

Academic Technology Transfer

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Academic technology transfer is the passage of knowledge from its creator to another person or organization for some purpose or public benefit. Academic technology transfer occurs every day in a university, in the collegial exchange of research data between faculty members; the knowledge passed from the teacher to the student; faculty publications and reports; presentations of research results at conferences; expertise communicated to industry partners, and many other means. Academic technology transfer is the very heart of the traditional missions of academia: education, research and public service.

1. A More Focused Definition

A more focused definition of academic technology transfer has emerged in the last twenty years, perhaps with origins in the “Bayh-Dole Act of 1980,” an amendment to the United States patent code. This legislation enabled U.S. universities to claim ownership rights in intellectual property arising from research funded by the U.S. Government. To manage this intellectual property, U.S. universities began to focus upon the protection of their inventions through U.S. and international patent systems in the 1980s, and to enter into contracts with industry for the commercial development of these inventions. This bold experiment by the U.S. Congress was tremendously successful in achieving its goal of the commercialization of university inventions. As a result, the Bayh-Dole Act inspired many other countries in the 1990s to adopt their own systems for the commercial application of university research results. Accordingly today, “academic technology transfer” is generally understood to refer to the commercialization of university research results, and is defined in this paper as the transfer of university-owned intellectual property rights (IPR) to industry for commercial application and public benefit.

Academic research is the foundation for technology transfer, the “factory” that creates the potential “products” for commercial application. Some universities focus upon education and instruction only, and not upon research; such institutions do not conduct sufficient research to generate the quantity and the quality of innovation that warrant the creation of offices to manage intellectual property and technology transfer. For example, there were 2,363 four-year degree granting institutions of higher education in the United States in 2000.¹ Yet, only an estimated 200 universities in the United States accomplished sufficient research to warrant establishing a formal office or process to manage IPR and technology transfer.²

After more than twenty years of valuable experiences, the international Association of University Technology Managers (AUTM) today promotes four primary reasons for academic technology transfer:

- Facilitate the commercialization of research results for the public good
- Reward, retain and recruit faculty
- Induce closer ties to industry
- Generate income and promote economic growth³

2. The Academic Technology Transfer Process — The Foundation

2.1. Mission Statement

To begin with, a university must determine if its research base warrants a dedicated technology transfer initiative or office. In many cases, a university may possess some research with commercial potential, but not sufficient volume to create a dedicated commercialization service. In such cases, the institution might consider: (i) partnering with other universities in the region to create one program to serve all; (ii) assigning technology transfer activities to another office within the institution, such as the university’s research man-

agement office; (iii) partnering with local community economic development organizations, such as “techno marts”; or (iv) contracting with another capable organization to manage the limited opportunities.

This paper assumes that the university has sufficient research to warrant the creation of a dedicated technology transfer office or a “TLO”. A TLO must have a clear and well-understood mission statement to guide its activities and decisions. In a study recently conducted for the U.S. National Governors Association, Dr. Louis Tornatzky identified a “clearly articulated mission statement” as one of seven critical attributes of an exemplary TLO.⁴ The TLO’s mission statement should be brief, establishing its operational focus and setting the expectations of its customers. The TLO’s mission should also be consistent with the stated mission of the university. As an example, the mission statement of the TLO at The Texas A&M University System clearly identifies service to research faculty as its primary mission: “The TLO serves the faculty to transfer research results to commercial application for public benefit.”

2.2. *Policies and Procedures*

Next in importance in establishing a TLO are clear policies and procedures to provide guidance to the technology transfer process. Policies must be transparent to all of the university’s constituents (administrators, faculty, students, industry partners, government, the public, etc.). Clearly defined and easily understood rules defining ownership of intellectual property must be at the core of the policy. There is no “correct” way to define ownership. In fact, it is defined and managed differently around the world: some countries require institutional ownership of inventions; some countries reserve ownership for the faculty inventors; some countries stipulate that rights in inventions are jointly owned by the university and the faculty inventor; and some countries leave the determination of ownership to each university. In the United States, each university is free to choose its own rule regarding IPR ownership; in every university but one, the institution places ownership of IPR in the university (the exception is the University of Wisconsin). Regardless of the approach chosen, without clarity in the ownership of IPR arising from academic research, technology transfer is not possible.

Obviously, policies should address other issues critical to the success of academic technology transfer programs, such as distribution of income, the disclosure process, assignment of responsibility for seeking patent protection, management of potential conflicts of

interest, and many more requirements. As examples, the intellectual property policies for most research-intensive universities in the United States and in many other countries are found on the AUTM website (www.autm.net).

2.3. *Establishment of a Technology Licensing Office (TLO)*

The university’s mission statement and its IPR policies impact the internal infrastructure to support research and technology transfer. Internationally, there are many different forms of university technology transfer organizations, such as: (i) an office or department within the university typically described as a Technology Licensing Office (TLO), an Office of Technology Transfer (OTT) or some similar name; (ii) an external office, established either as a for-profit company (“UNICO” = <http://www.unico.org.uk/>) or a not-for-profit organization such as a foundation; (iii) both an external organization and a university office working together; and (iv) an external company to perform contract services for the university on a project-by-project basis.

The size of a TLO typically is reflective of the university’s research budget, the size of the subsidy provided to the TLO by a third party (government), or both. In 2002, the author published a paper entitled, “Financing Technology Licensing Offices,” which indicated that funding for TLOs is provided from many different sources from country-to-country, including government funding, private venture capital, third party philanthropic foundations, percentage of earnings and the like.⁵

3. **The Academic Technology Transfer Process — Operations**

3.1. *Identifying Innovations with Potential Commercial Value*

University research may lead to innovations with potential commercial value. The process for identifying innovations with commercial value should be clearly defined and understood in written protocols.⁶ A few U.S. universities employ individuals whose sole job function is to monitor faculty research, and to collaborate with faculty to identify research initiatives that may lead to innovations with potential commercial value. Yet, the most prevalent model in the United States is to rely upon the faculty researchers themselves to voluntarily bring forward their innovations to the attention of the TLO by submission of a formal “Disclosure of Invention.” The disclosure describes

the unique technical features of the discovery, as well as addresses certain questions impacting legal or contractual issues (correctly naming the inventors, identifying research contracts that funded the discovery, noting any publication dates, and the like). Most disclosure of invention forms utilized by U.S. universities are linked to the AUTM website.

Upon receipt of a disclosure, the TLO establishes a physical project file, and enters relevant information for the project into an electronic database. The project is assigned to an individual, typically called a project manager or licensing manager, to work closely with the inventor to develop a strategy for protecting and commercializing the invention.

3.2. *Evaluating Disclosures of Invention*

The first step in developing a commercialization strategy is to evaluate the invention, encompassing five broad areas of critical importance: (i) ownership of the innovation; (ii) the innovation's technical and development stage (an unproven idea versus a prototype, for instance); (iii) "patentability" of the innovation; (iv) the invention's market potential and its competition; and (v) the qualities of the inventor (enthusiasm, reputation, etc.).

The evaluation process may result in a number of results (this list of examples is not all inclusive):

- The TLO may determine that there is some barrier to commercialization that warrants closing the file. No further time, money or other resources are devoted to the project by the TLO. The TLO may provide a "Release of Rights" to the inventor upon request.
- A corporate research sponsor may hold a first right to pursue commercialization.
- The TLO may file a patent application immediately to protect the innovation. This decision might be made upon the basis of a number of factors, such as a pending publication date, other institutions conducting very closely related research, the perceived market value of the innovation and the like.
- The TLO may enter into negotiations with a licensee identified in the evaluation process, before or after filing a patent application. In the event that negotiations ensue before a patent application is filed, a Nondisclosure Agreement is utilized to protect the "patentability" of the invention during negotiations.

3.3. *Protecting Intellectual Property Rights*

Patent prosecution is an expensive process. Very few if any TLOs have unlimited resources to file patent applications for every disclosure or innovation received from faculty. Difficult decisions must be

made, as described above in the evaluation process. Funds are placed "at risk" by the university when it has no immediate source of external funding to prosecute an unlicensed invention. Finally, the patent prosecution becomes even more expensive if international patent protection is sought.

TLOs secure funding for patent applications from many different sources. In some countries, the national or regional government provides the funding. In some countries, philanthropic foundations provide money to TLOs for patent applications. In some countries, patent expenses are sometimes funded from royalty income accumulated by the TLO. Furthermore, even within one country, the funding of patent expenses may be managed differently from one university to the next. For instance, in the United States, while no government funding is provided for patent expenses, TLOs pay such expenses from a variety of sources: from royalty income, by the university itself (typically in an annual patent budget), or from the inventor's college or department. The model utilized varies from university to university.

Likewise, the level of patent expenditures varies greatly from one institution to another, impacted by factors such as the patent budget, the research budget, the income stream to the TLO, the number and quality of invention disclosures, and the institutional success in licensing. The AUTM Annual Licensing Survey for FY2000 indicated that among the Top 25 Research Universities in the United States, legal expenses incurred by the TLO as a percentage of the institution's sponsored research ranged from 1.65 percent to approximately .05 percent.⁷ Analyzed in another way, legal expenses incurred as a percentage of license income among the Top 25 U.S. Research Universities in FY2000 ranged from almost 95 percent to less than 10 percent of the income stream. Finally, analysis of data in the AUTM Licensing Survey for FY2000 reveals that the percentage of disclosures for which patent applications are filed varies from institution to institution, ranging from 100% to 45% of invention disclosures.⁸

3.4. *Transferring University Innovations to the Corporate Sector*

Traditionally, faculty members claim "academic freedom" to research topics of interest within their area of scientific expertise for the advancement of knowledge and the education of students; these research interests may have no relevance to the commercialization interests of the TLO. Industry-funded research is more likely to result in technology with commercial application

than is research funded from other sources. In a landmark study published in the 2000 *AUTM Journal*, economists Jerry and Marie Thursby reported the results of a survey of hundreds of companies that had licensed academic inventions. When asked how they became aware of the innovation eventually licensed from a university, the companies most often cited the personal relationship between their employees and employees at the subject university. Second, the companies reviewed peer journals in the relevant field, as well as issued patents, and contacted the author or inventor if there was commercial interest in the innovation described in the publication. Finally, the marketing effort of a TLO was of last and least importance to the companies in identifying an innovation of importance to the company. These survey results indicate at least two important recommendations. First, as an “industry,” university technology transfer professionals continually should seek better ways in which to market their portfolio of technologies. Second, the faculty inventors rather than the TLO are the most effective marketing agents, and subsequently, TLOs should support the faculty members’ research interests in all ways possible.⁹

Despite the results of the Thursbys study, many presentations at technology transfer workshops are devoted to how TLOs can better market their portfolio of technologies “available for licensing.” The obvious goal is to identify one or more industry partners willing to devote time and valuable resources to develop a commercial grade product from university research. Other points to consider in marketing follow:

- When the research which led to the invention is sponsored by an industry partner, then the choice for transfer of the innovation is usually determined by the research contract.
- TLOs must be talented in conducted market research to help them identify market segments, applications and potential licensees for an invention. Marketing information may come from a variety of sources including but not limited to the TLOs own list of contacts and friends; databases (public databases and commercial database services); and the inventor, the inventor’s students and the inventor’s former students.
- Upon identification of potential licensees, the TLOs marketing efforts only begin. The TLO must next identify the individuals whom to contact within the companies. potential corporate partners. Should first contact be made with the corporate president, the director of marketing, the director of R&D, or the chief scientist? There is no easy answer to this ques-

tion other than “enter as many doors as possible” in a large corporation, hoping that one will open to the licensing opportunity!

- Marketing tools such as invention briefing papers, press releases, direct mail campaigns, participation in industry trade shows, posting of the technology briefings on the internet, and the like are often utilized by TLOs to identify and reach the industry contact person.
- Once identification of a contact person in the company has been made, “face-to-face” contact is most appropriate when possible to introduce the opportunity.

Finally, as stated above, the goal of all of these marketing efforts is to find a company willing to devote the time and resources to the university innovation to the marketplace; negotiations with that prospective partner now begin.

3.5. *Negotiating License Agreements*

The basic principle of negotiation is that the university transfers its intellectual property rights in an invention to a licensee (assuming an exclusive licensee) for consideration provided by the company to the university and a firm commitment by the licensee to take the product to the market. Many books have been written to explore this very basic principle, including topics such as drafting license agreements and negotiation strategies. Some basic principles of university licensing follow:

- Because university innovations are embryonic or “early stage,” focus is often placed upon “performance milestones” to be achieved by the industry partner in order to maintain or hold the license. Such milestones are critical to achieving the public mission of universities.¹⁰
- The management of patent rights is an additional focal point for negotiation. Universities often seek to license inventions before a patent filed for the invention has issued, impacting the value of the transaction, but placing risk upon the licensee. In such case, the license agreement typically terminates if the patent fails to issue.
- The “type” of technology often determines whether the university will negotiate for an exclusive or non-exclusive license. Innovations that may result in proprietary products are most often licensed exclusively, while biotech tools, software and other basic technologies (as opposed to proprietary products) may be licensed non-exclusively.
- Furthermore, an exclusive license is often necessary to induce the investments necessary to commercial-

ize the invention and benefit the public, the primary goal of technology transfer.

Once a contract is negotiated and executed, the work of the technology transfer office is not concluded. The TLO must record, monitor, manage and maintain the agreement. Contract management requirements include both fiscal requirements (payment of fees and royalties, reimbursement of patent expenses, etc.) as well as performance milestones and other non-fiscal requirements. In the United States, the magnitude of work in management of the portfolio of accumulated license agreements over time has resulted in the creation of both accounting offices and paralegal offices within the larger TLOs. The scope of the work has grown as well to include such functions as “accounts payable” and “accounts receivable,” auditing of licensees, protecting the university in the event of bankruptcy of the licensee, assuring that the licensee achieves performance milestones, assuring that the licensee does not become delinquent in its payments, amending or terminating existing contracts for any number of reasons as might be set forth in the agreement. Additionally, electronic and “relational” database management systems — focused upon the needs of technology transfer offices — are now available to manage all of these complex details.

4. Conclusions

In the introduction to this paper, academic technology transfer was defined as “the transfer of university-owned intellectual property rights (IPR) to industry for commercial application and public benefit.” And as demonstrated in this paper, academic technology transfer is complex in implementation. Offices established to manage this process typically have many individuals and organizations to which they must be accountable in some way, such as the university administration, the faculty inventors, industry, the government, and the public. Many of these individuals and groups have growing expectations, and in some cases, competing expectations. In general, it can be concluded that the complexity of academic technology transfer increases every year, as the importance of intellectual property to the academy increases and as more variables outside the control of the university are introduced. Despite the many challenges, academic technology transfer is growing in importance and activity around the world. The countries active in this arena — such as the U.S. and Japan — increase their performance statistics every year. Additionally, many organizations — such as the World Bank, the World

Intellectual Property Organization, private philanthropic foundations, and government agencies — are working to assist developing nations to create academic technology transfer programs. The future for academic technology transfer is very positive!

References

- 1 National Center for Education Statistics, <http://www.nces.ed.gov//pubs2002/digest2001/tables/PDF/table005.pdf>
- 2 In FY2000, 167 U.S. universities, hospitals and research institutes responded to the AUTM Licensing Survey.
- 3 www.autm.net
- 4 Louis G. Tornatzky, “Building State Economies by Promoting University — Industry Technology Transfer,” National Governors Association, 2000. http://www.nga.org/center/divisions/1,1188,C_ISSUE_BRIEF^D_653,00.html
- 5 See <http://www.oecd.org/dataoecd/17/56/16212536.pdf>, pages 63–67.
- 6 The written protocol for IPR management by the TLO for The Texas A&M University System may be found at: <http://tlo.tamu.edu/documents/INFO/tloprotocol.pdf>
- 7 IPR evaluation and IPR valuation are quite different and distinct processes. Evaluation seeks to assess the opportunities for identifying a corporate partner for commercialization of an invention. Valuation seeks to assign a monetary value to the innovation. In the United States, TLOs spend much time on evaluation, and very little time on valuation. Evaluation is critical for making patenting decisions and developing commercialization strategies, while valuation holds little value to the TLO, as the monetary value of the invention is determined by “what the market will bear,” and not by analytical economic studies.
- 8 A disclaimer must be made: there is not a strict “one-to-one” relationship for Disclosures filed with the TLO in any year and the Patent Applications filed by the TLO in the same year. For instance, a Disclosure filed with the TLO in 2003 might not be filed as a patent application until 2004. Additionally, a single Disclosure filed with the TLO may result in multiple patent applications, including but not limited to Continuation-in-Part Applications and Divisional Applications. These circumstances account for four institutions among the Top 25 Research Universities filing more patent applications than Disclosures of Inventions received in FY2000.
- 9 Jerry and Marie Thursby, “Industry Perspectives on

Licensing University Technologies; Sources and Problems,” Jerry and Marie Thursby, *AUTM Journal*, XII, 2000. (http://www.autm.net/index_ie.html)

10 The most predominant characteristic of university technology is its “embryonic stage of development,”

requiring partners committed to a significant product development effort. Richard Jensen and Marie Thursby, “Proofs and Prototypes for Sale: The Tale of University Licensing,” Working Paper 6698, National Bureau of Economic Research, 1998.