INDUSTRY-ACADEMIA- GOVERNMENT COOPERATION AND REGIONAL INNOVATION

Steven W. Collins
University of Washington, Bothell

Introduction

For developed countries like Japan, sustainable economic growth depends on the growth in productivity that comes from technological innovation. For most of the postwar era, sources of innovation were in abundant supply ranging from production workers and suppliers to academic, corporate, and public research laboratories inside and outside Japan. Firms typically competed on the basis of their ability to source technology from outside the company, improve it, and incorporate it into new products and processes that delivered immediate value to the economy. The economic environment today is very different. Competitive advantage now turns less on the capacity to in-license and adapt existing knowledge than on the ability to generate new knowledge and translate it, faster than competitors, into goods and services that people around the world want to buy. While corporate R&D laboratories will continue to be important in many sectors, universities are emerging as primary sources of the basic scientific know-how that is driving technological change. Promotion of basic academic research in growth industries, such as biotechnology, nanotechnology, and information technology, has thus become an imperative of public policy. Even more important, however, are the institutional channels linking universities to the firms and entrepreneurs most likely to translate basic research into new economic value. Hence a second imperative: to build and deepen institutional channels between universities, public research institutes and private firms.

Japan's Second 5-Year Basic Plan for Science and Technology not only acknowledges the importance of industry-academia-government cooperation in sustaining future innovation, it provides a general framework for developing new policy initiatives. Other presenters have given details on the changing role of universities and their role in regional economic development. This presentation is

reflective, commenting on various aspects of the emerging policy framework supporting industry-academia-government collaboration and the development of regional innovation systems.

Industry-Academia-Government Cooperation

The reform of the system of industry-academia-government collaboration has been a major objective of science and technology policy in recent years. As Mr. Naoki Saito's presentation has made clear, these reforms have centered on enhancing the effectiveness of industry-university research cooperation, facilitating the management of intellectual property at universities, promoting technology transfer to industry, and supporting the creation of start-up companies based on university research. By nearly all standard measures, these initiatives have borne fruit: a four-fold increase in the number of industry-university cooperative projects between 1995 and 2002; a more than two-fold increase in numbers of commissioned research projects over the same period; and a more than eight-fold increase in the numbers of university-initiated start-up companies. Technology transfer has also taken off: between 1999 and 2003, the number of domestic patent applications from technology licensing organizations (TLOs) shot up from 280 to 1,679, while royalty income paid to TLOs rose from 20 million to more than 554 million yen. Finally, university start-ups such as OncoTherapy Science, Anges MG, and Cell-Free Sciences provide long-awaited proof that Japan's universities can spin out dynamic, innovative new ventures now that regulations inhibiting faculty involvement with start-up companies have been eased.

Although the new policy framework has clearly opened channels of knowledge transfer from university to industry, there are several concerns that need to be addressed. In particular, the present system evolved to serve universities still under the authority of the Ministry of Education. On April 1, 2004, Japan's national universities became special corporations, with substantial management autonomy and the independent authority to manage intellectual property. For decades, faculty at national universities have managed their own intellectual property, applying for patents as individual inventors and transferring ownership to corporate sponsors at their own discretion. I have argued elsewhere that such inventive activity by

individual faculty and related research collaboration with industry constituted an important, if difficult to measure, form of technology transfer; it certainly belies the commonly held notion that universities were detached from the broader innovation system. Those of us who thought that system had its advantages naturally wonder whether its demise will be outweighed by the reversion of ownership of intellectual property to the university. Moreover, the role of the TLO is unclear now that universities have the authority to manage their own intellectual property. In cases where multiple entities handle intellectual property, where will the ultimate authority reside?

Japan will also have to secure technology licensing and industrial liaison professionals with the appropriate skills to evaluate reported inventions and determine how they will be used. Ideally, these should be experienced but relatively young professionals with requisite technical skills and a network of relationships with the private sector; knowledge of local sources of seed capital is also important. Anecdotal evidence suggests to me that many licensing professionals are retired technical staff of major corporations. Although the wisdom and personal connections of older professionals are undoubtedly important, even more important are intimate knowledge of the needs of potential clients and the ability to market the portfolio of the university's inventions.

Another issue that will take time to resolve is management of conflict of interest. Who will have ultimate responsibility for oversight? What in fact constitutes conflict of interest, and who will decide? Full disclosure of financial relationships and transparency of oversight are essential to preserve the integrity of the university and maintain faculty morale.

Finally, there is an emerging debate in the US concerning the appropriateness of patenting and licensing as indicators of the effectiveness of technology transfer. Are policy makers relying too strongly on indicators of technology transfer that can be readily counted? The main economic (and cultural, social, etc.) contribution of the university comes from educating the next generation of business, civic, and educational leaders. This raises important questions about assessment of the contribution of universities to economic development. Assessment measures should

consider contributions that may not be patentable, such as educational tools, copyright content, biological materials, software, and research tools. At the University of Washington, where I teach, the university last year executed 553 material transfer agreements and 104 technology management agreements that facilitate technology transfer but are not specifically a grant of a commercial right and thus do not generate income. Lastly, the number of university-initiated start-ups should be supplemented by data on their economic significance. To what extent do they contribute to expansion of employment? Value-added? Change in market capitalization over time? What is their impact on the local economy?

Policies Supporting Regional Innovation

Complementing the policies supporting industry-university relations is a new framework for harnessing technological innovation as a means of revitalizing regional economies. As Mr. Saito pointed out, every local government has established an office, conference, advisory council, general principles, or a combination dedicated to supporting regional economic development based on technological innovation. Nearly every ministry administers policies targeting regional economic infrastructure and small and medium-sized businesses under their respective jurisdictions. Emphasis now is shifting toward the development of metrics for assessing and comparing the capabilities and performance of regional innovation systems, as well as facilitating linkages between related programs sponsored by various ministries and regional bodies.

Perhaps the most promising and innovative policies are the intellectual and industrial cluster projects administered by the Ministry of Education and METI, respectively. By spring of 2004, 18 regions had been designated as intellectual clusters, while 19 projects had been approved under the industrial cluster plan. To the outside observer, perhaps the most striking characteristics of these initiatives are the sheer number and variety of clusters—36 in biotechnology alone, according to one count, the relatively modest amounts of public funding being committed, the wide range of collaborative models being deployed, and the large number of small and

medium-sized companies that are participating—roughly 5,000 firms in the various industrial cluster projects.

Assessment of regional polices is especially challenging because most of these programs are still relatively young, and it is difficult to surmise what might have happened in their absence. The best results appear to be in regions already well endowed with an infrastructure supporting research and innovation, including Hamamatsu, Kobe, Kyoto, and the Tama region in the Kanto area. Hamamatsu in particular has the unusual distinction of being home base to several of Japan's most dynamic manufacturers, including Honda, Suzuki, Yamaha, and Hamamatsu Photonics. Few regions in the world equal Hamamatsu's capabilities in optoelectronics and research fusing photo-optical imaging and medical equipment technology. In all the cases with which I am familiar, the policy instruments are varied, relying—wisely in my view—less on direct subsidies and more on facilitating partnerships and building networks. Having interviewed coordinators of one of the industrial cluster projects centered in Hokuriku, I was amazed by the numbers of companies the interviewees had visited and their commitment to building trust within a fairly widely dispersed network of companies and regional bodies. Dr. Kuhlmann, one of the presenters at this workshop, underscored the importance of understanding the nature of the regional innovation system in the proper design of public policy. Although it is too early to judge whether METI and the Ministry of Education have made the right bets in all their cluster designations, the cluster projects are as well grounded analytically as any regional policies I have studied.

Certainly one of the most promising intellectual cluster projects to date is the Kobe Medical Industry Development Project. The aim is to create an integrated innovation platform capable of commercializing products based on the fusion of basic research in regenerative medicine and applied research in advanced biomedical imaging and medical devices. One of the novel features is an institute dedicated to translational research, which bridges clinical research with commercial application; another is an institute that serves as a staging point for clinical development of regenerative medical technologies and associated advanced imaging systems. Kobe's innovation system is well endowed with the human, physical, and institutional resources to support a biomedical cluster, including excellent universities, Riken's

world-class Center for Developmental Biology, and close proximity to Japan's major drug manufacturers. But what most clearly distinguishes the Kobe cluster is the energy and vision of the man who conceived it and championed it, Dr. Hiroo Imura, and the profound sense of crisis wrought by the 1995 Great Hanshin Earthquake.

Although I am optimistic about the prospects for regional policy, I do have some concerns. First is the need to maintain simplicity and transparency. The framework for regional policy in Japan is enormously complicated. A one-stop clearing house of information on regional policy would probably be welcomed by local officials. Also needed are sunset provisions. How will programs be phased out? Will clusters be able to thrive once public support has ended? And although it is rational to support regions already well endowed with resources, consideration should also be given to regions most in need. Will regional policies reinforce the tendency for economic activity to concentrate further in Kansai and Tokyo? Regional policies, moreover, should strengthen the autonomy of regional governments. Research I conducted in one prefecture last year gave me the impression that regional policy is top-down: national policies drive regional policies; there appeared to be little upward influence of SMEs on policies made at the local level. Market distortions should be minimized: Care should be taken to ensure that regional policies do not displace the market mechanism in influencing firms' investment decisions. Monitoring and assessment tools are needed, and I applaud NISTEP's work in developing them. Policies should seek to maximize synergies between existing organizations, leveraging the resources of local TLOs, university IP centers, *kosetsushi*, venture businesses, SMEs, large firms, and cooperative research centers; merge or eliminate organizations whose work can best be done elsewhere. Finally, every effort should be made to apply regional S&T policy to the revitalization of existing small and medium sized companies. These are still the backbone of Japan's economy, and likely will remain so for many years to come.

Conclusion

The contribution of academic research to innovative activity in Japan is increasing markedly, at least as measured by indicators of patenting, licensing, and new venture business startups. Many other important economic and social

contributions of the university, however, are not captured in the statistics most commonly cited as indicators of the university's performance. By far the most important contribution of the university is the creation of the next generation of human capital, and on this Japan has serious cause for concern. The amount of time elementary and middle school students spend studying the physical sciences has fallen steadily over the past few decades, and the mathematical competence of Japanese college students has fallen to levels well below that of students in other Asian countries. The decline of interest and competency in science and math could have serious impacts on the future of Japan's innovation system. On the upside, Japan's university science faculty have risen to the task of taking advantage of the opportunities made available to them through the easing of regulations and provision of supports for technology transfer. Growing numbers of entrepreneur-scientists in Japan will inspire others with an entrepreneurial bent to try their hand at starting a business. Japan may very well be on the cusp of a major change in the business climate that will see rising numbers of entrepreneurs, many of whom will build companies around the intellectual property now making its way out of the nation's universities.

In regional policy, many success factors are already in place. Universities are reaching out, engaging local industry with a commitment to contribute to regional economic development. This should be encouraged even more. Equally important is networking among managers, workers, trade associations, university researchers and venture capitalists. Local governments can play an important role in providing neutral space in which individuals from industry, universities, and government can meet to create a common vision for the region. Direct government subsidies should be limited and where possible used as a lever to secure other sources of external support. Finally, the availability of risk capital is crucial; but even more so is the capacity to assess risk, judge the viability of new firms, and evaluate their intellectual property portfolios.

In both these policy domains, Japan has made great strides under the Second 5-Year Plan. Although significant challenges remain, Japan's innovation system seems well positioned to capitalize on new technological innovations in this new century.