

CHAPTER 3

Invention Management in Japanese Universities and its Implications for Innovation: Insights from the University of Tokyo

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3.1 Introduction

This chapter describes the system of technology management in the University of Tokyo and the dominance of sponsored joint (collaborative) research as the main mechanism of technology transfer. As is probably the case in other major national universities in Japan, this system has resulted in large, established companies controlling a large proportion of university discoveries, while opportunities and incentives for start-up formation have been constrained. 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 shaping Japan's system of university-industry collaboration, and it serves as a model for other universities. Nevertheless practices do vary and some of these instances are noted.

3.2 Past and present legal framework for technology transfer

Prior to 2004, ownership of inventions arising in Japanese national universities, which account for approximately 75 percent of all university research expenditures and include most of Japan's major academic research centers, 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—usually in effect by the Ministry of Education, Culture, Sports, Science and Technology (MEXT, or its predecessor, Monbusho). This was true even in the case of inventions arising under contractual company sponsored research. Government ownership meant that inventions either were free for anyone to use or would be licensed nonexclusively for modest royalties, except that in the case of contractual company sponsored research, the sponsors could obtain exclusive licenses.

On the other hand, inventors could retain ownership of inventions arising under donations (in theory, charitable gifts, but prior to 2000, the principal mechanism for companies to fund university R&D) or the standard research allowance allocated to each faculty member (usually only several thousand dollars annually after deductions for infrastructure and other fixed laboratory expenses). Considering the proportions of the various sources of funding, inventions ought to have been roughly equally distributed between government and inventor ownership. In fact almost all commercially relevant university inventions were attributed to donations. 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 to recommend those companies to their capable students as places to work. (Kneller 2003)

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. University researchers did invent, but companies usually applied for the patents.² The average number of patent applications per year was about 50-70 percent of the average following incorporation of national universities in 2004 (Kanama and Okuwada 2008, Takahashi and Carraz 2009).³ But it was nevertheless respectable and represented a first significant step in technology transfer, in that companies were sufficiently interested to apply for patents.

There were other barriers to industry university cooperation. As government employees, faculty members in national universities were barred from compensated consulting for outside organizations (although donations facilitated extensive informal consulting). Also, research funds generally could not be used for personnel expenses,

the exception being use of donations to pay secretaries and occasionally technicians. (Kneller 2003) 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 resembles on the surface the US System after passage of the 1980 Bayh-Dole Act:

- 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 39 by 2005 (UTTAAJ 2009). Even more important than approval and subsidies, this law legitimized the transparent, negotiated, contractual transfers of university discoveries to industry and the channeling of royalties back to the inventors, their laboratories and the university. Although the system of IP ownership was left unchanged, 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 US Bayh-Dole Act, except that it did not apply to national universities until they obtained legal status as semiautonomous administrative entities in 2004.⁴
- 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 companies from using contractual sponsored research, rather than donations, to fund university research. Among other things, 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. So too did the Japan Bayh-Dole Act. MEXT has urged the incorporated national universities to assert ownership over commercially valuable inventions. (MEXT 2002)

3.3 Key steps and policies in the University of Tokyo's invention management process

3.3.1 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 work-related ("No" 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
- 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 (Kneller 2006). 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 outside attorneys who file patent applications seldom scrutinize them.

Co-inventorship automatically gives the sponsor co-ownership rights, whereas if all inventors were all university researchers, the sponsor would have to negotiate with the university for a license. Because Japanese patent law (Article 73) requires the consent of all patent co-owners even for a nonexclusive license to a third party, co-ownership by a sponsor means the sponsor has a de facto perpetual, royalty-free, nontransferable exclusive license to the invention. In other words, a co-owning sponsor has unlimited use rights and the right to veto any transfer by other co-owners. It cannot license the invention without the university's permission, but this limitation rarely is a concern for large companies. The University of Tokyo has tried harder than any other university to circumvent these provisions and to require that companies that want unified exclusive rights negotiate an exclusive license for the university's ownership share. However, companies that oppose the university licensing its rights to a third party (essentially giving the third party a non-exclusive license) are able to do so by insisting on their Article 73 rights. Thus in all universities, if the sponsor wants exclusive control over a co-owned joint research invention, all it usually has to do is to pay the patent application and maintenance costs.⁵

The ease with which university inventors can designate company employees

as co-inventors and thereby obtain exclusive control has been a key factor in the resurrection of the pre-1998 donation system, the main difference now being the requirement for a formal joint research contract.⁶ As in the past, companies sponsor research (however such support is still small in proportion to total university R&D funding and also in relation to the proportion of US university research funded by industry⁷), 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 in the University of Tokyo and probably most other major universities. The scope and implications of joint research partners having so much control over a large proportion of publicly funded university research are discussed in part 4 below.

3.3.2 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 patentability and 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 and trademarks. In practice, in the University of Tokyo, the TLO makes these decisions, although the IP Management Office (also known as the IP Headquarters, or IPHq) must ratify them.

MEXT authorized the formation of over 30 national university IPHqs in 2003 in anticipation of the incorporation of national universities the following year. MEXT felt that major national universities needed IP management capabilities within their official structures, even though they may also have a TLO. (Most of the existing TLOs had been formed as foundations affiliated with their universities or as nominally independent for-profit corporations. They were so organized in order to be able to collect royalty payments and to recruit staff from the outside at competitive salaries. Before incorporation it would have been administratively difficult for any organization within a national university to perform these tasks.) This often overlapping dual authority sometimes led to friction. (Kneller 2004) But now, these have been largely resolved in favor of the IPHqs which have absorbed the TLOs and confined their responsibility to licensing. The outstanding exception is the University of Tokyo, whose TLO had sufficient license revenue to hire competent staff who could take the lead in all aspects of invention management. Even in this case however, the vetting of decisions by the University's IPHq is becoming more pervasive.

As a matter of practice, the University of Tokyo does not require assignment of inventions by company researchers engaged in joint research or by students. In the case of the remaining inventions, the TLO assesses patentability and market demand. Approximately 12 licensing associates carry out this work. Most 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 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 apply for a patent, or let the inventor retain title. If the university does

not decide within a month, in principle, the inventor should retain title unless the university provides reasons for its delay.

The ease with which universities can let inventors retain ownership stands in marked contrast to the situation in the USA. There the Bayh-Dole law requires that the right to apply for a patent reverts back to the government funding agency if the university declines to patent. The university, on behalf of the inventor, can request that the government waive this right in favor of the inventor. However this process is not streamlined. If the inventor has a development plan (including companies or investors who can assist in company formation), easy transfer of rights to the inventor can provide an important safety valve in case the TLO lacks resources or expertise to manage the invention. Several Canadian universities (for example Queens University and University of Waterloo) go even farther and give inventors the choice of assigning their inventions to the TLO or managing the inventions themselves. Such flexibility is absent from the US system in the case of government funded inventions.

3.3.3 Patent application, marketing and licensing

In 2006 the University of Tokyo applied for 432 Japanese patents, and about 170 international patents (ie Patent Cooperation Treaty applications). Overall it files patent applications on about half the inventions reported to it. The proportion for some other major universities is higher indicating that the University of Tokyo is more discriminating concerning which inventions it decides to patent. This probably reflects a better capability to assess marketability and to find licensees.⁸

Royalty income between 2005 and 2007 ranged from \$1.7 million in 2006 to \$0.9 million in 2007 (Cabinet Office and U of Tokyo data). 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 rarely produces licenses. Close communication with the inventors is an important part of the licensing associates' work. Although some faculty members are still skeptical about university invention ownership and 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 future of Japan's new system of technology management depends largely upon efforts to increase the capabilities of TLOs in other universities.

3.4 Joint research as the dominant mechanism of technology transfer and the dearth of viable start-ups

The above notwithstanding, in the University of Tokyo and probably most other major universities, licensing accounts for a minority of IP-based technology transfer. Instead, joint research is the dominant mechanism of technology transfer. The first year following incorporation, 2004, the number of license agreements by the University of Tokyo exceeded the number of joint patent applications for joint research inventions. However since then the number of licenses has increased only modestly, while the number of joint patent applications for joint research inventions has grown considerably. In recent years (2006-2008) over 70 percent of transfers to industry of university inventions have occurred via joint patent applications by the university and the joint research partner, while less than 30 percent have occurred via licenses unrelated to joint research.⁹

Such precise data are not available for other universities. However

conversations with technology transfer officials in other major national universities indicate that the ratios are similar. Approximately half of all patented inventions are attributed to joint research and three-quarters of all inventions that are actually transferred to companies are transferred by joint patent applications associated with joint research.

The dominance of joint research by large companies is especially strong outside of the life sciences. An analysis of a sample of invention reports from the University of Tokyo shows the differential impact on start-ups vs 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 start-ups. Of the 20 percent that are attributed to joint research, over three-quarters of the sponsors are start-ups or other small companies. In other words, in the life sciences, established companies do not receive the lion's share of university discoveries, and start-ups 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. (Kneller 2007c, Kneller 2006).

More macro-level data confirm the dominance of large Japanese companies over Japanese university inventions. Among technologically advanced countries, Japan appears to be unique in the high proportion of university discoveries that are automatically exclusively controlled by companies by virtue of joint patent applications. Approximately 60 percent of all US patents assigned to Japanese universities are co-assigned to companies. In other words about 60 percent of all issued/registered US patents on which at least one applicant is a Japanese university, also have a corporate co-applicant. Almost all these co-applicants are large Japanese companies. The country with the next highest rate of co-ownership is Germany, but only about 15 percent of its university patents are co-owned by companies, about one-third of which are foreign. Propensity of universities to patent as measured by US patents issued per \$1 billion R&D spend does not seem to be able to explain the difference, as Japanese universities' output of US patents per unit of academic research expenditure is equivalent to that of Germany and the UK.

Table 1: Prevalence of industry co-ownership of university patents: A comparison of five major high technology economies

	Approx. no. US patents issued 2008/4-2009/3 where one assignee is a university in this country (A)	Univ patents per \$1 B univ R&D spend [(A) / (2004 or 2006 R&D spend by higher education institutions in country)] (B)	percent of (A) where at least one co-assignee is a private co. (C)	percent of (C) where co-owner is a foreign co. (D)
Canada	92	11	10	50
Germany	38	4	16	33
Japan	125	6	61	0
UK	70	9	6	100
USA	2249	48	3	0

This analysis is based upon a sample of 40 patents issued April 2008 to March 2009 from each of the countries listed in Table 1. In the case of Germany, all 38 US patents with a German university listed as assignee were reviewed. The time period is late enough so that there are few applications by Japanese universities made before Japan changed to a system of university ownership of IP in 2004 or by German universities before Germany changed to a system of university ownership in 2002. Data for academic R&D expenditures are from NSB (2008).

One interesting aspect of these findings is that patent law concerning the rights of joint patent owners is similar in Japan and almost all other countries, except the USA. Except in the USA, agreement of all co-owners is necessary for any transfer of patent rights (even a non-exclusive license), and thus if a company co-owns a patent with a university, it essentially has a perpetual, royalty free, non-transferable, exclusive license. This would seem to make co-ownership of university discoveries by Canadian and European companies participating in joint research just as desirable as it is for Japanese companies. Yet rates of company co-ownership of German, UK and Canadian university patents are low compared to those of Japanese university patents. This may indicate that cooperation between industry and universities is indeed closer in Japan compared to other countries. However it may also indicate that Japanese universities are letting companies assume control over a large proportion of university discoveries without diligently assessing whether these inventions really ought to be attributed to company funding or trying to ensure that the companies are committed to developing them. In other words, Japanese universities are guarding the public interest (cynics might argue, the universities' interests) less carefully than their European and Canadian counterparts. A recent report to the Kauffman foundation comparing industry perspectives on cooperation with universities in Japan, Canada, the UK and the USA suggests that both factors are at work (Ternouth et al 2009).

Under the Japanese system, engagement between companies and universities is primarily based on the relationship between companies and professors. TLOs, which are sometimes accused of being obstructionist, bureaucratic or simply greedy, generally do not get in the way. Expectations between professors and companies are generally well aligned, with professors willing to let companies control IP in exchange for research support.¹⁰ Many Japanese TLOs simply are not capable of effectively managing inventions, and the surrounding environment is not supportive of start-ups. For these universities letting joint research partners manage inventions is the best option for technology commercialization. Even under more favorable circumstances, having a large company that is interested in a discovery is an important first step to commercialization.

However there are also reasons for concern regarding the Japanese system. First, a majority of inventions from major universities are monopolized by large companies under the assertion that they are joint research inventions. Since joint research accounts for less than 5 percent of total R&D funding, the fruits of much publicly funded research is being exclusively appropriated. This may not be a problem if the transferees make concerted efforts to develop the discoveries, but this is probably not the case. The normal licensing mechanisms (including the inclusion in the license contract of development incentives, such as development milestones and obligations to pay royalties) have been bypassed and the joint research contracts impose, at most, weak development incentives. Also there is no system for tracking the fate of these discoveries. Interviews with large companies that have collaborated with universities suggest a real problem in transferring discoveries from the basic research to the development laboratories in big companies (Ternouth 2009). Joint research partners, which control prosecution of most joint research patent applications, request the Japan Patent Office to review only about half of these. Most of the non-reviewed applications are, in effect, dedicated to the public. This mitigates the fact that the companies have

chosen not to develop them, except that this decision is usually made three years after patent filing. Only then can other companies feel free to use them. The fate of the inventions on which patent applications are pursued is also uncertain. In some cases, the joint research partner makes concerted efforts to develop. In others, the patents are held to deny access to rivals, or as ammunition in case of patent litigation.

Second, interviews with the founders of university start-ups indicate that faculty inventors do perceive an either/or choice between forming a new company and entering into joint research with a large company in order to develop their discoveries. They usually choose the latter, not only because it is so much easier and the rewards in terms of research support much more immediate, but also because much of the IP covering their own or related university research is already controlled by large companies engaging in joint research. In other words, their energy and time and sometimes relevant IP are pre-empted by large joint research partners. This constriction of opportunities for faculty entrepreneurship might not be a problem, provided a large company is willing to develop a promising discovery in most its various applications, but again this usually is not the case.

After a high point of start-up formation in 2000 and 2001, the number of start-ups formed annually has declined.¹¹ The University of Tokyo has established incubator space for start-ups and it has launched entrepreneurship training programs. With cooperation from main line investors it has also established an early-stage venture capital fund, which has become one of just a small number of sources of early-stage funding for science and technology based ventures throughout Japan. However it seems that these efforts are unique. Except for incubator space which is still provided close to several universities, other universities are scaling back on their efforts to promote start-ups. A major university in Western Japan that has approximately 60 persons working in various fields of coordination with industry and technology commercialization devotes few personnel to fostering start-ups. Rather, in most universities, including the University of Tokyo, the emphasis has switched to obtaining more joint research support from large companies. Probably one reason is the immediate financial support that such support affords (including overhead of about 30 percent), since all universities are now facing steady annual cutbacks in core support from the government (Kneller 2010).

A careful assessment of the technologies, sales and employment trends of all the start-ups established before 2005 from the University of Tokyo, Keio University and the Agency for Industrial Science and Technology (the umbrella organization for METI's main research laboratories) showed that almost all those with growth potential are in the life sciences. (About one-third of all University of Tokyo start-ups are in the life sciences.) Only a few start-ups in engineering, materials science, chemistry and software seem to have unique or high-demand technologies and the basic elements of a business development strategy in place. (Kneller 2007a) Yet it is clear from invention reports and government research grants 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. Currently there are one or two promising start-ups from the University of Tokyo each in material science and communications, but these seem to be the exceptions that prove the rule. Except perhaps in the life sciences, all of Japan's future innovation potential depends upon its large companies. There is no viable alternative mechanism to develop science and engineering discoveries that big companies are not willing to develop.

Third, standard joint research contracts (for example, articles 25 and 30 of the University of Tokyo's model agreement) give companies considerable authority to restrict academic publications. How often they exercise this authority is still unclear, but interviews with companies and students show it is exercised occasionally and that

professors and students are widely aware of this authority. More broadly, there is the yet unanswered question of the extent to which joint research narrows the education and the professional opportunities of graduate students working on joint research projects. Of course, participation in joint research projects can also benefit graduate students tremendously - scientifically and in terms of their careers.

3.5 Concluding observations

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. This is a point that should be born in mind by critics of the so-called Bayh-Dole system of university ownership, who often advocate inventor ownership as an alternative. Japan had, and still by and large has, a system where inventors effectively control their discoveries because of the way they and corporate sponsors can manipulate the reporting system and thus determine the recipients of 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.

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, low levels of immigration, low levels of smart investment capital for start-ups, and a continuing preference by large Japanese companies to rely on their own laboratories for innovation.

In this latter regard, Japanese companies are willing to partner with overseas universities and start-ups because they perceive the need for expertise from overseas. They are increasingly willing to partner with Japanese universities, in part because the cost of research is relatively low and they can obtain exclusive control over emerging IP. But in what appears to be a self-fulfilling prophecy, there is still widespread skepticism towards domestic (Japanese) start-ups. Some deals are made. Also, fault often lies with the start-ups for not communicating effectively with potential large customers or not anticipating their needs and how they can help respond to those needs. Nevertheless numerous interviews suggest Japanese start-ups must try exceedingly hard to get the attention of potential large Japanese customers. (Kneller 2007a). Also there is a complete absence on the part of large Japanese companies of the approach of some major US companies (such as Qualcomm, Cisco Systems, Apple and even IBM) that supporting new entrepreneurial start-ups will benefit the major companies in the long term.¹² Innovation still remains largely closed in the established Japanese companies, at least from a domestic perspective. The system of technology transfer which gives large companies so much exclusive control over publicly funded discoveries helps perpetuate this closed innovation system—probably to the long term detriment of Japan's industry and economy.

Notes

¹ Based upon the University of Tokyo's share of funding from various project-specific funding programs over recent years. Chief among these funding programs are Grants-in-aid from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and various commissioned research programs from government agencies. See Cabinet Office Data, Kneller 2007b, Kneller 2010.

² Occasionally the inventors themselves would apply for patents, but probably this was common only in the case of a few well-known serial inventors.

³ That is, comparing patent applications published in 2001-2002 with those published 2005-2006 from Tohoku, Tsukuba and Hiroshima Universities.

⁴ 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 Exploratory Research for Advanced Technology (ERATO) projects funded by the Japan Science and Technology Agency (JST).

⁵ 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. Based upon close communication with the university's TLO and understanding of its operating procedures, the amount of additional royalties beyond patent prosecution and maintenance costs required by the university for an exclusive license of its ownership share is modest. The TLO's main concern seems to be that companies that obtain exclusive control are committed to development. If a company foregoes an exclusive license to the university's share, the TLO will push for permission to license its share non-exclusively to interested companies. Sometimes the sponsor agrees. Sometimes a long process of negotiation ensues. Two licensing professionals in the TLO are responsible for managing these negotiations and the licensing of joint research inventions. Among companies, the University of Tokyo's TLO has the reputation of being the hardest bargainer among all university TLOs (Ternouth 2009). Most other universities with fewer human resources probably simply accede to a sponsor's request (backed up by Article 73) that, even without a license from the university to the sponsor, the university will not license its rights 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.

⁶ Commissioned research contracts, which do not permit collaboration between company and university researchers, are relatively rare in the case of for-profit companies (Cabinet Office, Kneller 2010, Kneller 2007a). This is partly because through actual collaboration, companies are able to claim their researchers are co-inventors which automatically leads to co-ownership and exclusively control over any emerging IP.

⁷ In 2007 joint research sponsored by private companies accounted for less than 6 percent of all project-oriented research funding in the University of Tokyo, that is, government grants and contracts, and corporate sponsored research and donations, *but excluding* salaries for

permanent staff, infrastructure and most overhead costs (University of Tokyo 2008 Data Book). For Japanese national universities as a whole, joint research accounted for less than 8 percent of such direct, project-oriented funding (Cabinet Office). According to OECD statistics, which attempt to account for salaries and infrastructure attributable to research (as opposed to education and administration, industry funded only 2.8 percent of Japanese university R&D in 2004, compared to 5.3 percent of US university R&D in 2006 (NSB 2008).

⁸ This is based in part on discussions with various TLOs suggesting that many, aside from the University of Tokyo's, have not yet developed strong marketing capabilities but instead patent many inventions in the hope they can be licensed later. It is supported by the fact that only University of Tokyo and Nagoya University are close to breaking even on revenues versus expenditures. (In other words, most of the universities that file patents on a high proportion of their discoveries but so far have earned meager license revenue.) The University of Tokyo is in a stronger position financially to apply for patents, on the strength of its respectable royalties and also windfall earnings from a successful 2003 initial public offering (IPO) by a company to which it had given a license in return for stock in the company. Also the number of invention reports, about 600 annually, is the largest among Japanese universities (Cabinet Office).

⁹ For example in 2008 the University entered into 169 contracts with joint research partners to apply jointly for patents. Some of these contracts covered more than one invention, so 169 underestimates the number of inventions transferred in this manner. In the same year, the University executed 65 independent licenses. Some of these were non-exclusive licenses covering the same invention, so 65 overestimates the number of inventions transferred by licenses (University of Tokyo data available at www.casti.co.jp. See also chapter 3 in Kneller 2007a.) Overall, a respectable two-thirds of patented University of Tokyo inventions are transferred to industry, but as the above indicates the vast majority of these transfers are by joint patent applications, not licenses.

¹⁰ However, direct and overhead support payments are both quite modest compared to the USA (Kneller 2007a).

¹¹ In the case of the University of Tokyo, seven start-ups actually based on University discoveries were formed in each of 2000 and 2001. By 2004 this number had fallen to two or three (Kneller 2007a). Using the more restrictive definition of start-ups actually *based upon licenses* from a university, no University of Tokyo start-ups were formed in 2005 or 2006, one or two were formed in 2007 and for all Japanese universities only 25-45 have been formed annually since 2005 (UTTAJ 2009).

Readers who are familiar with Japan may recall official government statistics showing over 200 university start-ups formed annually, at least during the first half of the decade. 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 start-ups as companies based upon university discoveries would require reducing the overall figure by 40 percent to 50 percent (Kneller 2007a). The definition used by UTTAJ is probably too strict however, and probably does miss some legitimate start-ups based upon university discoveries.

¹² For example by developing applications for their products, developing new technologies they can later buy and turn into new products, becoming customers, and developing workers with unique skill sets that may eventually be useful to them.

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