

Invention Management in a Major Japanese University and its Implications for Innovation

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Introduction

This chapter describes the system of technology management in the University of Tokyo and the dominance of joint/sponsored research as the main mechanism of technology transfer that gives large, established companies privileged access to university discoveries and inhibits startup formation. The University of Tokyo is Japan's most important university, accounting for approximately 12 percent of all Japanese university research and development (R&D).¹ Its faculty and administrators have played important roles in shaping changes in the Japanese system university-industry collaboration, and it serves as model for other universities. Nevertheless, practices do vary and some of the descriptions in this chapter do not apply to other universities. I try to indicate when this is the case, as well as aspects that are common to most universities, such as the legal framework summarized next.

Past and Present Legal Framework for Technology Transfer

Prior to 2004, ownership of inventions arising in Japanese national universities² depended upon the source of funding that gave rise to the inventions. Inventions arising under government research grants as well as all contractual sponsored research were supposed to be owned by the nation—in effect by the Ministry of Education, Culture, Sports, Science and Technology (MEXT, or its predecessor, Monbusho).³ This was true even in the case of private corporate sponsors, although these could usually negotiate the right to co-own inventions with the government. Government ownership meant that inventions either were free for anyone to use or would be licensed nonexclusively for modest royalties. Because Japanese patent law (Article 73) requires the consent of all co-owners of a patent for even a nonexclusive license, co-ownership by a sponsor meant the sponsor had a de facto perpetual, royalty-free, nontransferable exclusive license to the invention.

On the other hand, inventors could retain ownership of inventions arising under corporate donations⁴ or the standard research allowance allocated to each faculty member.⁵ Considering the proportions of the various sources of funding, inventions ought to have been roughly equally distributed between government and inventor ownership. In fact, except for some contractual sponsored research inventions co-owned by the sponsoring corporations, almost all commercially relevant university inventions were attributed to donations.⁶ As quid pro quo for receiving donations, the donor companies expected faculty to pass their inventions and related intellectual property (IP) rights to them and also recommend those companies to their capable students as places to work.

Thus, prior to 1998, Japan had a system of de facto faculty ownership of university inventions, shaped in large part by direct links between faculty and companies. Donations were among the most important of these links.

In addition, as government employees, faculty members in national universities were barred from compensated consulting for outside organizations (although much consulting occurred under donations). Also, opportunities to use research funds to provide stipends to graduate students or to hire postdoctoral researchers, technicians, or secretaries, were limited, although less so in the case of corporate donations.⁷ Using research funds to supplement salaries of permanent faculty was (and remains) prohibited. In other words, unlike the United States, Japan still does not have a soft money system of funding tenured faculty, although steps in this direction are under discussion.

The following four laws implemented between 1998 and 2004 changed the legal framework governing IP management and university-industry cooperation, so that it is now very close to the so-called U.S. Bayh-Dole Act system:

- The 1998 Law to Promote the Transfer of University Technologies (the TLO Law) established a system for the government to approve and subsidize university technology licensing offices (TLOs). Starting with five approved in 1998, the number of approved TLOs had increased to about 40 by 2006. Even more important than approval and subsidies, this law legitimized the transparent, negotiated, contractual transfers of university discoveries to industry (especially the inclusion of due dili-

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gence and royalty obligations in contracts) and the channeling of royalties back to the inventors, discovering laboratories, and universities as a whole. Although the system of IP ownership was left unchanged, in practice, careful inquiries as to the sources of invention funding were avoided, and faculty in universities with competent TLOs began to let those TLOs manage a considerable number of inventions even though they may have arisen at least in part from government grants or contracts.

- The 1999 Law of Special Measures to Revive Industry (the Japan Bayh-Dole Act) has the same effect as U.S. Bayh-Dole Act, except that it did not apply to national universities until they obtained legal status as semiautonomous administrative entities in 2004.⁸
- The 2000 Law to Strengthen Industrial Technology established procedures permitting university researchers to consult for, establish, and even manage companies. It also streamlined the procedures for company-sponsored commissioned and joint research. Thus it opened the door for university researchers to found companies. At the same time, it eliminated many bureaucratic obstacles that had previously dissuaded established companies from using contractual sponsored research, rather than donations, to fund university research. In particular, it opened the door to the use of sponsored research funds to pay personnel expenses, although not to the extent of covering salaries of permanent administrative and teaching staff.
- The University Incorporation Law gave national universities independent legal status when it went into effect in April 2004. Previously, they were merely branches of MEXT. By gaining status as independent legal entities, Article 35 of Japan's Patent Law, which enables employers to require assignment to them of employee inventions, became applicable, as did the Japan Bayh-Dole Act. MEXT has urged the incorporated national universities to assert ownership over commercially valuable inventions.

Key Steps and Policies in the University of Tokyo's Invention Management Process

Invention Reporting and Determining Whether an Invention Is Work-Related

Under Article 35 of Japan's patent law, universities can require their employees to assign work-related inventions to the university. Thus, determining which inventions are work-related is an important issue. University of Tokyo guidelines set forth a broad definition, saying that any invention that relied substantially on university facilities or whose conception was related to an employee's research in the university is work-related.

All inventions should be reported using a set form to departmental-level invention committees, whose main responsibility is to make a preliminary determination whether an invention is work-related. The standard form can be supplemented with diagrams, articles, etc. In addition to information about the invention and the identity and affiliation of the inventors, it asks:

- whether the invention relied upon university funds or facilities,
- whether it arose under joint research (and the identity of any joint research partner),
- whether the invention is not work-related ("Yes" is possible only if the answers to the two preceding is "no." Also the inventors must explain why the invention is not work related.), and
- even if the inventors claim their invention is not work-related, whether they nevertheless want to assign it to the university.

It also asks the inventors to provide their perspectives on:

- how their invention solves unresolved problems in its technical field,
- practical uses and likely important markets,
- ability to produce as (or incorporate in) a commercial product,
- antecedent technologies/discoveries,
- background IP (e.g., patent applications on prior related discoveries),
- plans to disclose the invention in publications or conferences,
- whether patent applications ought to be filed overseas,

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- development plans, and
- whether they have a desired development/commercialization partner.

One notable feature is that the lead university inventor designates the percentage contributions of each individual inventor. In the case of inventions arising under joint research contracts with private companies, corporate researchers are almost always listed as co-inventors. These percentage allocations are usually decided by discussions between the lead university inventor and the company collaborators. They are rarely, if ever, questioned at the university/TLO level, and I have heard of no cases of the outside attorneys who file patent applications scrutinizing them.

Co-inventorship automatically gives the sponsor co-ownership rights, whereas it would otherwise have to negotiate with the university for a license. The default provisions of the university's standard joint research contract provide for the university to have the sole ownership of any inventions made only by its personnel. As noted above, a patent co-owner has unlimited use rights and the right to veto any transfer by other co-owners. In practice, if the sponsor wants exclusive control over a co-owned joint research invention, it will usually pay patent application and maintenance costs, but little more.⁹

The ease with which university inventors can designate company employees as co-inventors has been a key factor in the resurrection of the pre-1998 donation system, the main difference now being the requirement for a formal contract and reporting to legitimize the transfer. As in the past, companies sponsor research (but such support is still small in proportion to total university R&D funding and also in relation to the proportion of U.S. university research funded by industry¹⁰), they employ students and they receive nontransferable exclusive rights at low cost with no development obligations. Most university researchers seem comfortable with this. Joint research and joint patent applications have become the dominant mechanism of technology transfer, at least in the University of Tokyo and probably most other major universities.

Deciding Whether to Require Assignment and to Apply for Patents

The departmental-level invention committees in the University of Tokyo should decide within two weeks of receipt of an invention report whether the invention is probably work-related and forward the report and their assessment to departmental-level administrators. These then forward the report to central university administrators and then to the TLO. In practice, many inventors first send their reports directly to the TLO so as to receive early feedback on commercialization prospects.

The Intellectual Property Management Office in the central university administration has final authority whether to require assignment from the inventor and to apply for patents, copyrights, or trademarks. In practice, in the University of Tokyo, the TLO makes these decisions, although the IP Management Office (also known as the IP Headquarters) must ratify these decisions. This dual authority is due to the University of Tokyo's TLO being an independent for-profit corporation that nevertheless has a special relationship with the university and special obligations arising from this relationship.¹¹

As a matter of practice, the university usually does not require assignment of inventions by company researchers engaged in joint research or by students. In the case of the remaining invention reports, the TLO assesses patentability (mainly by searching Japanese and to some extent foreign patent applications) and market demand for the invention (by discussions with the inventors, a growing network of companies and review of trade and other publications). This work is the responsibility of approximately twelve licensing associates, most of whom are relatively young and have university science or engineering training and industry experience. Inventors are usually required to assign to the university rights to inventions deemed patentable and for which there will likely be market demand. Thereupon the same licensing associate who was responsible for making the decision whether to require assignment assumes responsibility for licensing.

In principle, the TLO and IP Headquarters should decide within two weeks whether the university will require assignment. Thus, within a month of submission of an invention report, the inventor ought to know whether the university will require assignment (and will apply for patents) or let the inventor retain title. If the university does not decide

within a month, in principle, the inventor should automatically retain title unless the university provides reasons for its delay. This guideline has been administered flexibly. Occasionally the time limit is exceeded, but, to my knowledge, inventors rarely complain or insist that they retain title because of a delay.

Patent Application, Marketing, Licensing, and Startup Formation

In part because the University of Tokyo's TLO has cash reserves from the sale of stock in a startup that had a successful initial public offering in 2003, the university can afford to patent inventions for which it does not have a licensee waiting in the wings. Few other TLOs have this financial cushion. Patent applications are handled by outside attorneys. In 2006, the university was applicant (or co-applicant) on 432 Japanese patent applications.¹² Overall, it files patent applications on roughly half the inventions reported to it.

Royalty income was about \$1.7 million in 2006, slightly higher than the previous year. The TLO license associates use a variety of databases, personal contacts, as well as cold calls to search for potential licensees. They also advertise some inventions on the Internet, but this method probably accounts for a small proportion of licenses. I have been impressed with the frequency with which they enter into negotiations with large and small companies including companies overseas. Close communication with the inventors also is an important part of the licensing associates' work. Although some faculty members are still skeptical about university ownership invention management by the TLO, those faculty members who have actually worked with the TLO usually seem satisfied. In other words, the staff seems to be doing a competent job. However, many other TLOs lack such competence. Staff of the University of Tokyo's TLO frequently take part in training sessions for staff of other TLOs. The fate of Japan's new system of technology management depends largely upon such efforts.

In 2006, the University of Tokyo concluded nearly 277 technology transfer contracts, not including material transfer agreements and consulting contracts. This indicates it transfers to industry about two-thirds of the inventions on which it files patent applications.

However, the breakdown of these contracts shows how joint research and joint patent applications have become the dominant mechanism of technology transfer. Two hundred

of the 277 contracts were contracts with a joint research sponsor to apply jointly for patents. The actual number of inventions covered by these contracts is greater than 200, because one contract occasionally covers more than one invention. On the other hand, the 77 license contracts cover nonpatented inventions and multiple nonexclusive licenses of the same invention, as well as exclusive licenses. Thus, the number of inventions licensed independently of joint research is less than 77, suggesting that only about one-quarter (or even less) of transferred inventions are licensed at the discretion of the TLO, i.e., the TLO actually sought out a licensee able and committed to developing the discoveries. Three-quarters were transferred in a pre-ordained manner with weak obligations on the part of the transferees to develop the discoveries. This trend of increasing dominance of joint research has been evident since 2004.

My own analysis of a sample of invention reports confirms this phenomenon and also shows its differential impact on startups and established corporations by technology field. Only about 20 percent of life-science inventions are attributed to joint research. Thus, the TLO is free to license 80 percent of the life-science discoveries to the companies most able and willing to develop them. In fact, these are licensed to a wide variety of companies including startups. Of the 20 percent that are attributed to joint research, over three-quarters of the sponsors are startups or other small companies. In other words, in the life sciences, established companies do not receive the lion's share of university discoveries, and startups have access to a large proportion of university discoveries.

However, in non-life-science fields (engineering, chemistry/materials science, and software) 40 percent of reported inventions are attributed to joint research, and among those on which patent applications are filed, well over half are joint research inventions. More than 80 percent of the sponsors of the inventions attributed to joint research are large, established companies. So in non-life-science fields, which account for two-thirds of the University of Tokyo inventions, most of the inventions are transferred automatically to large, established joint research partners.

These findings show that, under current conditions, transfer of a substantial proportion of university technologies via joint research, whatever its other merits, is not conducive

to the formation of vibrant new companies. In light of Japan's experience under the pre-2004 donation system, it also shows that academic inventors retaining ownership does not necessarily promote entrepreneurship and the formation of new companies. Japan had, and still has, a system where inventors usually determine the recipients of their discoveries (because of the way they and their sponsors can manipulate the reporting system) and, thus, effective control over their discoveries. But this freedom usually results in the direct transfer of discoveries to research sponsors which, except in the life sciences, are almost always large, established companies.

Examination of startups themselves confirms this phenomenon. Official METI data indicate that 54 University of Tokyo startups were in existence as of April 2004, with founding dates range from 1980 to early 2004. However, these include subsidiaries of established companies and other companies whose only tie with the university is the existence of a joint research contract or board membership by a university researcher or recent graduate. Defining startups as companies based upon university discoveries would require reducing the overall figure by about 40 percent. Looking only at startups actually based on university discoveries, year-by-year rates of formation began to rise from near zero prior to 1997 to a peak of seven formed in both 2000 and 2001 and then to decline in subsequent years. No startups based upon licenses from the university were found in 2005 or 2006. The rise coincides exactly with the period between the enactment of the 1998 TLO law and the 2000 Law to Strengthen Industrial Technology.

A careful assessment of the technologies, sales, and employment trends of all these startups indicates that almost all those with growth potential are in the life sciences. About one-third of all University of Tokyo startups are in the life sciences. There are only a few startups in engineering, materials science, chemistry, and software that seem to have unique or high-demand technologies, and the basic elements of a business development strategy in place. It is clear from invention reports and government research grants awarded to the university that first-class research is occurring in non-life-science fields. But with just a few exceptions, only large, established companies are developing these discoveries. Outside of the life sciences, university entrepreneurship is weak.

Concluding Points

Judging from official pronouncements and a host of government programs to support startups and other new high-technology companies, promotion of such companies is a high priority. The University of Tokyo has even organized a private venture capital consortium to target startups based upon university discoveries. This consortium has the right to offer to be lead investor to any university researcher contemplating forming a company, although inventors are free to seek funding elsewhere. It is not clear that this particular consortium offers as much guidance and other support to startups as do a handful of other venture capital companies that concertedly try to help new companies grow. But its privileged status may discourage competition from more capable funds.

There are other examples of official policies working at cross purposes to the goal of promoting viable new high-technology startups—in particular, the government's continued fostering of consortia between leading universities and large established companies to pursue research in cutting-edge fields of science and engineering. The ubiquity of such consortium research, along with accounts of various startups managers, strongly indicate that consortium research, coupled with the system of invention management described above, has limited the scope of new companies to grow. Although I am most familiar with the situation in the University of Tokyo, available information indicates that the same situation prevails in other leading Japanese universities.

There are other factors that contribute to the weakness of new high-technology companies in Japan besides the system of university-industry cooperation. These include the continued prevalence of lifetime employment in high-technology industries, a strong social preference for employment in large companies, and an autarkic approach to innovation in large companies. But the system of university-industry cooperation is a major factor that continues to inhibit high-technology entrepreneurship in Japan.

The system of technology transfer in the University of Tokyo and other major universities works well for large, established companies. But to the extent Japan needs vigorous new companies to be pioneers in new fields of technology, its system of technology transfer is a drag on innovation and long-term scientific and economic progress.

The same is probably true in other countries whose technology transfer systems are biased in favor of large, established companies—particularly those where joint/sponsored research is the dominant mechanism of technology transfer. I hope others will pursue research to support or refute this claim—and to clarify the extent and implications of joint research in other universities, as well as the relative merits of technology transfer via joint research vs. startup formation.

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Notes

1. Unless otherwise indicated, supporting materials for this chapter can be found in the R. W. Kneller sources listed in the bibliography, as well as other sources cited therein.
2. National universities account for approximately 75 percent of all R&D university expenditures. With a few exceptions, the most important academic R&D centers are national universities. In addition, even the most important private and local government universities tend to follow the example of national universities with respect to technology transfer policies. Thus, although this section focuses on national universities, it is also largely applicable to private and local government universities.
3. Or in a few cases, by another sponsoring ministry.
4. In theory, donations are charitable gifts. At least prior to 2000, however, they were the principal mechanism for companies to fund university R&D. Even today, they are probably still the largest source of corporate support for universities, although joint or commissioned research may have surpassed donations as the principal form of corporate support for specific R&D projects. In 2005 donations (mostly from corporations) to the University of Tokyo were 9.9 billion yen (approximately \$90 million), compared with 4.5 billion (approximately \$40 million) for joint research (roughly 80 percent of this was from private companies, the remainder from government-affiliated organizations) and 22.4 billion yen (approximately \$200 million) for commissioned research (less than 20 percent of which was from private companies). (University of Tokyo Data Book 2007) However, some donations only peripherally support R&D. In other words some of the 9.9 billion yen in donations supports endowed faculty positions, specific building projects, etc., but a significant proportion is earmarked for specific professors' laboratories.
5. The standard research allowance is usually a few thousand dollars annually after mandatory deductions for infrastructure and other fixed laboratory expenses.
6. Less commonly to the standard research allowance.
7. This was another attractive feature of donations.

8. The Japanese Bayh-Dole Act authorizes, but does not require, government-funding agencies to let contractors and grantees own inventions. However, at the urging of the Ministry of Economy, Trade, and Industry (METI), most funding agencies now let universities claim ownership, the principal exception being inventions arising under ERATO projects funded by the Japan Science and Technology Agency (JST).
9. The standard joint research contract of the University of Tokyo, as well as those of some other prominent public research institutes, contain provisions that attempt to limit the effect of Article 73 of Japan's Patent Law. For example, article 21.3 of the University of Tokyo's standard contract stipulates that, if the sponsor has not taken an exclusive license to the university's ownership share, the university can request permission from the sponsor to license its share to a third party, and the sponsor *should not refuse this request without justification*. Some sponsors demand up front that even this clause be stricken from the agreement. When these clauses are retained and sponsors exclusively license the university's ownership rights (thus obtaining unified exclusive rights) their royalty obligations are usually no more than total patent application and maintenance costs. Even if they forego an exclusive license to the university's share, it is rare for the university to license its co-ownership interest to a third party. By 2007, some other leading national universities had shifted to letting university inventors retain their co-ownership rights in inventions arising under joint research contracts thus stepping out entirely from the management of co-invented joint research inventions. Just as under the old donation system, these inventors can manage their co-ownership rights as they wish. Most will let the sponsors have unified exclusive ownership in return for research support and providing training and employment opportunities for students.
10. In 2006, joint research sponsored by private companies accounted for less than 7 percent of all project-specific research funding in the University of Tokyo (i.e., government grants and contracts, corporate-sponsored research and donations, *but excluding* salaries for permanent staff, infrastructure, and most overhead costs (University of Tokyo 2006 Data Book, pp. 39-40). In comparison with the U.S., according to Organization for Economic Cooperation and Development statistics, industry funded only 2.5 percent of Japanese university R&D in 2000, compared to more than 7 percent in the United States (National Science Board, *Science and Engineering Indicators* 2004).

11. The reason the TLO is an independent corporation trace to its formation in 1998 when universities were still just branches of MEXT. At that time, to be able to manage royalties and recruit competent staff at competitive salaries, it made sense to be an independent corporation rather than part of the university. The same applies to many of the TLOs of other leading national universities that were formed in 1998, 1999, and 2000. Cooperation between the University of Tokyo's TLO and the IP Headquarters has been fairly smooth, with the TLO responsible for operational decisions and the IP Headquarters making policy decisions. However, in other universities, this dual authority had resulted in friction or, in what seems to be an increasingly common trend, marginalization of the TLOs. Total domestic patent applications by Japanese TLOs fell two years in succession from a peak of 1,679 in 2003 to 1,054 in 2005. But applications by IP Headquarters more than made up for the decline, increasing from zero to 1,522 over the same two-year period (data from the 2006 Technology Transfer Survey of the University Technology Transfer Association, Japan (in Japanese), p. 111).
12. It also filed foreign applications on about 170 inventions.
13. This list is not exhaustive and I am indebted to other researchers and many other sources of information, which are cited and discussed in the listed bibliography.