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Trends in Canadian Science and Technology Policy

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7.1 Introduction

High-tech executives of Silicon Valley in the US have recently been discussing in earnest the removal of production bases and R&D bases because of deterioration of earnings structures due to the US economic slump, the problem of rising labor costs because of protracted prosperity, as well as the electrical power crisis in California and rising power costs, etc., and as a new location, Canada is being mentioned as a strong contender. Investment capital for the fourth quarter in fiscal 2000 was actually down 30% in the US, but increased 50% in Canada for the same period, and we can conclude that US investment is flowing to Canada.

Canada not only attracts research bases of overseas companies through its preferential tax system measures, it is also showing extremely positive moves in terms of policy, such as the building of alliances between education and industry that serve as hubs, in the same way that Stanford University formed the hub of minds of Silicon Valley in the US, and IPO (initial public offerings) incentives and so on that are very appealing to entrepreneurs.

In Japan, some aspects of Canadian trends are hidden in the US's shadow and are hard to recognize, but in the field of computer software and communications, there exists many of the world's top technical sectors that surpass Japan and the US, including the University of Waterloo, which sends the greatest number of talented people to US giant Microsoft, and Nortel Networks Corporation, which has led the field of frontier optical fiber communications in the past few years.

Aspects of this kind of industrial policy have also been taken up and attracted attention in JETRO (Japan External Trade Organization) reports recently, and this paper will focus on aspects of science and technology policy and analyze Canada's special features.

Canada's population is only one-quarter of Japan's (Canada: about 31 million people, Japan: about 127 million people), and the number of Nobel Prize recipients in natural science fields is the same as Japan (total of six, Canada: two people have won the prize for physics, three for chemistry and one for physiology and medicine; Japan: three for physics, two for chemistry and one for physiology and medicine). Canada is also strong not only in the information and communications field, but also in basic sciences such as physics, chemistry, medicine and physiology, etc.

In the past, the outflow of R&D human talent (brain drain) and technology outflow from Canada to the US and Europe was a major problem, but the country has overcome this and is succeeding in increasing research activity by conversely calling people back and actively encouraging the flow and mixing of human talent.

It is also worth noting that Canada has been the first to implement policies that are also being adopted in Japan, such as a matching fund system for R&D and construction of industrial clusters, and in addition to the construction of that kind of research infrastructure, the major distinction of new knowledge creation in Canada is its recognition that the flow and mixing of human talent with different cultures is very important.

7.2 Cooperation between industry and University, and bringing in foreign investment

Though not very familiar to the average Japanese person, about one hour from Toronto in the direction of Detroit in the US is the town of Waterloo. While being famous as a source of maple syrup, Waterloo is also very famous for University of Waterloo, one of the top-ranking universities in North America including USA in computer science research. Though close to Toronto with its population of four million people, it is also a place of great natural beauty, next to St. Jacobs district, self-sufficient in agriculture and where a life of street lamps and horse-drawn carriages still remains. As was mentioned at the beginning, it is also known for sending the highest number of graduates to Microsoft in the US.

The CTT (Canada Technology Triangle) ICT (information and communications technology) cluster, straddling the three cities Waterloo, Kitchner and Cambridge, is formed with this University of Waterloo as the hub. In relation to IT, three places including this CTT and the Ottawa area, where there is a concentration of research bodies of domestic and foreign communication device makers including Nortel Networks Corporation, Nokia and Alcatel, and Montreal, where there are IT companies related to multimedia, such as 3D image software used for motion picture special effects, are known as the Canadian East Cluster. (In the Canadian West, a cluster is formed by Vancouver, Calgary and Edmonton.)

We will now introduce the case of a start up company that has shown developments not seen in the US, at University of Waterloo, which among this forms the hub of the CTT.

Waterloo Scientific was established in the 1980s by C.J.L Moore, a professor at the University of Waterloo, et al, as a highly reputed instrument maker of compound semiconductors used for devices that are currently very much in the spotlight, such as lasers for communications, lasers for CD/MD/DVD and other disks, and high-frequency devices for satellite broadcasting and mobile telephones. The company aimed to develop and manufacture photo luminescence measurement systems and X-ray diffraction mesurement systems, requiring very advanced physical knowledge.

However, being an unknown Canadian start up company, the company had a hard fight business-wise, and in 1996 it received capital participation from Dutch company, Phillips (the company name also changed from Waterloo Scientific to Phillips Material Characterization Systems: PMCS). Phillips has a very strong R&D division for semiconductor measuring instruments in Holland, and in particular had also been boasting the top share in X-ray diffraction machines, and there were fears that the company would be taken over.

But PMCS, whose backbone was the Computer Science Department of the University of Waterloo, developed control software and data analysis software for X-ray diffraction machines making exhaustive use of advanced software technology and simulation technology, and surpassed the Dutch company. Through the unification of Holland's high-level precision technology about devices and Canada's advanced software technology, the Phillips Measuring Instruments Division became even stronger, and PMCS also succeeded in making best use of its own unique features without being swallowed by the Dutch company.

This is a case where even with capital participation by foreign investment, in terms of technology, unique technology based on cooperation between industry and university increased the power of that foreign investment, and consequently brought benefits in terms of technology and human expertise for the homeland.

7.3 New strategies in Canada's science and technology policies

In the previous section we talked about IT-related matters, but in the same way as Europe and the US, the next point of emphasis of R&D, while emphasis on the importance of IT continues, is shifting to the nanotechnology area and biotechnology/life science area.

In regard to nanotechnology, a plan was announced to commit 120 million Canadian dollars (about 9.4 billion yen 1C$= 78.4 yen) to the University of Alberta in the next five years to establish a world class National Institute of Nanotechnology (NIN). This research institute is being established because it is thought that nanotechnology holds the key to breakthroughs in a wide range of technological fields, from the health and medical care area, to energy and computer technology. This budget is comprised 50% of a federal appropriation through the National Research Council (NRC) and 50% from the Alberta state government budget. The number of personnel is expected to be around 200.

In the same way as IT-related R&D mentioned before, we can see that cluster construction-type policies are being adopted.

Meanwhile in regard to life science, virtual institute construction-type policies are being attempted, in contrast to IT and nanotechnology that have been mentioned so far.

Government research funding aid and coordination in the life science field is carried out principally by the Canadian Institutes of Health Research (CIHR) started in 2000, and the 2001-2002 base budget is 477 million Canadian dollars (about 37.4 billion yen).

Dr. Philip Hicks, affiliated with the NRC and currently also counselor in charge of science and technology at the Canadian Embassy in Japan, comments: "Research institutes under the CIHR umbrella will not be gathered in one place. Thirteen virtual institutes will be established, and these will provide cross-wide support and linkage of researchers at universities, hospitals and other research institutions. This virtual institute will have four mainstays of research including biomedical, clinical medicine and medical care systems and services; and research on social and cultural problems that effect the health of the population. This kind of research domain has wide-ranging related fields of research, and diverse knowledge becomes necessary in order to solve one problem. For that reason, a virtual institute, which encompasses various domains of learning and research bodies, serves as an effective method.

What is more, it is also an effective way to make up for Canada's vast geographical intervals. And since institutions and hospitals, etc. that actually carry out research will remain as they are, it has the advantage that technology transfer of results will proceed quickly and smoothly. This is an original approach by Canada that is unprecedented in the world."

Furthermore, in regard to advanced genome science, an experiment is being undertaken in the form of a non-profit corporation called Genome Canada, establishing five genome centers in Canada with 300 million Canadian dollars (about 23.5 billion yen) from the federal government. Through this Genome Canada, twenty-two large-scale projects are being supported, covering not only research on human genomes, but also a wide range of genome-related research such as agriculture, forestry and fisheries, the environment, legal issues and ethical issues. Involving two-thousand researchers and technicians across industry, education and government, it is planned to also provide training opportunities to seven-hundred or more students and post-doctoral candidates. Over 117 universities, hospitals, non-profit foundations and companies are expected to take part.

7.4 Securing talented research personnel in Canada

Up to the previous section we discussed features of science and technology policy in Canada (IT= cluster construction type, life science= virtual institute construction type); next, we will talk about securing talented research personnel in Canada.

For many years, the outflow of talented research personnel (brain drain) to neighboring USA has been a problem in Canada. For example, while the fact that at US company Microsoft, graduates from University of Waterloo are the most numerous confirms that the ability of Canadian students is highly regarded, it also shows the extent to which outstanding students are flowing out.

Since the difference between the US and Canadian dollars shows up in the same way in terms of income as well, it is unavoidable that those in pursuit of a high income will set their sights on the US.

Based on that kind of background, the Canadian government is implementing a few policies.

First, measures to improve treatment of researchers in order to prevent the outflow to other countries promote improvement of research facilities and improved treatment in terms of income. Most conspicuous among those measures is the founding of "research chairs" (2000). This will cost 900 million Canadian dollars (70 billion yen) over the next five years, and offers high level treatment as "research chairs" to researchers, who form the core of universities and affiliated researched bodies and hospitals. It will almost double the wage level of those core researchers (ensuring an annual salary of 20 million yen) and it is said that it will be able to secure world-class researchers for Canada. In addition to preventing the outflow of outstanding Canadian-born researchers, it also means that attracting top-level researchers from overseas will be possible.

But it was also said the outflow of talented research personnel was not necessarily negative in all aspects. According to Counselor Philip Hicks mentioned earlier, and Noriko Abe, Science and Technology Examiner at the Canadian Embassy in Japan, "The new knowledge creation in Canada has major elements based on assimilation of other cultures attendant to the outflow of skilled individuals. Some leave for the US and Europe and other come back. For instance, some go to Silicon Valley in the US and work very hard to the point of being workaholics, while others get tired of that lifestyle and return to Canada seeking repose and healing. Coming into contact with other cultures and directly coming into contact with researchers from other cultures in the midst of that kind of outflow most surely gives rise fresh ways of thinking of original theories that break through conventional common sense. Creation is surely stimulated."

7.5 Conclusion

In Japan, Canada's image lies between the US and Europe and some aspects are difficult to be known accurately, but among the G7 countries, Canada along with the US is a country with a government balance of payments surplus considered from a national account base (from 1997), and continues to have extremely high national strength. There is thought to be many points that should be referenced in regard to that success.

The angle of bringing in overseas technology and research results to the homeland in particular is a very interesting one. Canada recognizes that Foreign Direct Investment (FDI) is very important for technology-based economic growth, and not only giants such as Nokia and Alcatel in Ottawa and IBM in Calgary, but also venture companies are inviting much R&D investment from overseas. Government research as well stresses the importance of partnerships and alliances with overseas. And a foundation has been formed that makes the results of that research (the) assets of the homeland, and not just accomplishments of the investing country.

Japan is also bringing in R&D investment and outstanding researchers from overseas, and it is thought that the creation of a system will surely be sought whereby results stay in Japan and are beneficial in terms of the treatment of Japanese researchers and in training human talent.

Furthermore, it is thought that arguments like the one to stimulate knowledge creation will also serve as a reference for arguments to increase the number of Japanese Nobel Prize recipients.

(Original Japanese version: published in September 2001)