Session 4: Creating Innovation Based on Science and Technology

Chairperson: Prof. Itaru Yasui

Prof. Itaru Yasui: Among the main points to be addressed through our discussion today are the roles of basic science and researchers, the roles of technology and researchers, the roles of supporting systems including funding systems and institutions, the roles of "Ba," and the output of innovation.

Prof. Kazuhito Hashimoto: In Japan, in spite of the Science and Technology Basic Plan with its four priority fields, it is very important to recognize that efficiency-leading innovation remains low. Consequently, the question at hand is how can we fund good research and how can this research be nourished.

The first important issue to take up is how research money should be invested. In light of the low efficiency of basic research, funding at the initial stage should not be concentrated in particular research fields or specific researchers. Instead, funding should be distributed widely under a step-by-step selection and concentration of research groups, and it should be increased incrementally.

Next is the modality of turning good research results and findings into innovation. Doing so should not follow a linear model of basic research to applied research to industrialization. The process should be a multi-step cycle in which the application field target changes every time new ideas are created.

Academia can provide a good platform for the R&D community in interaction fields and can serve as a hub of information exchange and knowledge creation. Collaboration neither serves to facilitate the transfer of intellectual property nor accomplished technology; rather, it achieves the transfer of research capability. Universities can be a platform for the R&D community.

Mr. Lennart Stenberg: Innovation is taking place within the context of global networks and research institutions. The Swedish Governmental Agency for Innovation Systems (VINNOVA) is responsible for strengthening research under cooperation between academia, companies, and the public sector in the Swedish innovation system.

Swedish companies today are more than ever looking for the most competitive business climates globally. As such, it is imperative that Sweden attract foreign firms with the capital and knowledge bases to advance innovation. We also need to step outside our too-constricted domestic mindset and interact with the best and brightest companies to succeed.

University-industry joint research is to a large extent related to incremental innovation. While we naturally need to use universities as a source of new ideas and technologies, this input does not necessarily fit into the innovation strategies of R&D-intensive firms. To take the value creation process one step forward in Sweden, one idea is for universities to spin-off firms as an effective way of generating growth. Yet, to grow into an economically viable entity, these new spin offs will probably have to tie up with larger firms which likely will not be in Sweden.

This thus produces the risk that the innovation created will be applied outside Sweden. The extent to which spin-offs have important relations with universities and other companies inside Sweden will determine the value of our innovation.

Overall, government policies have to acknowledge that both companies and universities increasingly engage in innovation processes as partners in global innovation networks, the research infrastructure

for existing domestic industry has to be internationally competitive, research policy must also aim at creating seeds for radical innovation, and the creation of university spin-offs may be an important early step in securing economic value out of university research.

Mr. Motoaki Saito: There are many reasons to promote innovation in the medial field. Apart from the obvious benefit to human health, medical advances should lead to lower healthcare expenditures by all levels of government.

Technology innovation is the most important and efficient means to achieve advancements in the medical industry. TeraRecon Inc. was established in 1997, inspired by the latest modality technology in inventing innovation. TeraRecon has all necessary development capability in house. Its strategy is not to focus on one specific layer or field but to provide fully integrated solutions to eliminate any inefficiencies.

To advance technology in the medial field, R&D must be considered one part of the medical process. Japan newly certifies more than 6,000 doctors each year. An individual doctor can uniquely and specially help thousands of patients over the course of his or her career. Yet, new technologies developed through innovation can have a much larger contribution, having the potential to help millions of patients every single year.

Dr. Gerald J. Hane: Partnering in open innovation for venture companies is important. Because it takes a long time for drugs to be developed, drug development is a high-risk endeavor and the development process is very expensive. The difficultly of this process has led to a pharmaceutical innovation gap, meaning that as development costs increase, the number of new drugs coming onto the market falls. In response, pharmaceutical companies are now entering into more collaborative partnerships.

M&As are an essential tool for a vital venture sector and they should hence be celebrated. In Japan, there is increased M&A activity, but a lot of this is due to restructuring. There is some activity in bio-M&As, but that tends to be venture-to-venture activity. Attracting international M&A activity into the Japan's venture sectors would ignite this important ecological stimulus for venture innovation.

In Japan, securities houses, banks, insurance companies and corporations tend to invest directly in new ventures but often only for strategic purposes. Pensions in Japan have been slow to invest in ventures. Hence, the one untapped source of financing for Japanese ventures has been the international community but securing funding is a difficult endeavor.

Going forward, some key issues regarding venture innovation in the "Ba" are a weakness in partnership opportunities with larger biotechnology and pharmaceutical partners, the absence of M&A strategies and activity, and restricted flows to "learned financing." Overall, the internationalization of the venture sector would be a valuable development for energizing venture "Ba."

Mr. Kenji Takeda: It is believed that the life sciences are the most promising sources of innovation in the 21st century. By acting as a stimulus for change, innovation is likely to have a broad influence and lead to the creation of new industries.

An ecosystem conducive to innovation is one in which people from different sectors cooperate, collaborate and compete both within and outside their own sectors.

Small science should be mission-driven, whereas big science requires sophisticated research facilities. RIKEN has contributed to research. Our next challenge is to create an effective baton zone for the

life sciences. At issue is to ensure a seamless transfer of basic knowledge required through big science to clinical research so as to create new drugs.

The mobility of people is as important as clusters for innovation. Support structures are needed to help the fluidity of human resources in the cluster. To ensure success, local and national governments need to play a role. Universities also need to provide "Ba" such as forums that encourage information exchange and personal networking.

A global innovation ecosystem requires international cooperation and partnerships. It is necessary to advance the sharing of new knowledge as well as the exchange of materials and information. A pro-patent approach must advance to pro-innovation.

Prof. Lei Jiang: By understanding the unit property, the application of a technology can be straightforward. For example, the mosquito has a "lotus eye," which has nano structures on its surface. If you spray water on its eyes, no water drop will be left since the mosquito lives by ponds and naturally has the ability to keep water away. A water spider that can walk on water has a coating on its legs that prevents it from sinking. After understanding this, we can have an idea of how to reproduce this technique artificially. The Chinese Academy of Science has adopted plasma aging techniques to recreate the surface, creating a super "amphiphobic" surface. From this basis, we have created products like a self-cleaning necktie.

Prof. Itaru Yasui: Based on the invited speakers' presentations, it is possible to make some preliminary summations. From Prof. Hashimoto and Prof. Jiang's presentations, it can be said that partnerships between universities and industry are important in creating a field to nurture R&D talents and promote innovation. As well, there is a need for funding and the creation of open research communities, as well as a need to nurture talented persons. Prof. Jiang noted that science-based innovations can take many forms. For Dr. Hane, the interaction field should be strengthened with useful functions to foster successful innovation in view of the long, expensive process and low success rate of drug development. It is necessary to foster partnerships, venture capital and M&As, promote the flow of capital, and internationalize "Ba." For Dr. Stenberg, agencies like VINNVOA are successfully creating "Ba" to be competitive while universities have a role to play such as tie-ups with partners from an early stage. On the outcome side, Dr. Takeda talked about collaboration among various stakeholders as being essential for innovation in life sciences. Dr. Saito also noted that innovations can take advantage of relative advances in multidisciplinary product development, but this is not always the case. Combing engineering knowledge in medical product development is one example of a successful multidiscipline approach to innovation.

Floor: In my experience, the activities of academic societies have been very beneficial to me. I have found workshops on liquid crystals and SIT to be extremely useful, allowing members of different disciplines to get together and have good discussions.

Prof. Kazuhito Hashimoto: The activities of academic societies have been quite important for liquid crystal. Yet, such activities do not always guarantee success. One problem is that there are too many academic societies in Japan. Attending just one academic society is not sufficient to receive enough information and academic societies have now become training grounds for students to give presentations.

Mr. Lennart Stenberg: My impression is that academic societies are important in Japan, but in the case of Sweden, we are too small a country to have effective academic societies. On the other hand, this situation has required Swedish engineers to act more on the global level.

Floor: I was impressed by the speed with which the company in Prof. Jiang's presentation brought the product to market. Was there any magic in getting the prototype to market quickly? In addition, what is an ideal ratio for big science and small science? And what is the lead time for big science innovation and small science innovation for coming onto the market?

Prof. Lei Jiang: From my experience, as a research scientist, you must set up two teams to transfer technology to the market. One is a team to do basic research, while the other team consists of engineers who seek innovations that can be transferred simply and at a low cost to the market.

Mr. Kenji Takeda: Concerning the ratio of funding for small science and big science, at RIKEN we have been creating a lot of big science. RIKEN has almost 300 principal investigators, among whom 50 are conducting small science research independently. The other 250 investigators are dedicated to big science. Concerning the lead time question, innovation lead time from the technological seed to a real product cannot be said in a general way. For drug discovery, it is at least 15 years.

Floor: It was said that as the efficiency of basic research is low, funding should be spread widely. Yet, with limited resources, it may not be good to spread funding in this way.

Prof. Kazuhito Hashimoto: Too much concentration of funding is harmful. In the basic sciences, we need to spread our funding widely to avoid investment in areas without good prospects.

Floor: In the "Ba," funding is very important. Hence, what is the Japanese situation in the funding system for commercialization?

Dr. Gerald J. Hane: There is a lot of money available for venture capital in Japan, but it has not always been invested wisely. Companies often invest for strategic reasons in order to help themselves rather than invest based on the possible future success of a venture.

Prof. Kazuhito Hashimoto: Curiosity-driven research is very important in the scientific community, but it is not always done to advance innovation. Curiosity-driven research does not necessarily equate to good research.

Floor: From your experiences, is there a "Ba" in Silicon Valley? What about weaknesses? Do you have any experiences of weakness in Silicon Valley?

Mr. Kenji Takeda: I have experience in doing business in Silicon Valley. It is one of the strongest areas of "Ba." I think one of the reasons we are having a hard time making a great "Ba" in Japan relates to the employment system, particularly the limited mobility of people. With lifetime employment, people are secure and do not need to change jobs. Yet, if they faced the possibility of being laid off, then people would become more interested in the world around them and begin to question whether there are better opportunities.

Prof. Itaru Yasui: We discussed innovation, but our discussion has been limited to the national innovation ecosystem. We need to discuss a more distinguished way of what is international and national and what is advanced and developing. My tentative conclusion is that a two-dimensional discussion is not enough and it must be looked at in a three-dimensional multilayer schematic for the global level: consisting of advanced countries, countries in transition, and developing or least developed countries. To really have a global innovation ecosystem, it is necessary to move our knowledge not just vertically but also horizontally. In addition, there are probably other kinds of knowledge, such as traditional or indigenous, and it should be identified.