experience and shared facilities. I hope we need to develop such resources within one to three years, and we can start from well-defined collaborative activities critical to strengthening innovation systems. Grow as we go and create excellent achievements and build a community of practice. Thank you very much.

Krisada Visavateeranon

The topic of my speech today is the ASEAN University Network or AUN/SEED-Net. This is an example of a regional collaboration in science and technology in Asia. I think that many of us heard about this network before. Professor Miki gave a brief explanation of this network yesterday in the workshop. Also at the beginning of this symposium, Mr. Oshima from JICA mentioned about it. Now I would like to give some more explanation about this network because this network is a great network that is contributing very effectively to the development of the engineering field in ASEAN countries. Thanks to JICA and the government of Japan in initiating this project, and their continuing support, this project has been ongoing for about ten years. I heard today that they will continue their support in the Third Phase. This will have a very big impact on the engineering society of ASEAN countries. AUN/SEED-Net means the ASEAN University Network and the Southeast Asian Engineering Education Development Network. This university network includes both academic and science & technology networks. The network involves and promotes collaborative research in science and technology. This network consists of 19 leading universities in ten ASEAN countries including Chulalongkorn University and King Mongkut's Institute of Technology in Thailand, the University of Technology, Cambodia, the University of Malaya in Malaysia, and Nanyang Technological University and the National University of Singapore and etc.. These are all leading universities that belong to the network that educate young engineers in the region in order to upgrade their abilities to serve the social and economic development of the region. This network is also supported by leading Japanese universities including Hokkaido, Keio, Kyoto, Tokyo, TIT, Kyushu universities and etc.. The National Graduate Institute for Policy Studies (GRIPS) is also a member of this network.

In 2001 the Ministries of ASEAN and Japan agreed upon the development of academic network and the operation was started in 2004. The project has been ongoing for about 10 years. I became involved in this project in 2005 when I was in Chulalongkorn University. The objective of this network is to develop human resources in engineering field for the social and economic development of Asia through enhancement of educational and research capacity of member institutions in ASEAN. There are three goals for this project. The first is to improve the quality of the academic staff (about 800 including Masters and Ph.D. students in ASEAN). The second is to improve the quality of the research with the assistance of the Japanese supporting universities. We have one program that we call the Ph.D. Sandwich Program, in which students come to

study at member institutions with support from Japanese professors, and the students have the chance to do research in Japan for perhaps one year. People who are involved in the collaborative research of the network join conference and sometime are dispatched to other member institutes. The expected output is the enhancement of educational and research capacity of the member institutions resulting from the upgrading the qualifications and strengthening the graduate schools of the member institutions. The second expected outcome is the establishment of academic and human networks through joint activities. This is one of the great outputs. The third expected outcome is collaborative research actively focus in the region. This involves S&T activities and to upgrade the function of the partnership between ASEAN and Japan.

We have developed 3 strategies to achieve the objective. First, we organize a consortium of engineering graduate schools to produce high quality graduates. Not all of the member institutions have a high quality graduate school. Secondly, we use resources from ASEAN member institutions and Japanese supporting universities. The third one is that we identify engineering fields that are essential for the region with one member institution as the host institution that will educate the staff of other institutions, promote mobility, and conduct research in cooperation with Japanese supporting universities.

The concept structure involves 3 activities, the graduate program, collaborative research, and an academic network. In the graduate program, some of the member institutions serve as a host in one engineering field. The host institutions have graduate school and organize regional conferences and promote that particular field. The other institutions send their staff and students to the host institution to study in master or Ph.D course. During their studies at the host institution, they conduct collaborative research. The collaborative research is funded by AUN/SEED project funds. With support from the Japanese supporting universities, the professors give research advice to the student and sometime they are dispatched to the host institution. The students have a chance to go to Japan for a short-term research, and some of the good students can stay and study in Japanese universities.

This network organizes a regional conference, dispatches Japanese professors, and supports a short-term research. There are nine engineering fields: chemical engineering, environment, manufacturing, materials, civil, electrical, information technology, mechanical, and geological. Each university is in charge of certain field. For example, De La Salle University in the Philippines is in charge of chemical engineering, and has a graduate school to educate students from other member institutions. And this is supported by the Japanese supporting universities, University of Tokyo, Tokyo Tech, Waseda, and Kyoto University. In Thailand, Chulalongkorn University is in charge of civil engineering and electrical engineering. King Mongkut's Institute of Technology is in charge of information and communication technology, many Japanese supporting universities support these fields. Other than the nine engineering fields, there are interdisciplinary fields that combine many fields, and most of the research topics concern issues common to the region such as biotechnology, disaster mitigation, the global environment, natural resources, and renewable energy. One member institution is assigned to act as main facilitating Institute which will host collaborative research and organize regional conference in that field with assistance from the Japanese supporting universities. They organize conferences, and professors from all member institutions and Japanese universities attend. The conferences are open to outside the network such as people from industry, government, and community.

The 10 year operation has produced a significant output including scholarships for 800 students. Thailand educates about 200 students from Laos, Myanmar, Vietnam, Indonesia, and the Philippines. They came to study civil engineering, electrical and ICT. The network also supports research projects, and all the students have to publish papers. All together they publish 865 papers and proceedings, some of which are in national journals or international proceedings.

As you remember, in 2004, we had a big earthquake in Indonesia. Gadjah Mada University together with Kyushu University and Kyoto University developed a hazard map under a cooperative research project. This map can be used for effective earthquake countermeasures such as crisis management and architectural standards. This contributed greatly to Indonesia at that time. Another example of cooperative research in civil engineering, a student from Laos conducted research on construction management at Chulalongkorn University together with an advisor from Hokkaido University. The research involves planning and control, utilization of construction methods and equipment, and modern methods for decision making in construction quality and safety. The cooperative study actually made a significant contribution to solving the problem of the discharge of waste water. Another example is a renewable energy project conducted at the Institute Teknologi Bandung in Indonesia by a student from Ho Chi Minh City University of Technology with assistance from Hokkaido University. They conducted research on the effect of biodiesel fuel from rubber seed oil on direct injection diesel engines. You can see that most of the collaborative research involves topics that are concerns of the region. The projects may not be high-tech, but fit the requirement of the region. Many students from various countries participate in the collaborative research with professors. AUN/SEED-Net organizes many regional conferences every year in every field, and more than 4000 faculty, staff, Japanese professors including alumni take part. In the conference they get to know each other and they exchange knowledge and experience. The conference venue rotates among the member countries so that people can travel to many countries in the region.

ASEAN Engineering Journal is a new project to create an additional channel for research in AUN/SEED-Net. This can level up the quality of the research of the students and of the network too. This program is mostly funded by JICA. We are now in Phase 2 and are going to extend to Phase 3. There are still many challenges and expectations form this network. One of the issues of the network is the cooperation with industry. All of the member institutions should have contact with industry. ASEAN has to produce highly skilled human resources in the next phase because the level of technology in Southeast Asia should also level up. Now, many countries are not only involved in manufacturing products but also in the design and development of new products. Students of this project should have the ability to cope with that. We have to increase the university and industry projects in the next phase.

Although JICA supports the program, the financial sustainability of the program is crucial. We should discuss cost sharing for scholarships with member institutions or with industry. The cost sharing will help the financial situation. The program promotes collaborative research and regional journals, and serves to solve ASEAN common issues. Issues like pollution, climate change, green technology, and disasters cannot be solved by one country alone. But if we can promote this kind of collaboration, we will be able to attenuate such issues. Multinational collaborations in science and technology like the AUN/SEED-Net promote a joyful exchange of human resource among member institutions. Think about the double degree of transfer grade. Students can go from one country to another country. If possible, we would like to establish a regional collaboration area that will serve science and medical science and food science. I think this network is a great network, and has a very big impact on the engineering field of ASEAN countries. I hope that this network will go on and last many years and produce a lot of engineers. Thank you for your attention.

Vijay Babu

Interestingly, I believe that I'm one of the very few members from industry who have gotten the opportunity to share their experiences from an industry perspective as to how we can collaborate in our region. It is indeed a great honor to share the dais with very eminent researchers and research firms, research laboratories, universities and the like. I was very

impressed with the great deal of collaboration that is already taking place among the institutions between various regions in Asia. I believe that institute-level collaboration may focus predominantly on basic science as well as social sciences such as medical, education, or environmental science. At such a level of collaboration, there may not be an intellectual property-related conflict to be expected, and it typically results in a social impact on the collaboration thereby leading to improving the quality of life across the region. Yet another kind of collaboration, I believe, can happen in the industrial space, or what I would call private space as opposed to the public space that I just talked about. In general, industry-level collaboration could lead to social impact or the growth of the region, but in a slightly different form of building industries together, and thereby growing together. In fact, Mr. Akamatsu from ITOCHU shared his experience of how a large Japanese industrial organization grows across the globe and also enables various leaders in various regions to grow along with it. I come from the experience of a start-up organization, which is very unlike a large organization, where I would like to share some experiences of collaboration in developing products for the bottom of the pyramid people in the region. The Asian continent includes countries that are very developed such as Japan and South Korea, countries that are very large and very rapidly developing such as China, and other countries that are also developing fast such as India, Indonesia, Malaysia, and others. In such a situation, I believe there is a great opportunity in the private space, in the industrial space, and one of the key areas where I believe a great deal of cooperation can occur is in the form of growing the market. Typical large organizations in a developed country have already grown, and the markets in developed countries may not be growing fast enough. Therefore, they are looking for growth in developing countries for their products or for similar products in their space. At the same time, companies in the developing countries and entrepreneurs in the developing countries are looking to developing products specific for that region.

Earlier in the afternoon, Dr. Min gave a very insightful speech, and I have actually seen some of what he said as being true in our case. For example, when you talk about green technology in developed countries, the intent is to reduce environmental pollution and improve the environment, while in a developing country, green technology is not necessarily used for improving the environment, but as a need for running a particular business. One example of that is that we have developed a low cost, low power consuming ATM for rural areas where running the ATM on solar power is absolutely necessary because there is no electricity available. The aim is not necessarily to save on carbon dioxide emissions, but to make the equipment available for use even when there is a power problem. Similarly, as Dr. Min mentioned, each region has a very specific need for a product. The ATM that we have developed may not be as complex as an ATM in a developed country, but the needs are different, and the intent of the product is very different for a different type of industry or a different developing country's needs. We believe that this opportunity for products for developing countries could enable collaboration with large industries in the developed countries looking for growth. They can invest in companies in developing countries that are in great need of funds. The investment will allow new opportunities be explored. This is a typical situation where a public partnership may not work because a business, at the end of the day, is high risk, and may not really tie in with the requirements for public funding or partnership. On the other hand, for an industry, this may be a great opportunity to invest and look at new areas of growth for them in the coming years. Similarly, many companies in developing countries may not have all of the technical expertise required to scale a product or build a product of very high quality, while developed countries have gone through that phase and they already have a great deal of people expertise in terms of the technology, in terms of manufacturing, in terms of business or marketing ability, which could be of great help to entrepreneurs or other businesses in developing countries. And this kind of collaboration would actually enable both the developed and developing countries to grow together and complement

each other's skills in a very effective manner. A typical example I would like to share here is the Singapore government, which has an arm called the Temasek Holdings, which normally invests in large organizations, but it also has an arm that invests in very early stage companies. If that company grows, they are in a much better position to enable large companies to partner with them and grow together. Similarly, Intel Corporation, like many large-scale corporations, runs separate investment funds called the Intel Capital Fund, which invests in many companies in emerging countries in the hope and expectation of looking at the new technologies that could emerge from within these countries, which will also enable Intel to grow in the coming years. So I believe that these kinds of collaborations and partnerships between various countries on the Asian continent could help all of us to grow together. Thank you.

Keophayvanh INSIXIENGMAY

In my opinion, I very much support Asian cooperation and partnership. I very much understand that in order to develop the economy of a country, we need globalization and researchers. Human resources are very important for a country, especially, for example, in Laos the educational system and research systems are still in a low condition, in poor environmental condition. I hope that through collaboration with developed countries we will be able to develop our economy. In Laos, we still have abundant natural resources, but how to develop and use these natural resources efficiently and in a sustainable manner are very important. Without knowledge, we cannot develop them economically. This is my opinion. Thank you.

Seetharam Kallidaikurichi E

Reflecting on what was discussed today, and also in the plenary speech by Dr. Aizawa, I have three points to make that will be relevant for the continuing discussion. I was and am very proud to be one of the many beneficiaries of the 100,000 foreign students who studied in Japan. I am very happy that I have been able to use the knowledge that I gained for the sake of Asia because I am part of the staff of the Asian Development Bank. More recently, I have been sent to Singapore to help develop thought leadership through the University of Singapore. So the first suggestion I want to make is this. Japan has this great potential to think very long term. An example which I give to schoolchildren is that it's like planting a coconut tree. A coconut tree gives nothing for the first ten years because it takes ten years for a coconut tree to grow and produce coconuts. But once the coconut tree has grown, it will keep giving coconuts for the next fifty or sixty years without much effort. So I would like to propose a scaling up of foreign student programs in a very big way such as ten times. One million foreign students study abroad in the Asian region. They will have a long-term impact and contribute to society by interacting with local people. This is very important, and Japan has the potential to take initiatives. This can expand beyond engineering to social sciences and life sciences. But expand it in a very big way because knowledge sharing, as the Chinese proverb says, is like creating the next generation of society.

The second suggestion I would like to make is as follows. We have now discussed the funding plans for science and technology by the Japanese government. We have also heard about the Korean plans. I also have gotten some information on the Singapore government's plans. In my view, these plans still represent short-term thinking that looks at immediate problems. But strangely, on the other hand, there are hundreds of millions of people, as my friend Mr. Vijay Babu said, who don't have electricity, who don' have fresh water, who don't have basic sanitation, and we are not doing anything immediate to solve these problems that don't require huge amounts of money. Here again, Japan has a huge potential as the overseas development assistance leader. Japan can really scale-up these programs 10 times or 100 times. We all agreed on the United Nations Millennium Development Goals to be completed by 2015, but the real data show that tap water is available for only about four hours a day in many cities

such as Chennai or Mumbai. Even if you can get it, you can't drink it because it's not safe. It's the same in Jakarta or Vientiane. Those cities are not like Tokyo or Singapore where anyone can open the tap and drink the water. This may look like a technology problem, but it is a societal problem that we all need to address. But there is a further reason for it, because if we address it, then a huge population will enter the active economy, and create a lot of positive opportunities. Nowadays, people buy mobile phones while they have no safe water supply. They don't need mobile phones, but they need water and sanitation first. So we really need to make people aware and give the solution early on because the social and economic spin-off effects are so great.

The third point, which may sound a bit philosophical, is that Japan has this huge potential to bring this new thinking in the context of global events, such as great disasters, climate change, and changing weather patterns. We have been reminded about the bigger powers of nature and of the impact of human activities on nature's cycle. So maybe a new way of thinking is needed in science and technology to connect science and technology with a deeper human consciousness to cause behavioral transformation in the people. As we see the projections of population, the planet cannot support the same levels of consumption in terms of the per capita use of energy, water and other resources. So we need to become not just resource-conservative individuals or efficient societies but become enlightened citizens who can not only conserve resources, but also share with people who don't have. Isn't it a shame that on a planet like this there are many rich countries, while there are so many poor countries where people don't have enough food? We from the rich countries and the developed societies and the educated communities should lead a new transformed lifestyle, and I think that this concept can come from not only Japan, but from the Asian way because Asian cultures believe in the cycle of life and the recycling of societies. I have learned from our Indian lifestyle where we pray everyday "Lokah Samastah Sukhino Bhavantu" in Sanskrit, which means, "Let all the world be happy". It has nothing to do with any religion. We believe that if everybody is happy, we'll be happy. If a new way of thinking comes, it will create a new way of doing business and a sustainable way of living where we seek happiness by sharing with the people who have nothing. And I think that Japan can make a great contribution to the development of new way of thinking and the sustainable way of living. They have demonstrated the behavior of being resilient and acting in a manner of complaisance in the recent great disaster. This lesson should be transferred because such disasters may come to Asia. These are the three points that I want to share. Thank you very much.

Muhamad Jantan

Let me address three issues. One issue is whether collaboration is a welcome thing. Secondly, the issue of joint collaboration with regards to human resource development. Finally, I would like to address joint efforts in research. In terms of collaboration, of course, as we know now, it is a borderless world. It is inevitable that things need to be done collaboratively. As I was looking through the preliminary report on this proposal for international collaboration, one of the issues raised was about brain drain from Asia, but within Malaysia and Asia itself there is brain drain. Malaysia loses its talent even to our neighbor Singapore in huge numbers. But then we do get talent from Indonesia. But we also have talent moving to Japan, Korea, and Taiwan, and this has a lot to do with ethnic heritage. So in terms of collaboration, Malaysia does welcome it because we have always had an open economy. We are a huge trading nation, and, therefore, we are open to working together in the international arena. In terms of human resources, we have found that the number of our research scientists and engineers is not large enough to drive the innovation agenda of the nation. Therefore, there needs to be a catching up, and for this to happen, since the 1970's and 1980's, the government has been sending thousands of students mostly to English-speaking, developed nations. After graduation from foreign universities, a portion of these students remain abroad. It's only recently that we have been sending students to

East Asia (China, Japan, Korea, and Taiwan). One of the main reasons for this change is the cost. The Malaysian government spends about one million ringgits to educate a Ph.D. candidate in western countries. This is simply too expensive, and the government does not have the resources to continue this policy. As mentioned by Dr. Seetharam just now, regional graduate school programs should be scaled up in Asia.

The other area to be addressed is industrial internships for researchers. There are not enough big companies in Malaysia that undertake research. A lot of the research is being done by public institutions. We still have problems of the university/industrial linkage. Academia may not understand the needs of industry. Therefore, access to internship placement would better help in human resource development. In terms of the research agenda, we feel that the level of development of the various countries in Asia is too diverse. It may be difficult to find common areas which have high priorities among nations. For example, currently, we are trying to develop indigenous technological capability, leveraging on diversity. At the same time, we have moved to thematic or society-driven innovation rather than technology-pushed innovation. For a long time technology that we have adopted has never worked for society. Therefore, in the last couple of years a condition for a research grant is that the research must be trans-disciplinary, meaning that the project must involve social and humanity aspects as well as scientific aspects. Therefore, it is more thematic, like issue-driven and society-driven research rather than basic discipline research. Therefore, I would like to make a general suggestion that joint research should focus on more fundamental aspects because you can find common areas in the fundamental research, whereas national research can focus on translational aspects whose results can be put to use within national or area context, and become useful to society.

Another thing concerning the research agenda would be about access to intellectual property rights (IPR). IPR is still an issue, and translational research typically requires use of IP produced in the fundamental research. To be able to find solutions for societal problems in the national or local context, inexpensive or free access to IPR as was mentioned earlier, would be advantageous. This would be similar to the computer software world where you can develop inexpensive software based on open source programs which is similar to IPR of fundamental research. Thank you.

Susan Y. Mabunga

Actually, I think that over the past two days I have done a lot of introspection. So many ideas were presented yesterday. I would like to respond to what has been discussed already. I agree that science and technology should be issue-driven and value-driven. Some of the issues were clearly articulated yesterday and today. From my perspective (I come from the health sector), some of the values that would drive science and technology for us would be equity, health and sustainable development, universal health care, and the eradication and control of tropical neglected diseases. This has also been alluded to yesterday and today. I would like to agree one hundred percent with Dr. Min about the need for adaptation technology, as shift from parachute science support to partnership. The university issues are mostly open to changes and innovation, and we would welcome a shift to or the possibility for private/public partnerships, especially if issues concerning technology transfer are addressed. The University of the Philippines has set its direction, and it will move toward an entrepreneurial university basically because we anticipate a decline in our resources. We are also trying to beef up our research capability. We have problems with our scientists. They are doing very well, but not in our country, and we would like to get them back. We are seeing this trend now with our scientists coming back, but we would like them to stay, and I think we would like to welcome the lessons that we can get from other countries that have had similar problems. We are definitely open to regional collaboration and networking in both education and research, especially at the graduate level and for clinical

training. I agree with Dr. Tatang on the need to come up with a consensus on a common platform. I think there is also a need to emphasize the need for innovation to diffuse knowledge. There are existing mechanisms for collaboration through ASEAN and SEATO. The Japanese role has always been pleasantly and sincerely felt through JICA and the Philippines, and we welcome the presence and further collaboration with the Japanese government. Thank you.

Dong-Pil Min

Let me just speak on the human resources problem because I couldn't participate in yesterday's meeting. If we compare human resources with water, then the problem we are considering is how to use our water more effectively and more valuably. But, first of all, in order to carry on collaboration, we need manpower in the science and technology and innovation areas. Especially in the science and technology area, more and more the young generation doesn't want to get involved because it's considered as 3-D (dirty, difficult and dangerous). They have learned a lot and paid a lot of effort, but nevertheless, at the end of the day, they found themselves in a very unstable and unappreciated position. This kind of trend must be universal. If one country is developing, then for a certain amount of time they will face this problem. As a kind of simple solution to this problem I would like to mention CERN, the European Organization for Nuclear Research. It's a very academic organization, and is probably the first venture organization founded in 1954 or so. Since its foundation, they have been preparing the training system for young people and the present director was a young student attending summer school sponsored by CERN. I think that this kind of opportunity must be provided to our young generation, especially for Asian students. Professor Koshiba who won the Nobel Prize a couple of years ago and other Asian Nobel Laureates created a camp called the Asian Science Camp in order to keep the dreams to the young generation. There are other opportunities that our Asian young generation could participate with Western people, but they have some kind of language and culture problems and they could not enjoy discussion with Western students. That is why Professor Koshiba and Professor Yuan T. Lee of Taipei created the Asian Science Camp. I want to raise just one example of this kind of movement. This is quite important to my eyes that we should organize an Asian movement in order to bring up our younger generation. I think that Asian collaboration can be quite successful if we organize some events like this inviting very young people. Let me recommend one thing we can do to encourage our collaboration. We should organize a meeting with a very clear and very exciting subject and invite our young generation. That could be the most interesting item on our agenda to be discussed. We must discuss how to sort out proper issues for our collaboration. I am very grateful to Mr. Vijay Babu for mentioning that market enlargement is possible even while discussing this appropriate technology. I think that Asian countries have a lot of common culture and tradition and so on. That's why we can spring out very exciting subjects if we really want to make a collaboration. Thank you very much.

Tateo Arimoto

I really wish that students who now devote themselves to experiments in the laboratory and their professors could listen to the today's discussion along with today's audience. I have been quite moved by today's discussion. Last March 11, we experienced the great earthquake and the disasters of tsunami and the Fukushima nuclear power plant accident. I think that these extraordinary events have made us ask what we are living for. They have made us ask what the science and technology community and universities could have done in the aftermath of the disasters. The distrust of the people and politicians is now spreading over the science and technology community. It is essential to establish systems that allow the appointment of scientific advisors to the Prime Minister in times of emergency, and to establish a think tank to

support the scientific advisors, and study measures to confront the current disasters.
In the past, Japanese academia has tried to remain neutral in value judgment. They promote themselves by using young researchers, but not considering the future of the next generations. The next generation is only utilized as workers. What we need to do now is, as Dr. Seetharam and Dr. Min mentioned, revisit the concepts of appropriate technologies in the 1970's. But if I tell this to current university professors, they will not understand or sympathize with me. However, if you visit the disaster-affected areas in northern Japan, even non-scientists like me can realize that there is new frontier in science and technology. I really hope that young students will go to the affected areas and see what they can find. It may sound too philosophical, but I think that now the extraordinary time is ending, and we are going back to normal times. At this moment, it is really important for all of us to discuss challenges and measures we can take in Asia to keep the importance of the past extraordinary events in our mind.

I should mention that the Japanese science and technology community is not just being too idle. They are seriously discussing the validity of pursuing discipline-based engineering research, and the necessity of introducing system thinking and design thinking into research. They are also discussing the introduction of value-judgment in science and technology. The disasters have been such a bad experience; however, a new science and technology system, a new set of values, may come out of this tragedy. Thank you very much.

Tatang Taufik

Just two things. The first is that we should not forget our cultural roots when we discuss the advancement of science and technology. I think that we share common cultural roots, whether we are Japanese, Indonesian, Singapore or whatever. We share the same cultural roots, and I think that the future of science and technology in Asian countries should be based on our cultural roots. The second point concerns the importance of the participation of young generation. We need to make more serious effort to invite our young generation. In Indonesia, we will have some kind of demographic bonus when the young generation will dominate our population. There are two sides to this kind of demographic bonus. If we have a productive, innovative young generation, then Indonesia will grow better, but, otherwise, I think we will have a serious problem in the future. Those are the two points that I wanted to make. Thank you.

Krisada Visavateeranon

I support Dr. Seetharam's idea for increasing the budgets ten times for foreign students and for joint science and technology collaborations because Japan has a big potential. They have the experience as well as many researchers and a big budget. This will have a big impact. Second, I think that for international collaboration in S&T, we need to find common issues in which all countries are interested. Pollution, climate change, green technology, disasters, floods, and drought are potential common issues. These are quite serious problems in many countries in Asia, and cannot be solved by a single country alone. We need experience and expertise. If we organize a multinational consortium for research in these areas, perhaps every country can gain from this. Another subject is industrial cooperation. I think that in our country industry and university researchers are still kept at a distance. The university professors are more research-oriented, but in industry they start by asking what the topics are. What is the feasibility of the development of product or design? Maybe they have no time for basic or fundamental research. Universities could support that. Only based on basic research they can design and develop a prototype product, and all parts of the manufacturing process including S&T development and marketing. I hope that we can learn from the Japanese experience. If industry and universities can come together in joint cooperation, then they will find great power. Yesterday, I met some Japanese who proposed a very interesting project. They said that they have many retired

Japanese who are 60-65 years old with no jobs and want to continue to work. They have a lot of technological know how. If they could go to other countries and help some industries to set up production or start a new business, then that would be very good. I have heard a lot about brain drain, and, even in our country, we suffer a lot from brain drain. Our talents usually go to America or Europe to study, and never come back. We do not have a good environment for them to come back and help our country. However, if we have this kind of network, then we could create a chance for them to play a role, and we may be able to draw them back to help the country.

Muhamud Jantan

I have just one additional comment on a subject that has not been mentioned. I think that in the less developed countries in terms of research, there is still a need for expertise in the management of research. For this, there are needs for sharing of knowledge for managing research. These countries have very low innovation efficiencies. Because their resources are limited, we need to optimize the available resources to enhance the research output. This experience is particularly relevant now in a lot of developing countries. Thank you.

Tateo Arimoto

I have a proposal. In listening to many of the presentations yesterday and today, I realized that there are various international cooperation systems of which some are small in scale, and some are in different stages. I was thinking we could develop various effective funding systems by collecting all these various cooperation systems, and carefully studying them. If you try to develop ideal funding systems or research systems out of the blue, then you will get stuck. So you start where you can, meaning that we start by collecting all the experiences of the panelists and discussing the pros and cons of the different cooperation systems. Another point is to start specific projects even if they are small.

Kazunobu Tanaka from JST (audience)

I have a comment. I am quite confident that right now Japan has a very high competitive edge in science and technology in Asia. While Japan keeps this competitive edge, young researchers including students and young faculty members of universities should go to Asia. They should go not only to Asia, but also other foreign countries. There are many statistics to show that many Japanese youths have become inward looking rather than outward looking. In order to break through this, young people should go abroad. I have heard many suggestions. Dr. Min said that Asia should expand to give a greater dream to young people. Dr. Seetharam suggested that we can share and understand problems better by going overseas. He also suggested that the quality of regional collaboration will change by expanding the quantity. Dr. Krisada mentioned that even after sixty, people would go overseas with the right incentives. As discussed in the plenary lecture by Dr. Aizawa, social-driven or issue-driven research is necessary to meet real social needs. To do so, young researchers should go abroad and see the world. I think that persons in charge of science and technology policy or administration should take this into consideration when they make policies or make grants. Thank you very much for the wonderful discussion today.

Mime Egami

I actually have three comments on the Panel discussion. I come from the Tokyo Women's Medical University and participated in yesterday's program as well. Number one: this is related to how to understand the Asian basic issues. Do we take long-term in-depth issues or not? If we take issues that are too short-term or superficial, then we cannot create a platform for regional collaboration. I think that it is important to grab long-term and in-depth issues and facts by

communicating with Asian colleagues, and make lists of potentially available solutions and technologies to share. I think that it is not difficult or costly to develop such research centers or information centers to analyze regional basic issues & solutions if we collaborate and share information and technologies.

My second comment concerns issue-driven research. If technologies are developed by engineers in the business community including middle size companies who know real social needs, then many of them can be used in Asia to address basic issues along with the results of research developed by good scientists at good universities. For example, there are new excellent water treatment technologies developed by mid-size companies in Japan, but it is not easy to get timely review and support from government to market products based on it in Japan. But if you introduce these technologies to China, they will review and try to take up the technology as there are quite urgent needs. It is worthwhile if we can make a system to accept proposal of such appropriate technologies available in Japan and introduce it to Asian countries to evaluate and develop together; it will eventually stimulate university students and professors. It is important to make a real example in Asia to enhance the value of appropriate technology to solve basic issues.

My third comment concerns the development of research careers in Asian institutes. I would like Asian researchers to know that there are some world class excellent institutes with visionary leaders in Asia. They do not have to go to MIT or Harvard to develop a top scientist career. Students in our research center are not necessarily top rated, but their motivation is very high, and they are achieving world attention and world leading unique biomedical research. I hope that Asian students go to this kind of research center in Asia and conduct S&T research with confidence.

Susan Y. Mabunga

A comment. In the Philippines, every year for the last five years, students from the National Institute of Public Health of Japan come to the Philippines for one month. They experience all of the tropical diseases that Japan has managed to eradicate. This provides them with the exposure they need to understand the situation in developing countries. So this is one possibility: more exchange. The other, which might be a good idea, would be to explore the possibility of visiting professors. I don't know whether we can pay you, but the mechanisms could probably be discussed or we can find some way, but, definitely, if you have something you would like to share and our students would like to learn from you, that option should be considered.

Muhamad Jantan

Someone mentioned about appropriate technology. Currently all public universities in Malaysia are experimenting with what we call a knowledge transfer program in which teams of researchers and students go to the community for about one month and try to resolve very basic fundamental issues. One case that we are particularly proud of involves our doctors spending a month every year in Bangladesh to undertake operations for cleft lips. The operations were carried out at a very basic surgical room in a clinic. I thought that our researchers and future generations of researchers should be exposed to something similar on a larger scale to understand local needs. They should know that there are people who are really in need of solutions for problems that no large companies want to deal with simply because it is not profitable. Thank you.

Tatang Taufik

In Indonesia there are some initiatives to transfer technology into our SMEs (small and medium-sized enterprises), and we call these innovation centers. Innovation centers are located

in universities in the regional areas, and they help to support the local SMEs with the government. I think Japanese faculty members can provide some services to help SMEs, and work with local universities that play a role as innovation centers. A second role that can be played by young Japanese faculty members is to act as intermediaries because many large Japanese manufacturing plants in Indonesia could be helped by bridging the knowledge gap among manufacturing, local research centers, and universities. Some Indonesians who graduate from Japanese universities play this type of role in some cases, but, unfortunately, they usually work for some other organization. So, for example, Japanese professors could come to manufacturing industries or research centers in Indonesia and help bridge the knowledge gap. We used to have some Japanese advisors in every field of technology, but there is no one anymore. So I think that in the future we can develop new forms of collaboration. Thank you.

Dong-Pil Min

I would like to mention one different aspect of our collaboration. Indeed we have discussed regional collaboration within the region, but overcoming our frontiers or nationalities and so on is also important. But in the future, what I think is of importance is the convergence of different disciplines because science and technology cannot stand alone, so we must merge it with our cultures and traditions and other humanity and societal problems. While we are looking at European countries or the United States, for example, there are some institutes that are symbols of this convergence of disciplines, but it is hard to find such model institutes in Asia. We have different traditions and philosophies for our lives and for society. So I think we should create one discussion platform for the merging of different disciplines. We have heard that the future will be issue-driven, but I think these issues will comprise different fields, even the humanities. So I hope that Japan could play a role in creating a good place where we can discuss over such confined disciplines so far, and we must create a new trend as Asian countries. Thank you.

Audience 2

I have a question. Japan is lagging behind some Asian countries in economy, business, and even some technologies. My first question is: What do you really want from Japan? My second question is: Do you have a specific example of another effort of collaboration made by Japanese?

Vijay Babu

I suppose that today the competition among various countries and various companies is so high that certain organizations grow faster than other organizations, and it may not mean that one is technologically far superior; it may simply mean that one is hungrier for business leading to some organizations overtaking other organizations, or certain regional organizations doing better than Japanese organizations. So I think that Japan, the US, Europe, or many other developed countries do continue to have technology superiority and business experience that is much deeper than many other countries. So I think that despite the fact that certain organizations in developed countries are not doing well, most of these companies hold the technological superiority whether it be specific technologies or even the technologies of running a business or the technologies of selling products. So I believe that these are areas where we can continue to seek and gain from Japanese companies.

Seetharam Kallidaikurichi E

I will respond to your two questions very briefly. The first question, what do you want from Japan? Most developing countries have problems, have some idea of solutions, with due respect to my colleagues from developing countries. There are scholars in each of the developing

countries, but the governments, unfortunately, do not listen to their own scholars because they are not empowered to advise their people, including in India. There are many successful people in India, but their own Indian leaders are not listening to them. So what is needed is the transformational impact that we must give to society because such countries really need that collective wisdom to be shared, which was demonstrated by the Japanese people when a major disaster happened: the people, in my view as an outsider watching through the media, were ahead of the government in showing how they can respond to a situation and cope and still maintain their balance. Now, this is a very important quality; this is a type of leadership that we need to give. This gives motivation to the younger society and others. A concrete example of that is something that I was, in a little way, involved with in 2006. Together with Former Prime Minister Hashimoto, who has since passed away and has been succeeded by former Prime Minister Mori, we formed an Asia Pacific Water Forum because we realized that while everywhere in the United Nations and other places people were talking about water and sanitation problems, these problems were not getting the political leadership that is required because for many governments water or the environment is a very low priority ministry. Sometimes it's not even a ministry, it's a department, so it doesn't get the political attention. So Japan provided that leadership by creating at the Prime Ministerial level a forum in which to discuss water. This has not been done anyplace else; it's the first time, and it has been going on for the last five years. In that, I had a small role to prepare a thought leadership document, which was called the Asian Water Development Outlook. For the first time, we proposed that the problems of water in Asia can be solved. We did not worry about the hundreds of millions of people not having water and say, hey, we should do something about it, or we'll all suffer without it, we said it is possible because we have technology, we have money that is available, but we need the political leadership. So this is a very successful example of convening power because Japan over the years has accumulated a lot of good will from developing countries through ODA and other support. Now I think that Japan has a moral and political responsibility to convene new political wisdom and to give appropriate priority to necessary problems. As I keep saying, it is not a science and technology problem any more. Of course, science and technology can play a role. In Singapore, one of my colleagues is inventing a toilet such as we use in aircraft for office buildings because the toilets in aircraft use very little water and can be very efficient because in six to eight hours of flight 200 people can use the toilet. We can create a toilet that uses very little water, but how do we bring it to buildings? Similarly, the Japanese washlet type of toilet doesn't require the use of paper if you use it properly. Many Islamic and other cultures would love it. Can you make it for ten dollars and make it available to every household? These are new types of innovations where Japan can provide the leadership to make to it replicated. So these are concrete examples of what is possible. I could go on with a long list if you want, but I will stop here.

Audience 3

Each one of you has an area of expertise in science and technology, and I believe that you all believe in the strength of science and technology in contributing to society. I believe that is why we have this heated discussion here. I am also a student in the engineering field. I believe that the general public is quite separated from science and technology, especially here in Japan. For example, right now we see this budget compilation toward the next fiscal year, as the Minister said at the outset, and I believe that the media has focused on a second Hayabusa for planetary exploration. Mr. Sunami, I believe that you are an advisor in the space development field. The first Hayabusa was launched in 2003 to look at other small planets, and came back in 2010. In this area, Japan is trying to become a leader once again. There is a rumor that 7 billion yen will be taken from the budget of the second Hayabusa project and sent for reconstruction in

the Tohoku area. Of course, the scholars involved in the second Hayabusa project want money for its development, but people look at them like they are mad scientists who are not really concerned about the disaster and reconstruction. I am involved in space research and know that these scholars are not greedy or have only one-track minds. However, my opinion is not really accepted by many. Also, in the budget screening effort, one person in charge of the screening asked what's wrong with being number two in the super computer race. When Nobel laureates got together and criticized what that person said, the public's response suggested that these scholars were looking only at science and technology. So I see this discrepancy between the general public and the science and technology community. We see fewer students in the engineering area, and even if they do study they find themselves in jobs that are far away from science and technology. They say that they don't want to stay in this very closed world of academia. Maybe this is the case only in Japan, but I would like to ask what you think. Do you really think that science and technology is and will continue to support society in the future?

Dong-Pil Min

First of all, let me assure you that this is not just a typical problem for Japan; this is a problem everywhere. We must think about what the future must be, because technology is advancing very rapidly, and we need to arrive at a global idea of how technology should proceed. Let me just mention the comments of one scientist on the 21st Century. A very well known physicist, Dr. Michio Kaku, wrote a book entitled "The Future of Physics". He wrote that the 21st Century should be a kind of magnetic century, the age of the super conductor. Well, I don't want to go into detail, but what is interesting in his argument is that at present nobody pays too much attention to that, but there is some small group of scientists who are trying to solve these problems. We also have another example of such development, the MRI or laser or so on. It was such a simple subject of scientific research if you go back thirty or forty years, and it was just one corner of laboratories' job. But this sways the entire world nowadays. So we need the wisdom to separate long time frame subjects from immediate problems. So I think that policy makers must keep in mind the subject of what should be a proper scientific policy or whether they should tackle long-range programs or immediate and short-range programs. I think that if we educate the public on the importance of scientific research, we could collaborate in this respect to preserve our future. I think that we have enough wisdom on this issue, so I am quite optimistic.

Nobuko Kayashima from JICA (audience)

I am Kayashima of the Human Resource Development Division of JICA. I work in the division in charge of SEED-Net, which Dr. Krisada talked about. I am directly involved in the cooperation activities in developing nations, and in my day-to-day operations, there are issues that I always encounter. I would like to ask the opinions of the panel members about matters. The SEED-Net project is very important in establishing networking between Japan and ASEAN countries, making a contribution to the development of higher education in ASEAN countries, and in helping Japanese universities to become more globalized. It's one of the flagship projects of JICA. 200 Japanese professors and 400 professors in ASEAN nations are involved in the SEED-Net project. However, in my day-to-day operations, I see that it is not easy to send Japanese professors to ASEAN nations, and sometime very difficult depending on the field. SEED-Net is an engineering network. In the material science and environmental engineering fields, there are relatively many topics to study in developing nations, and it's easy to send Japanese professors. But in the electricity and electronics fields, it is quite difficult to conduct even joint research with developing nations or to send Japanese professors to developing nations. I regularly talk to these professors, and I realize that in the area of science and technology, most of them want to create something new with more advanced or, at least, on the

same level. It is very important to create regional collaboration. However, can we really develop bi-directional relationships when there is so much diversity among ASEAN nations ranging from Singapore to Myanmar?

Dr. Jantan said earlier that in Malaysia, professors go to Singapore, but people come from Indonesia. I think that what I just said about science and technology is not only a Japanese problem, but it must be a universal situation, which means that people are only moving upward, and it may be hard to develop bi-directional relationships. Dr. Arimoto mentioned earlier that science and technology should not remain academic only, but rather move to society to create values. Maybe what I thought is related to his comments. That is what I was thinking as I listened to the presentations. Now, in fact, regional collaboration in science and technology should be based on human networks of all researchers and professors in the region. I would like to know how we can create bi-directional networks and mobility while there is so much diversity in the region.

Krisada Visavateeranon

Not only in Japan, but also in ASEAN countries the levels of science and technology are quite different. Singapore represents a very top class. But we don't just dispatch professors to other countries; we also have cooperation in setting up curricula. For example, Chulalongkorn University helps to set up laboratories in Laos in materials engineering fields. Laos also sends many staff to Chulalongkorn University to learn. Vietnam sends a lot of staff to Indonesia to learn about geology, and the same is true of Myanmar. Not high technology, but they would like to cooperate in the technology that they need at the level available. Most of the research is on common issues, such as earthquakes. Many countries in that region have the same problems. We can share this kind of sense. I hope that if we select the topic, then the cooperation will go on, and another country will get more knowledge, and science and technology will help other countries in many areas.

Seetharam Kallidaikurichi E

I am actually not so worried about the future, but I can suggest three incentives based on my experience over the past few years at the University of Singapore. The first issue is that, yes, professors are reluctant to go and teach in another country, and work with the students. Since the SARS episode, every year in Singapore we have one week of class that is totally virtual because they wanted to create a system by which students can learn without going to school. Students can take their classes from home and professors can teach from home all through video Internet teaching. Now already many American universities provide their classes and lectures online. I think that with technological development, Japan, South Korea, Singapore, and so on, this may be one way to proceed. This is just basic knowledge, everybody knows it, but, of course, the way of teaching can be done. So I believe that will reduce the demand for the professor to be on site to teach. That time can be made very, very minimal, and they really teach from where they are. It's a virtual class, and technology supports that. The second suggestion concerns the need to offer real incentive for professors so that having a foreign student is also to help professor himself. If a professor wants to have Asian field data, he wants to have access to real world experience. The best and most efficient way is, of course, for him to go himself, but that is very time consuming. Rather, he can use the student as an agent to collect data, and that is very good because he knows the local language and all that. Even some of the professors in Singapore who are Chinese originally, but if he wants to study about a certain province in China, he cannot speak the local dialect, so he really relies on a native Chinese student from that place to learn, and it may be the same for Indonesia, India, and so on. We have been doing such research looking at various Asian cities, and you need the locals to learn to do that. The third

suggestion, which is where I think the discussion today is taking us, concerns the fact that we have to look for real problems, as Dr. Vijay Babu explained. It is not just about providing environmentally efficient ATM booths, but look somewhere where the technology is so restraining and you want to innovate something. Here, an international program is, in my view, the only way to look at these problems because they cannot be simulated in a laboratory so well; you really have to be in the field. And industry may really support this. I see that there is a lot of frontier innovation such as Dr. Arimoto mentioned, where if there is a big disaster, how do you provide all the services? If you look at developing countries, they are having a disaster everyday, actually; it's just that they are surviving without good solutions. So there is a lot of science and technology innovation possible. I will just give a small example and stop there. For example, the Samsung LD Company produces a lot of electrical gadgets for India after looking at the problems in India, poor electricity, for example, and they have innovated these gadgets in a new way. So I think that these kinds of innovations will come as a new science and technology frontier. So these three incentives are ones that we can give to the academics. So I feel that Japanese academics must be really interested if they look at it in this way.

Tateo Arimoto

I am so stimulated because so many interesting comments and suggestions have been presented during this panel discussion by the many panelists including Dr. Seetharam, Dr. Min, and others. As a student from the University of Tokyo commented, there are many controversial public opinions on science and technology; but if you are a scientist, you should put up with them. What is important is to network with other people. If you are alone, you will get exhausted. So there are good opportunities in gatherings such as this where you can network with people, and get to know more people. I ask the audience members that once you go back to your offices, please talk about your experience today with your colleagues. There will be same kind of symposia next year and the year after, so please try to create networking. We would like this network in Asia to spread, and I would also like the network in Japan to spread. Let's move together in a sustainable way. One suggestion for JICA: Why not create a JICA Ogata Award? It could be a strong incentive for Japanese professors.

CLOSING REMARKS

Mitsuo Akagi

Thank you very much. There are three points I would like to make. First, we talked about issue-driven research and development. After I heard this, I remembered what Dr. Takeda, who started the Foundation, used to talk about when he was President of his company, and also when he started the foundation. It's about the market. Industries develop many different products, but the decision about whether or not to use these products is in the hands of the user. If you go against the market, it means you are going against god. In other words, even if you think that you have developed something good, sometimes users do not accept it. In that case, you should stand by the user side, and try again from the viewpoint of the user. He used to say that.

Yesterday and today, we have had hot discussions, and I was very impressed that we were able to have very frank discussions without any antagonism. I was a little bit concerned that our discussions might produce some antagonism, but, instead, all participants were able to share their opinions in a very frank and open manner. I am grateful for their sincere efforts to make the dialogue worthwhile. This is not going to be the end. We should establish a human network, and utilize it to promote regional collaboration in science and technology in Asia.

What we should do to move further is a very complicated issue. If you think about it too hard and too seriously, you may get tired. My suggestion is that we go back and forth between a conceptual level and specific issues. While everyone agrees with concepts, that does not necessarily produce any keys to the next step. We can also think about some specific issues related to the concepts. We can go back and forth between concepts and specific issues, and we may come up with some solutions to connect the basic concepts and specific issues, which will create the next step.

At the next policy dialogue, I hope to see more participants and more audience. Thank you very much for participating in the International Policy Dialogue in Science and Technology in Asia.

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