JOINT FUNDING

Universities and Companies Learn Benefits of Teamwork

TOKYO—Some of the labs in the Institute of Industrial Technology (IIT) at the University of Tokyo don't fit the stereotype of academic labs in Japan. Instead of broken-down, outdated equipment crammed into tiny rooms with peeling paint and leaky roofs, these labs can boast of such new and costly tools as a scanning tunneling microscope and a Fourier transform infrared spectrometer. "*Science* always writes about how bad conditions are, but our equipment is very nice," observes Toshiaki Ikoma, a former IIT professor who still advises the institute.

The gleaming new equipment at IIT comes courtesy of an unusual collaboration between 10 private companies and 10 professors from four universities that has kept researchers on the cutting edge of both the science that underlies future generations of electronic devices and the accompanying fabrication techniques. Starting in 1988 and running until last April, this project received $100,000 a year from each company, with the Ministry of Education, Science, and Culture (Monbusho) matching the funds and dividing them equally among the research teams. Five of the companies also conducted their own research in similar areas, and all 15 groups met monthly to compare notes. "It was the first time we felt we participated in a university project on an equal footing," says Akinobu Kasami, vice president and chief research director for Toshiba Corp.

The Mesoscopic Electronics Project, a spin-off of which is being funded by Monbusho with continued corporate participation, is a rare example of a major research collaboration between Japanese companies and universities. The idea is still fairly new to most businesses: The $650 million spent last year by corporations on university research is five times the level of a decade ago, but it represents only 3.4% of overall research spending at Japan's national universities. "Japan is far behind Europe and the United States in promoting such ties," says Tsuneharu Nitta, director of corporate research for Matsushita Electric Industrial Co. Indeed, industrial support for U.S. university research was $1.5 billion last year, representing 7% of overall spending.

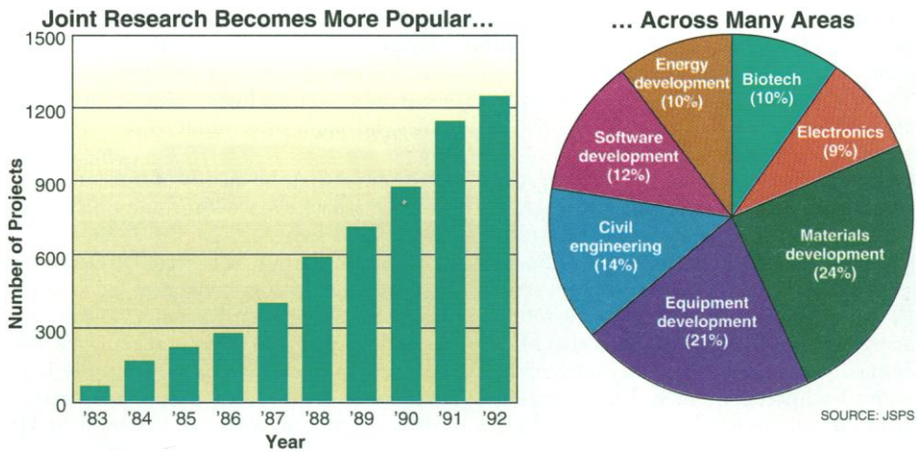
In contrast to the generous support and close cooperation that marked the mesoscopic project, the average joint research project in Japan has a budget of only $36,000, and rigid employment policies make it difficult to assemble teams of researchers to tackle big projects. Moreover, university professors are barred from working directly for private companies, even as consultants, and schools are just beginning to address patent and logistical problems that hamper collaborations with industry.

One reason industry and the universities have been slow to work together is a tradition of independence among Japanese universities, a posture hardened by the left-wing politics of many academics in the decades following World War II. "There was a kind of political movement against industrial collaboration," says Kazuo Murakami, director of the University of Tsukuba's Tsukuba Advanced Research Alliance (TARA). At the same time, industry saw universities as little more than a filter for promising employees—an attitude that is still prevalent. Fujitsu Ltd. Chairman Takuma Yamamoto says that, until recently, donations by companies to support university research "were just a means of making connections to recruit students. We didn't expect to see any results."

Monbusho reinforced that separation with rules that prohibited support for directed research and were intended to keep corporate researchers focused on basic research when they worked in university labs. But the ministry, in an effort to maintain hegemony over funds going into academia, changed course in 1983 after a dispute with other government agencies that also wanted to fund university-based research. Within a few years it had established university-based centers for cooperative research and created a process by which companies could endow a university chair, or "koza," paying the salaries and research costs of a full professor, associate professor, and a handful of assistants for up to 5 years.

Economic realities have also played a role in bringing together the two sectors. "If we did everything we wanted to in-house, it would be prohibitively expensive," says Naoki Yokoyama, manager of Fujitsu's quantum electron devices laboratory. Similarly, academics are slowly learning to seek inspiration outside the ivory tower. "One purpose [of joint research] is to let professors understand what the industrial world's problems are," says Ikoma, now president of Texas Instruments' Tsukuba Research and Development Center.

The old-boy network. Most corporate support to academia comes in the form of small, no-strings donations given to specific professors. The donations, typically based on personal contacts, allow companies to stay abreast of advanced work and to make contacts with promising students. And although it comes in dribs and drabs, the money adds up: Some professors receive as much as half their research budgets through such corporate donations.



In step. University-corporate collaborations are increasingly common, especially for work on new materials and equipment.

Not surprisingly, most joint and commissioned research is heavily oriented toward applications, with materials- and mechanical engineering–related projects together accounting for more than 40% of the joint research projects in 1993. For example, a collaboration between office equipment manufacturer Ricoh Corp. and a Tohoku University electrical engineering group, begun in 1989, has resulted in 10 patents on plasma evaporation and thin film deposition techniques for iron-nitride magnetic films. Ricoh hopes the fruits of that collaboration will some day wind up in its high-capacity magnetic disks for computers and other equipment.

The largest bloc of endowed chairs are also in engineering, accounting for one third of the 59 koza spread among the 98 national universities. Medical and pharmaceutical companies have funded 15 koza, the second-

EIJI MIYAZAWA/BLACK STAR

largest number. At Osaka University Medical School, Tanabe Seiyaku Co., a leading drug maker, is donating $3 million over 5 years to support a department of molecular neurobiology; Ono Pharmaceutical Co. is contributing slightly more than $2 million over 5 years to build a department of cognitive neuroscience.

Companies endow koza primarily as civic-minded donations, leaving staffing decisions to the university. But there are exceptions: the Tanabe koza is mostly filled with company researchers who may return to Tanabe to form a new research group when the grant ends. If the research results are promising, the endowment might be extended or permanent funding found to keep the group intact. Any patents that result become the property of the researchers or the national government.

One disadvantage of the endowed koza is its reliance on the old-boy network, which perpetuates old habits. Corporate research managers often hail from engineering and so may push to support research they are familiar with, rather than basic scientific research, with which they have less experience. "We've been unable to attract a single endowed koza," grouses Shun-ichi Kobayashi, dean of the Faculty of Science at the University of Tokyo. Indeed, there isn't a single endowed koza in natural sciences at any of the national universities.

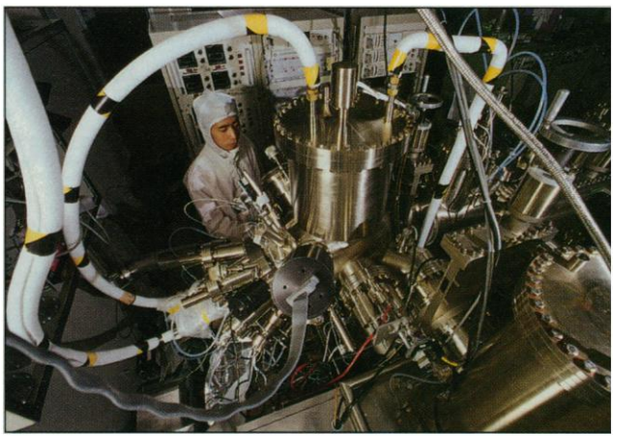
Another big drawback to the endowed koza is that they are temporary. "The government does not want to create new positions at universities," says Tadaharu Tsumoto, professor of neurophysiology at Osaka. This makes it difficult, if not impossible, to assemble a first-rate team or to tackle really ambitious projects that might take more than 5 years.

Global talent search. Indeed, the rigid employment policy of Japanese national universities is cited by Japanese companies as a major reason they have been investing overseas. Toshiba, for example, set up a British institute in 1990 to study basic semiconductor physics and chose as its director Michael Pepper, who remains a professor of physics at the University of Cambridge. "This is impossible to do in Japan," says Toshiba's Kasami.

The flexibility needed to put together a topnotch team is the main reason Daiichi Pharmaceutical decided to set up a 5-year, $20-million project on atherosclerosis at the University of California, San Francisco, says Susumu Makino, general manager of R&D planning for Daiichi. "Overseas it is very easy to gather the best and most appropriate researchers for a project," he says. "It's too bad, but in Japan you just can't do it." Job mobility, he says, is a must for a project that calls for a team of 11 faculty members, 10 postdocs, and seven technicians in addition to visiting scientists from Daiichi.

In Japan, collaborations are typically arranged and managed by individual professors (the Mesoscopic project was an unusual example of a joint effort to set a broad research agenda), and corporate support tends to be in tiny amounts given to many researchers. On the other hand, overseas collaborations are often arranged with an entire institution and can be on a much larger scale, such as the Daiichi-UCSF partnership. This approach has fed the perception in both Japan and the United States that Japanese companies spend more on U.S. universities than at home. (However, a 1993 study by the Congressional Office of Technology Assessment found that Japanese corporate funding represented less than 1% of overall research spending by U.S. universities and, at $50 million a year, was less than 10% of what Japanese companies spent at home.)

Another motive behind corporate largess abroad is the feeling, as one industry executive put it, "that we want to support the world's best"—and that often means those outside Japan. That notion makes leading scientists bristle. Ken-ichi Arai, a departmental chair at the University of Tokyo's Institute of Medical Science, points out that many Japanese scientists return home after distinguishing themselves at "the best university and biotechnology laboratories in the United States." But he agrees with Makino on the problems of assembling a team. Research groups have actually gotten smaller in recent years as universities have stretched a fixed number of positions to cover more academic specialties. The typical university research group of one professor, one associate professor, and a few assistants and graduate students, Arai says, "is just too small to compete with groups overseas."



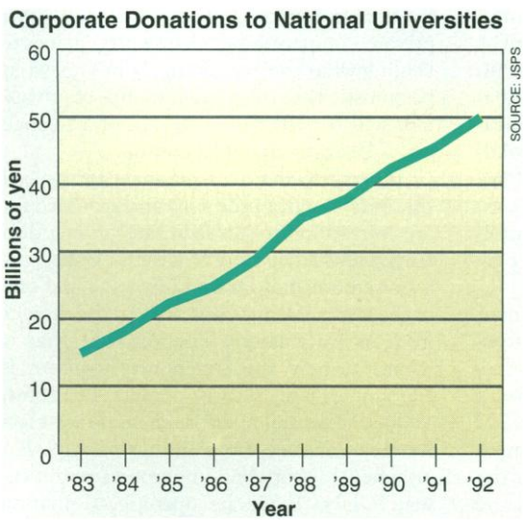
Shabby no more. Molecular beam epitaxy machine at the University of Tokyo.

The Mesoscopic Electronics Project was an attempt to set a new paradigm for industry-academic partnerships. Other fresh approaches are in the works. One closely watched initiative is Tsukuba's TARA, which has launched a worldwide search for scientists in broadly defined areas such as biological sciences and material sciences to work in close cooperation with researchers in other institutes and private companies. TARA also hopes to find financial support among the dozens of industry labs that have moved to Tsukuba since the 1970s. In addition to a new framework for research, TARA organizers are emphasizing managerial and logistical support and attention to intellectual-property issues.

Other universities are coming to the same conclusion. The Japan Institute of Science and Technology, Hokuriku, and its sister school in Nara, new schools focusing on graduate education and research, are both developing programs for greater cooperation with the private sector. Arai at Tokyo belongs to a group of professors and industry scientists proposing to set up a gene therapy research center on the medical school campus that would be funded by Japanese and foreign companies. Included in the proposal "is our answer to how to set up a venture system and share patents with the university, industry, and investors," says Arai.

These kinds of ventures represent a big departure from Japan's tradition of academic detachment, and it is likely to be some time before industry and the universities smooth out all the kinks. "The history of this sort of cooperation is very short, and the support systems just haven't been put in place," says Hiroshi Saito, director of the liaison promotion office for TARA.

–Dennis Normile



A helping hand. Corporate funds are a growing source of support for national universities.