

Desirable Form of Academia-Industry Cooperation

By Hashimoto Masahiro

Structural reform of the economy and academia-industry cooperation

In April 1995, the Office for Promotion of Academia-Industry Cooperation was set up in the Ministry of International Trade and Industry's Industrial Policy Bureau. While this office has performed a variety of tasks during the two years since its inauguration, it has consistently been endeavoring to create a better environment for academia-industry cooperation.

The Japanese economy is at a major turning point. While the globalization of the world economy is progressing further from a medium-term viewpoint, an age of international mega-competition, in which companies choose their centers of operation, is arriving. There are fears from a medium-term perspective that industry and the employment

picture will hollow out further if this trend progresses. From a long-term perspective, aging of the population is progressing in Japan at a speed that has no parallel in the rest of the world, and there are fears that an excessive rise in the public burden will sap the economy's potential energy in the long run.

Japan must create new industries and ensure stable growth of vital industries in order to resolve these problems in its economy and establish tough economic foundations from a medium- or long-range point of view. Aware that structural reform of the Japanese economy is absolutely essential, the Cabinet in December 1996 announced "A Program for Economic Structural Reform." In addition to setting a target year of around 2001, the government mapped out an Action Plan, which the Cabinet finalized in May 1997.

The government has identified funds, human resources, technology, and high-

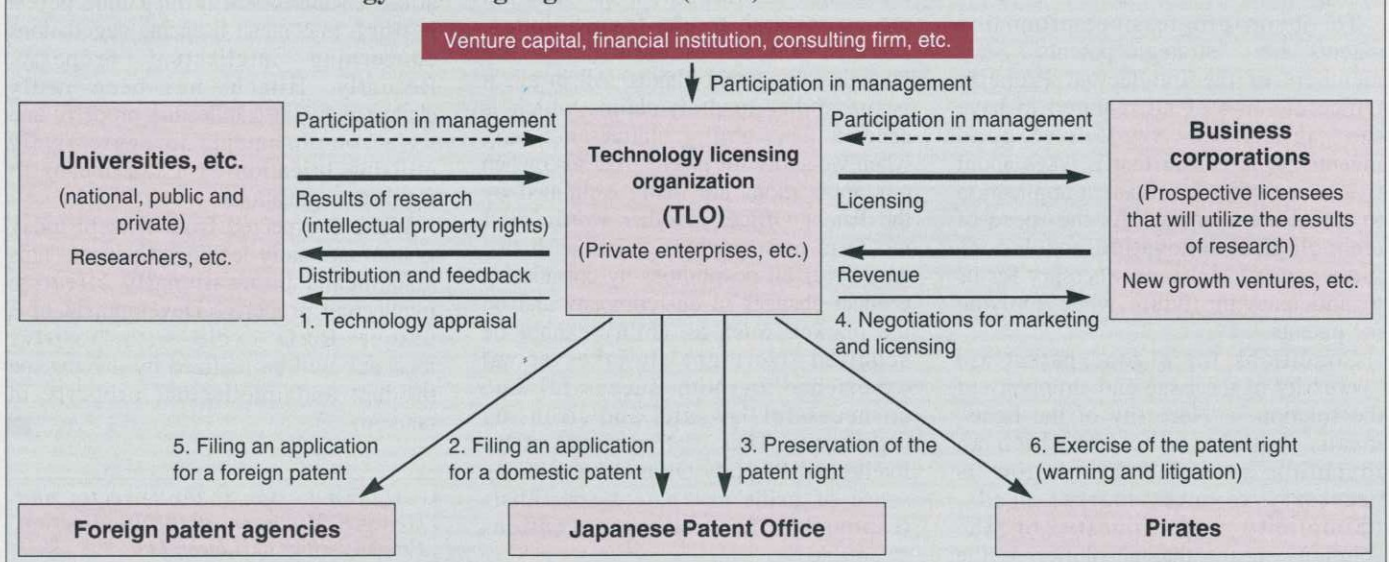
ly advanced information-telecommunications as the four areas that require sophistication for the Development of an environment favorable to new business activities, which is a cardinal part of the Action Plan. In the human resources and technology areas in particular, measures to promote academia-industry cooperation occupy an important position. In other words, the need to promote academia-industry cooperation has been emphasized as a means for carrying out structural reform of the economy.

Measures for promotion: tapping and bolstering academia's potential

Why, then, has academia-industry cooperation begun to attract attention in recent years?

Universities have two functions. One

Possible form of a technology licensing organization (TLO)



is research and development, and the other is fostering the growth of abilities. Great expectations are placed on the potential of universities, but Japanese universities are not making contributions to Japanese economic society that match their potential.

(1) Utilization and elevation of research and development function

Universities' great weight

The number of researchers in Japan is estimated at 670,000. Of these, 236,000 are university members. (About 37,700 belong to business corporations and about 47,000 to government research institutes or other public bodies.)

Spending on research in Japan is estimated at ¥14.4 trillion a year, of which about ¥3 trillion is spent by universities. The government's budget for science and technology is about ¥3 trillion a year, of which ¥1.3 trillion belongs to the Ministry of Education. Nearly 50% of the government's budget for science and technology goes to universities.

These figures mean that universities in Japan occupy an important position comparable to those of Western countries as far as the research and development budget is concerned. Therefore, Japanese universities perform a very important role in raising the level of research and development in Japan.

High level of academic research in Japan

Research in Japanese academia is of top international level. It may be said that Japanese universities are displaying considerable strength in their intellectual contributions in the academic research area. Their share of papers in major science magazines in the world is 8%. This figure, though much inferior to the 48% share of U.S. academia, compares with the British figure of 7% and the German figure of 9%.

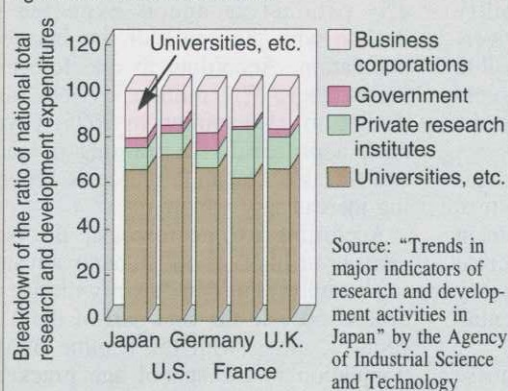
Intellectual contributions to economic society

When the functions of Japanese universities are compared with those of universities in Western countries, however, an overwhelming difference can be found in intellectual contributions that have market value in society; that is, contributions to economic society

Relationship between the research resources owned by universities and the number of patent applications

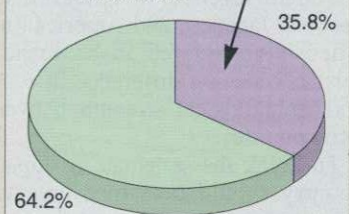
Many of the research resources in Japan are concentrated at universities, but it can hardly be said that university research resources are being fully utilized by industry.

Universities' share in the nation's research and development expenditures is 20.1% in Japan. This figure compares favorably with the corresponding figures in Western countries.



About 36% of researchers in Japan are on the university register.

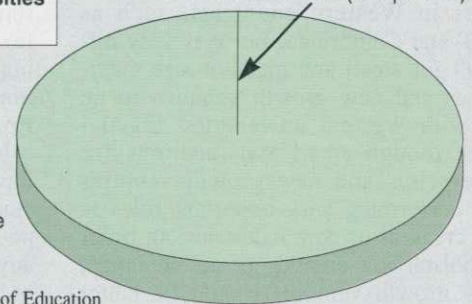
Universities: about 240,000 researchers



But patents that originate in universities represent only 0.04% of the total.

Universities: 0.04% (129 patents)

Total number of patents made public: 351,300 cases



through intellectual property rights, such as patent rights.

When the Bayh-Dole Act, which conferred on universities and companies property rights over the results of research and development activities carried out with federal funding, was enacted in the United States during the 1980s, universities suddenly developed a zeal to possess rights to intellectual property, and the number of patents owned by universities began to soar. In 1994, Japanese universities publicized only 129 innovations in their patent applications, while U.S. universities received as many as 1,862 patents. The University of California system alone had as many as 180 patents registered

in the same year. Royalty revenues from patent rights totaled \$266 million at U.S. universities in 1994, and the University of California system alone obtained \$57 million, far outdistancing Japanese universities' total of ¥29 million.

Again, a large number of new growth ventures came into being in the U.S. as spin-offs from universities, and led the U.S. in creating new industries. In particular, research parks were developed around Stanford University, the University of California and the Massachusetts Institute of Technology, and from there, Genentech, Silicon Graphics and many other new growth ventures came into being and created

many new industries in such areas of science and technology as biotechnology and information, and other areas. During the period from 1980 to 1994, more than 1,000 new growth ventures were born from universities in the U.S. In 1995, a total of 102 spin-off companies came into being from the top 20 universities alone.

The difference in research ability between Japanese and American universities is considered to be responsible for the widening difference in economic and technological strength between the two countries.

To break the stalemate in Japan, this country should take measures to turn the results of research and development at Japanese universities into concrete form, such as intellectual property rights, and connect academia's potential with the economic society.

It is relatively easy for large Japanese corporations to forge cooperative relations with international research institutes in Western countries, such as MIT and Cambridge, but it is very difficult for small and medium-size enterprises and new growth ventures to tie up with Western universities directly, even though small and medium-size enterprises and new growth ventures are performing very important roles in the creation of new industries. In order to bolster job-creating power in Japan, new growth ventures should be better able to utilize intellectual property owned by Japanese universities.

(2) Utilization of universities' human resources development function

Universities as human resources development bodies

Universities are major repositories of human resources. The number of university graduates hired yearly is 500,000, not including graduate school students. However, Japanese business corporations do not appear to appreciate the human resources development function that universities perform. Large business corporations in particular have been hiring the graduates of the so-called "brand-name universities" on a priority basis and training them to be productive employees through

on-the-job training (OJT) within their organizations. Now that Japanese companies are being caught in international mega-competition, however, they no longer can spend a great deal of time patiently training their employees. Demand for urgently needed abilities is becoming stronger and stronger. What's more, the number of people at industrially productive age is expected to decline with the aging of the Japanese population. According to one forecast, the number, 87.1 million in 1995, will decline to 71.5 million in 2025. Given such a prospect, the training of each student as a human resource is becoming increasingly important.

According to one forecast, the percentage of high school students advancing to universities in Japan will rise to around 60% in the first part of the 21st century, along with the decline of the population in the school age brackets. If this forecast is correct, the relative positions of universities and graduate schools in higher education will rise further instead of declining, and the importance of universities' educational function will increase.

Progress in university reform

No one would deny that universities have been functioning satisfactorily since the Meiji Period as suppliers of people of ability to contribute to the advancement of the nation. As economic internationalization and the globalization of industrial locations have progressed in recent years, however, doubts have arisen as to whether Japanese universities are in fact providing what is necessary in terms of education. Certainly, university education is not the sole core of education problems, but it has begun to be asked whether universities are fully meeting the demands of economic society for the type of talent that is really needed.

Criticism has been voiced that university administrations in Japan are under government control and protected under a convoy system from the establishment of new universities, which is subject to government approval. The University Council, an advisory body to the Minister of Education, and other bodies have held debates over university

reform. In 1991, it was proposed that a self-check and -appraisal system be introduced along with the establishment of policy guidelines regarding university licensing criteria. In order to introduce the rules of competition and upgrade Japanese universities to an internationally acceptable level, however, full-scale introduction of a system of accreditation by outsiders is necessary, together with the introduction of rules of self-accountability through deregulation.

Such self-help efforts by universities, however, are not enough. The business community should actively rate the quality of education and research by universities, provide funds and have the rating reflected in terms of university graduates who are hired.

Setting a framework for academia-industry cooperation

The Basic Science and Technology Promotion Plan approved by the Cabinet in 1996 calls for appropriations totaling ¥17 trillion in the science and technology budget by fiscal 2000 and reform of the academia-industry cooperation system.

Concrete measures to promote academia-industry cooperation should be taken in order to vitalize universities' two functions—as research institutes and as educational institutions, and ensure that both functions contribute to the structural reform of the Japanese economy.

Expansion of fund supply to universities

Appropriations for science and technology in the government budget for fiscal 1997 total about ¥3.0 trillion (and the requested appropriations in the fiscal 1998 budget are about ¥3.05 trillion). Appropriations for universities total about ¥1.3 trillion and represent 44% of the ¥3.0 trillion.

Sufficient funds should be appropriated to support research and development activities by academia in line with the direction charted in the Basic Science and Technology Promotion Plan. To make research and development activities more productive, however, the

existing systems should be reformed and funds of a competitive nature should be appropriated. Appropriations for the Ministry of Education are about ¥100 billion, whereas the appropriations for research and development of the proposal and invitation type in the fiscal 1997 budget are ¥56.9 billion for seven ministries and agencies. This is a considerable amount. Funds of such a competitive character should be expanded, with the most able researchers given the funds they require and their abilities fully tapped to create new industries.

Deregulation and university reform

In Japan, many regulations, especially those relating to research conducted by public research institutions and research conducted using public funds, are hampering the efficiency of research and development activities. The Basic Science and Technology Promotion Plan sets out in concrete terms the need for deregulation in order to create a flexible and competitive environment for research and development activities. In response to this recommendation, the government so far has taken deregulatory steps in relation to academia-industry cooperation such as introducing a

system of hiring university teachers for a fixed term, easing the regulations regarding side jobs performed by university teachers, and increasing the flexibility concerning rules on joint research. With regard to the university licensing criteria, the government has given flexibility to the screening of teachers and easing of regulations about the locations of universities.

To ensure that academia-industry cooperation progresses smoothly, the government should facilitate the introduction of external funds to universities, enable teachers at national universities to take part in the management of such enterprises as new growth ventures, allow the construction of private facilities in the compounds of such universities, liberalize or give greater flexibility to the university licensing criteria and introduce a system of rating universities by outside organs. By taking such steps, the government can reform universities and make them internationally competitive.

To foster the growth of abilities, a full-scale introduction of internship (or cooperative education) through academia-industry cooperation is particularly important.

Promotion of technology transfer

The system of providing licenses to industry in order to make use of the intellectual property rights resulting from research by universities is an area in which Japanese universities conspicuously lag behind their Western counterparts. An urgent task to pave the way to academia-industry cooperation is to set up an organization for transferring technologies from academia to industry. In the U.S., such major universities as Stanford University and MIT have technology licensing offices, and they bring considerable royalty income to universities and researchers every year. However, it will take such a technology licensing organization more than 10 years to become financially feasible. A system of close government-academia-industry cooperation should be set up before such an organization is established in Japan.

Steps for further institutional reform, such as drafting a bill to promote technology transfers from universities to industry, should be taken, activities concerning technology transfers, including the acquisition of patents, should be explicitly defined as universities' roles, and a perception revolution by the universities should be initiated by having the ratings of researchers' work properly reflect their contributions.

In the U.S., a great many companies are established as spin-offs from universities. In 1994, as many as 175 such companies were established.

Companies established as spin-offs from universities in the U.S.	Number of companies
Number of companies established as spin-offs since 1980 (as of the end of 1993)	916
Number of companies established in 1994	175

U.S. universities that rank first to 20th in the number of spin-off companies established in Fiscal 1994

University	Fiscal 1994	1980-1993 fiscal years	University	Fiscal 1994	1980-1993 fiscal years
1 MIT	22	64	11 Harvard U.	4	24
2 Stanford U.	9	19	12 Purdue Research Foundation	4	N.A.
3 U. of Florida	7	41	13 Thomas Jefferson U.	4	8
4 Virginia Polytechnic Institute and State U.	6	18	14 U. of California	4	26
5 Pennsylvania State U.	5	12	15 U. of Chicago	4	11
6 Texas A&M U.	5	11	16 U. of Minnesota	4	32
7 U. of North Carolina	5	3	17 U. of Utah	4	58
8 U. of Pennsylvania	5	12	18 Brigham Young U.	3	19
9 Washington U.	5	18	19 Case Western Reserve U.	3	15
10 Drexel U.	4	1	20 Iowa State U.	3	14
			Total	110	406

Source: AUTM Licensing Survey

Note: Spin-off companies are venture companies established with licenses by universities.

Conclusion

Problems to be settled in promoting academia-industry cooperation have been pinpointed recently, and the climate for academia-industry cooperation in Japan is rapidly changing. Industry, academia and government should recognize and actively perform their respective roles, and by doing so, they should further promote academia-industry cooperation and create an environment where new industries can be created.

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