VOLUME XI
1999

Journal of the Association of University Technology Managers

AUTM®

Association of University Technology Managers, Inc.

VOLUME XI
1999

Journal of the Association of University Technology Managers

AUTM®

Association of University Technology Managers, Inc.

VOLUME XI
1999

Journal of the Association of University Technology Managers

AUTM®

Association of
University
Technology
Managers, Inc.

1999 AUTM OFFICERS

PRESIDENT
Louis P. Berneman
University of Pennsylvania

IMMEDIATE PAST PRESIDENT
Karen Hersey
Massachusetts Institute of Technology

PRESIDENT-ELECT
James A. Severson
University of Minnesota

VICE PRESIDENT-AFFILIATE MEMBERS
Linda Kawano
GroupOptima

VICE PRESIDENT-COMMUNICATIONS
Beatrice Bryan
University of California, Irvine

VICE PRESIDENT-EXTERNAL RELATIONS
Terry A. Young
Texas A&M University System

VICE PRESIDENT-FINANCE
Sandra L. Shotwell
Oregon Health Sciences University

VICE PRESIDENT-MEMBERSHIP
Jon Sandelin
Stanford University

VICE PRESIDENT-PLANNING
Kathleen A. Denis
Allegheny Singer Research Institute

VICE PRESIDENT-PROFESSIONAL DEVELOPMENT
Connie M. Armentrout
University of Oklahoma

VP-CANADA
Janet E. Scholz
University of Manitoba

VP-CENTRAL REGION
Anne C. DiSante
Wayne State University

VP-EASTERN REGION
Patricia Harsche
Fox Chase Cancer Center

VP-WESTERN REGION
Catherine J. Hennings
Fred Hutchinson Cancer Research Center

**Journal of the
Association of University Technology Managers**

Volume XI **1999**

Editor's Preface vii

Opening Remarks to the U.S. Senate Committee on Commerce, Science, and Transportation
by Teri F. Willey 1

Plant Intellectual Property Transfer Mechanisms at Universities
by Steven C. Price and Bryan Z. Renk 5

Federally Registered Trademarks Add Value to Technology
by Ellen P. Winner 25

Personal Impressions of China
by Terry A. Young 39

Where do the Leads for Licenses Come From? Source Data from Six Institutions
by Christina Jansen and Harrison F. Dillon 51

A Suggested Method for Assessing the Economic Impacts of University R&D: Including Identifying Roles for Technology Transfer Officers
by Albert N. Link 67

Instructions for Contributors 93

Editor's Preface

It is my hope that the readers of this issue of the *Journal* will notice, when glancing at the Table of Contents or turning directly to a paper, that there is a difference in this issue of the *Journal*. The difference is that two contributions have more of a personal tone to them than articles of the past.

Teri Willey's remarks to a subcommittee of the U.S. Senate Committee on Commerce, Science, and Transportation appear first. Succinct, clear, and convincing, this record of Teri's oral remarks will serve as an encapsulation of the impact of federal R&D on university technology transfer and small business. If each member substitutes his or her own university's facts for those of ARCH Development Corporation, he or she could use these remarks to enlighten his or her own community whether academic, business, or governmental.

The other novel contribution by a member is Terry Young's personal impressions of his visit to China as part of a U.S. Delegation, which undertook to share information on technology transfer with the Chinese. Other members of the Delegation might well have different or even opposite impressions. Nevertheless, the *Journal* Board believed Terry's impressions would be of interest and value to members, many of whom will have experiences in China in the future.

Two other papers carry out one of AUTM's foremost missions: to teach members and keep them informed. Steven Price and Bryan Renk present an enlightening comparison and analysis of the two systems of technology transfer that often operate side by side—one for plant varieties and one for "everything else." Even members who do not work with agriculture research and products will find this article interesting and full of information that all members should know. Another very instructive paper, this one by Ellen Winner, makes a convincing case for registration of trademarks as part of the overall licensing strategy for increasing value in technology. Forward-looking and engaging, Ellen's paper is a must read for every member.

Opening Remarks

U.S. Senate Committee on Commerce, Science, and Transportation
Subcommittee on Science, Technology, and Space
Hearing on Federal R&D-April 15, 1999.

Technology Transfer and Licensing Activities of ARCH Development Corporation and the Impact of Federal R&D Technology Transfer Programs on Universities and Small Business and Related Issues

Teri F. Willey*

Thank you Dr. Frist and members of the Committee.

I was asked to speak to you today about the licensing and new venture creation activities of ARCH Development Corporation, and how university technology transfer efforts leverage our Federal R&D investment.

At this time I would like to request that my written testimony be made part of this record.

One of the themes of this hearing today is how Federal R&D fuels innovation in science. Yes, Federal R&D fuels innovation...and not just in our university laboratories. It fosters innovation in teaching, business transactions, academic administration, and policy making.

* *Teri F. Willey is Vice President, ARCH Development Corporation, University of Chicago, Chicago, IL 60637.*

This area of new venture creation is of considerable interest to ARCH. ARCH formed in 1986 to engage in new venture creation and licensing on behalf of the University of Chicago and Argonne National Laboratory. Since 1986 ARCH:

- formed and provided seed support for 25 companies,
- generated $25 million in returns directly from its start-ups and licenses,
- half of the returns are from equity—indicative of a few successful exits, and
- half of the returns are from licensing—indicative of products reaching the market.

Interestingly, about half of our royalties come from products developed or sold by companies formed by ARCH.

In addition, ARCH spawned an early-stage venture capital partnership and, through a robust relationship with the Graduate School of Business, has provided entrepreneurial experience and training to numerous students, including graduate students in life and physical sciences as well as business.

Our licensing activities are fairly typical compared to most university programs. Our new venture creation activities are not. In addition to licensing to start-ups formed by others, ARCH has, from its inception, taken it one step further and created its own licensees. In the Midwest, where there is limited infrastructure for this type of endeavor, we believe it is critical to be proactive in creating new companies, and in supporting and even causing the availability of early stage seed or "gap" funding for these ventures.

ARCH and its university counterparts have had some success. We have the capacity to be much more successful in leveraging our Federal R&D investment. We will be successful, if we continue to be innovative in addressing the challenges in this field—they are numerous and they are daunting.

Plant Intellectual Property Transfer Mechanisms at Universities

Steven C. Price*
Bryan Z. Renk*

INTRODUCTION

The release of plant materials as new plant varieties from U.S. universities has traditionally involved agricultural experiment stations associated with colleges of agriculture. This pattern has continued even though many universities have technology transfer offices that handle all other inventions. It is still common to find, therefore, especially at land-grant institutions, two "systems" of technology transfer—one for plant varieties and the other for "everything else."

These two systems of technology transfer have their own traditions, cultures, and administrations, and at many campuses interact only with great difficulty and misunderstanding.

The seeds of disagreement are rooted in a long history that begins with public sector initiatives concerned with quality control. In the United States, the first government investments in plant breeding followed the establishment of the land-grant colleges and state agriculture experiment stations through the 1862 Morrill Act and the 1887 Hatch

* *Steven C. Price is Director, University-Industry Relations, University of Wisconsin-Madison, Madison, WI 53705. Bryan Z. Renk is Licensing Associate, Wisconsin Alumni Research Foundation, University of Wisconsin-Madison, Madison, WI 53705.*

These new activities have met with considerable resistance from parties that have been accustomed to releasing plant varieties freely and without restraint. Indeed, many believe that proprietary concerns will interfere with scientific exchanges of genetic material with a resulting decrease in the advancement of the plant sciences.

This situation has become further exacerbated by international events, most importantly concerns about access to foreign genetic resources, brought to the public's attention as a "hot button" issue by the June 1992 United Nations Earth Summit in Rio de Janeiro, Brazil. Approximately 170 countries, excluding the United States, have signed the Convention on Biological Diversity, whose objectives are:

> ... conservation of biological diversity... the sustainable use of its components... and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources... including... appropriate access to genetic resources... appropriate transfer of relevant technologies... and by appropriate funding.

Article 15 (7) states that:

> Each contracting party shall take legislative, administrative... measures... with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources... upon mutually agreed terms.

The language of the Convention clearly acknowledges the desire for sharing monetary benefits and recognizes the need for intellectual property protection as being important for this end.

Article 16 (2) states:

> Access to and transfer of technology... shall be provided and/or facilitated under fair and most favorable terms, including on concessional and preferential terms where mutually agreed... In the case of patents and other intellectual property rights, such access... shall be provided on terms which recognize... adequate... protection of intellectual property rights.

Figures 1 and 2, appearing at the end of this paper, summarize intellectual property flow and business decisions that integrate these technology transfer systems. A discussion of the history of these systems and their utility follows.

DECISION POINTS

Figure 1 shows a decision tree flow for plant intellectual property. Four non-mutually exclusive elements—contracts, plant patents, plant variety certificates, and utility patents—are distinguished.

Plant Intellectual Property: Contracts

Plant varieties are protectable as "trade secrets" and can be released on a contractual basis using terms that are similar to license agreements (see related discussion in Licensing section). Such releases have the advantages of timeliness and low cost. However, disadvantages result because the strength of the protection is only as good as the laws in the state or country in which the terms of the contract are governed. This mechanism historically has been and continues to be heavily used by the U.S. seed industry.

Plant Intellectual Property: Plant Patents

Before the 1920s, there was little private investment in applied breeding/variety development in the United States because it was impossible for the private breeder to maintain control over a new variety once it was marketed. This situation arose because vegetatively-propagated and open-pollinated varieties could be easily multiplied, renamed, and sold. Without exclusive control, the private firm was not able to recoup the costs of variety development.

Interestingly, private cereal and fruit breeders lobbied for a plant patent system as early as 1885. In 1905, plant patent legislation was considered but never progressed beyond a U.S. House of Representatives Committee.

that time, private industry interest in breeding self-pollinated crops had substantially increased. A number of private firms had initiated successful marketing efforts based on certified and uncertified, branded seed. Additionally, several European countries had implemented successful plant breeders' rights laws for sexually-reproduced species. Moreover, in 1961, six European nations formed the Union for the Protection of New Varieties of Plants (UPOV) to provide an international framework for national plant breeders' rights legislation; this was called the UPOV Convention.

In 1969, the American Seed Trade Association introduced a bill to Congress based on European plant breeders' rights laws. The bill was successfully passed into law the following year as the Plant Variety Protection Act (PVPA). On October 6, 1994, the law was amended, and went into effect April 4, 1995. Under the new law, the USDA will issue a certificate of plant variety protection to the developer of a sexually-reproduced variety that exhibits novelty, uniformity, and stability. The term is from date of issue and is 20 years. With trees and vines the term is 25 years. It also covers F1 hybrids and tuber propagated plants, such as potatoes.

Enactment of the PVPA also added Title V to the Federal Seed Act. The clause means that if Title V is selected by the originator on the plant variety protection application, the seed must be sold as a class of certified seed, and the seed must bear the name of the variety stated in the certificate of plant variety protection.

Although the PVPA was modeled on the utility patent statute, it provides less protection because of two exemptions. The "research exemption" allows breeders to use protected varieties for research purposes and to develop new varieties. The "farmers' exemption" allows a farmer who is primarily a commodity producer to plant the progeny seed of a purchased protected variety on his farm or to sell the seed for other than reproductive purposes. A Supreme Court ruling that was instrumental in evaluating the farmers' exemption was *Asgrow Seed Co. v. Winterboer*, 115 S.Ct. 788, 33 USPQ2d 1430 (1995).

market value, or if the expected return is not at least $2,750 (the approximate cost of filing a plant variety protection application), then perhaps a contract release (trade secret) would be the most appropriate transfer mechanism.

2. If the invention to be protected is only a variety of medium value, then a certificate of plant variety protection may be most appropriate—a plant variety protection certificate costs approximately $2,750 for each variety versus a utility patent in excess of $10,000.

3. If there are a number of varieties involved, or if there is a basic invention that could be extended to a number of varieties if not species, then a utility patent may be the best protection.

Figure 2 shows a business flow involving the intellectual property, whether protected by contract, plant variety certificate, or patent. Also note that companies can use foundation seed organizations and crop improvement foundations as sources of seed.

SOURCES OF SEED

Seed Certification

Before the turn of the century it was difficult to find supplies of pure seed of new varieties that had been produced, tested, and released by the state experimental stations. Moreover, the general concept of varietal purity was not widely appreciated by farmers and seedsmen. Within three to four years of release, a new variety would generally lose its genetic identity and become worthless to the farmer. Also, new introductions were often renamed by those who used and sold them. For example, the USDA reported that a variety of wheat called "Futz" that was distributed by the USDA in 1871 was being grown a few years later under 24 different names. The main reason for this situation was that there were no standard procedures for insuring the production and distribution of new varieties under a single name and in genetically pure lots.

The Federal Seed Act was amended in 1969 to deal with differing standards among state certification agencies. The amendments established genetic purity as the minimum basis for certification by an officially-recognized certification agency. Certification agencies could either certify all seed for genetic purity only or could also impose additional seed quality standards. The amendments also required all certified seed to bear a label issued by the official certification agency depicting the variety and class.

Today the classes of seed used by certification agencies are breeder, foundation, registered, and certified seed. Breeder seed is from the developer or breeder. Foundation seed originates from breeder seed. Registered seed is grown from foundation seed and cleaned by the originator or an approved seed conditioner, and bagged, tagged, and sealed when sold. Certified seed can be grown either from registered or foundation seed, cleaned by the originator or an approved seed conditioner, and bagged, tagged, and sealed when sold.

State seed laws may go beyond the Federal Seed Law and require that all seed, whether certified or not, be labeled under one variety name only. Such is the case in Minnesota.

Today most states have an official seed certification agency that inspects fields for purity and regulates the production and labeling of foundation, registered, and certified seed.

However, with the growth of the private sector, many companies now have their own in-house quality control programs. The present trend could lead to a time when all varieties sold may be privately developed and noncertified. Attitudes of both large and small seed companies to certification vary. For some companies, there may be a continuing niche for seed certification, such as with varieties for specialty markets. Certification is also important for being able to export seed.

A quality assurance program is an additional service offered by state certification agencies in Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, and Missouri. These quality assurance programs are for seeds that are not certified, but are similar to those for seed that is that the company selling the variety did not name it, and therefore probably did not develop it. However, this is subject to state law; a number of states do not allow VNS.

Branding is an issue that raises a number of controversial considerations, one of which revolves around the issue of multiple naming of a single variety. The basic logic for branding is that it may serve as an inducement to companies to market a specific variety. The negative aspects of a variety being marketed under more than one name must therefore be balanced with the positive aspects of greater potential public usage.

ISSUES

In deciding how to select between these non-mutually exclusive options, consider the following points:

1. Does the marketplace or potential licensee(s) need certified seed? Many seed companies have their own quality control units and don't need the services of a certification agency. Others prefer it. Are there political factors within the state that push towards using their certification systems?

2. Does the licensee(s) need to be "incentivised" to market by allowing "branding"?

3. Is there going to be a fair amount of development work required? If so, perhaps the incentive of an exclusive license is required. Does any one licensee have the ability to cover an entire market? If not, perhaps non-exclusivity is best.

4. Is there a traditional method used for a particular crop? It may be the best way to license the variety.

LICENSING

The license agreement is the "capstone" that can hold various negotiated terms together. The license itself is a grant to some portion of another's rights for a prescribed period of time. A license agreement

Local Planting Politics. Pressure may be exerted from local constituencies to restrict commercial production to specific regions; license agreements again can specify this kind of item.

Royalty Distributions. One sometimes hears the objection to patenting or certificates of plant variety protection because of opposition to royalty collection. This goes back to the attitude of being public servants and releasing material free or for minimal compensation. Although this has nothing to do with the patent or certificate of plant variety protection *per se*, the amount and distribution of royalties can be specified in the agreement—how much to the inventors, how much for research, etc.

Other documents that are becoming more common when handling plant intellectual property include confidentiality agreements and research agreements. Prior to the filing of patent applications, confidentiality agreements can be executed with a potential licensee, simply acknowledging that the information to be shared is confidential and is not to be used by the potential licensee for economic purposes. The sharing of seeds themselves can be preceded with research agreements that acknowledge that the seed is to be used for research purposes, and that intellectual property rights reside with the originator. For example, once patent applications are filed, the content of the patent application can be shared with other researchers with little concern for losing one's competitive advantage because the date of filing constitutes a legal priority date in most foreign countries. The content of the patent application itself is published in most countries outside the United States after 18 months, prior to the issuance of a patent.

SUMMARY

In the future, all releases of plant varieties will be required to move through the same types of decision trees as we have presented here. Specifics may change from country to country, but these basic elements will need to be considered. Obtaining intellectual property protection, and negotiating and executing license agreements may increase

REFERENCES

Baenziger, P.S., R.A. Kleese, and R.F. Barnes, eds. *Intellectual Property Rights: Protection of Plant Materials.* Madison: Crop Science Society Association (CSSA) Number 21 (1993).

Bayh-Dole Act, 35 U.S.C. §§ 200-212.

Doyle, J. *Altered Harvest.* New York: Penguin, 1985.

Fed*eral Seed Act*, 7 U.S.C. §§ 1551-1611, *et.seq.* (1988). (Title V can be found at § 1611).

Hackleman, J.C. and W.O. Scott. *A History of Seed Certification in the United States and Canada.* Raleigh: Association of Official Seed Certifying Agencies (AOSCA), 1990.

Juma, Calestous. *The Gene Hunters: Biotechnology and the Scramble for Seeds.* Princeton University Press, 1989.

Kelly, A.F. *Seed Planning and Policy for Agricultural Production.* London: Belhaven Press, 1989.

Kloppenburg, J.R. *First the Seed: The Political Economy of Plant Biotechnology.* New York: Cambridge University Press, 1988.

McDonald, M.B. and Pardee, W.D. eds. *The Role of Seed Certification in the Seed Industry.* Madison: CSSA, 1985.

Plant Variety Protection Act, 7 U.S.C. § 2321 *et seq.* (1988).

Price, Steven C. "Survey Reveals Divergent Views on the Impact of the Convention on Biological Diversity on U.S. Plant Research Programs," *DIVERSITY,* Vol. 14, No. 3&4.

Stuber, C.W., G.H. Heichel and D.E. Kissel, eds. *Intellectual Property Rights Associated with Plants.* Madison: American Association of Agronomy (ASA) Special Publication Number 52 (1989).

U.S. Department of Agriculture, *Plant Variety Protection Act and Regulations and Rules of Practice.* Washington, D.C., 1997.

Business Flow-Decision Tree

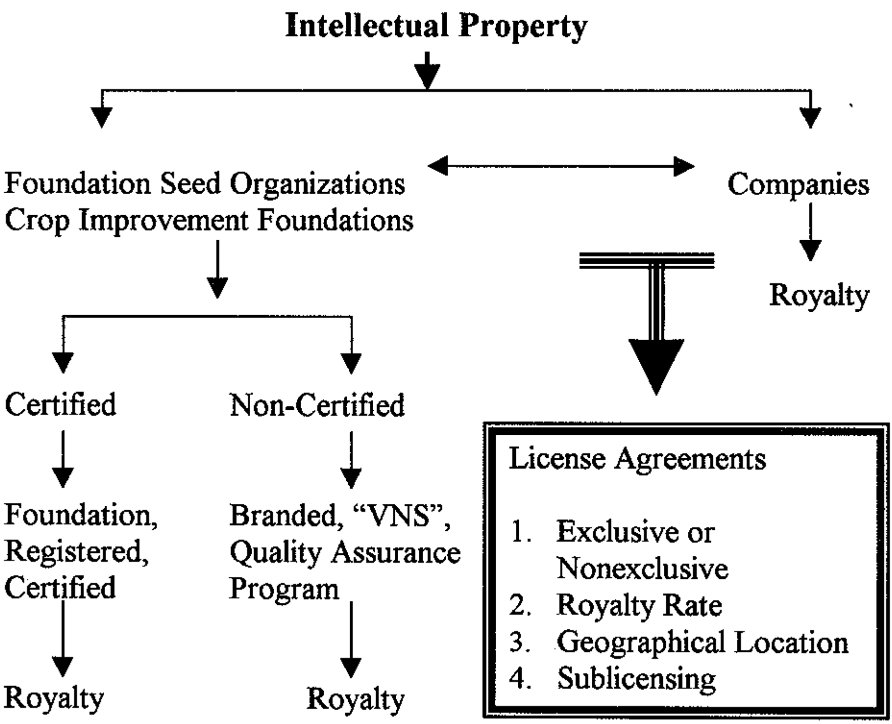


Figure 2

Federally Registered Trademarks Add Value to Technology

Ellen P. Winner*

Trademarks are brand names such as Coca-Cola Company's "COKE®" for soft drinks and 3-M's "POST-IT®" for sticky notes. Brand names used for services, such as "HOLIDAY INN®" for hotel services owned by Holiday Inns, Inc., are trademarks for services, sometimes called "service marks." The natural habitat for trademarks is the marketplace where products and services are being sold to the public. Why should they be found in a research institution's portfolio of technologies, most of which have a long way to go before reaching the final consumer?

IN-HOUSE TECHNOLOGY NICKNAMES CAN BECOME TRADEMARKS

A trademark is not fully born in the United States until it has achieved *bona fide* use in commerce, but many technologies pick up nicknames while still in early development. For example, computer programmers often name their programs long before the bugs are worked out well enough to go to market. Other technologies too—such as Nexstar's "SELLEX™" process—are named while still in embryonic form. These nicknames often become known in the industry through conference talks and publications. Sometimes they are catchy enough or have gained enough public recognition by the time the technologies are ready to license to be of real monetary value.

---

* *Ellen P. Winner is a Patent Attorney at Greenlee, Winner and Sullivan, P.C., Boulder, Colorado 80303.*

ago, federal trademark law allowed only entities that were actually using marks in commerce to apply for registration.

Fortunately for inventors and research institutions, however, the law now allows *applications* for federal registration based on the applicant's "intent to use" a mark in commerce. This intent must be a *bona fide* intent to use the mark in commerce. Although research institutions typically never intend to market goods and services and use trademarks themselves, the U.S. Patent and Trademark Office has taken the position that an applicant can have a *bona fide* intent to use a mark even when the intended use is through a licensee or potential licensee. This allows technology transfer managers to file applications for federal registration of trademarks on behalf of their institutions before products or services reach the market and even before a licensee has been found. The value of technology nicknames that are particularly apt or well recognized in the field can thus be captured for the institution.

To add value to such a mark in the eyes of potential licensees, before registration and actual use, the institution should encourage inventors, developers, licensing staff and others to use the mark properly and consistently in written materials and oral presentations whenever possible. The initials "TM" can be used as a superscript for the mark when it appears in printed form before it is registered. The "®" can be used only after the federal registration has issued. Trademarks should always be used as adjectives, and never used as nouns. That is, a computer program should be referred to as, for example, "the GIGO program" rather than as "the GIGO." An assay method should be called, for example, "the DETECTO assay," not "the DETECTO." This is particularly important when a mark is used for patented technology that is intrinsically unique. The generic name for the goods or services should always be used in combination with the trademark even if it sounds awkward and it is a struggle to find generic terms to describe the technology. If a trademark becomes the generic name for the goods because of improper usage of it as a noun, it is no longer protectable and falls into the public domain. Former trademarks, like "elevator" and "aspirin," have lost their value through improper usage.

although words that are suggestive of the product without being descriptive are also good, such as "ECOCRYL®" for paint and "XYMMUNE®" for assay equipment.

An application to register a trademark based on “intent to use” should be filed no more than three to four years before actual use of the mark in commerce is expected to begin. Typically it takes about nine to eighteen months for the U.S. Patent and Trademark Office to examine the application. As in the case of patents, Office Actions are routinely issued on trademark applications, and may require a consultation with an attorney to craft appropriate arguments in favor of registrability. After the Trademark Examiner is satisfied that the mark is registrable, the mark is published in the U.S. Patent and Trademark Office *Official Gazette*. Any third party who feels it would be damaged by issuance of the registration has thirty days in which to file an opposition. If no oppositions are filed, which is usually the case, a Notice of Allowance will be issued.

The Notice of Allowance gives the applicant an initial period of six months to prove actual use of the mark in commerce. This period can be extended in six-month increments, with the payment of a fee, for a maximum of thirty-six months. After the first extension, the applicant must include an explanation of the steps being taken toward commercialization in each request for extension. A federal registration is issued only after a Statement of Use with evidence of actual use in commerce (i.e., labels for goods actually sold in interstate commerce, or advertisements for services actually performed for others) has been filed.

It is recommended that the technology transfer manager have a written licensing plan in place prior to filing the trademark application because 1) the applicant must have a *bona fide* intent to use the mark as a prerequisite for filing and 2) it will usually be the case that the identity of the licensee(s) through which the use is intended is not known at the time of filing the application. The licensing plan can be used as evidence in the event that the registration is ever attacked for an alleged lack of *bona fide* intent to use the mark in commerce. Such an attack may be mounted region of the country before the owner's federal registration has issued, then the third party will be allowed to continue using the mark in that region. Its superior rights are based on its first use in commerce in its trade area. However, the owner of the federal registration can prevent the original third party user from expanding its sales territory.

MAINTAINING AND LICENSING TRADEMARK RIGHTS

Provisions granting a license to use trademark rights may be incorporated into technology license agreements covering patents, trade secrets and/or copyrights. Separate trademark license agreements may also be used. Trademark rights can last longer than patents or even copyrights, as long as the mark continues to be used in commerce. Thus, the trademark portions of a license agreement should not be set to expire with the expiration of the other rights. In addition, the trademark license agreement should allocate responsibility for the many requirements of maintaining valid trademark rights, as discussed below.

Obligation to Use

Registering a trademark alone is no guarantee of its continued value. The value depends on continued use of the mark in commerce. Identical goods or services can be sold under any number of different trademarks. A licensee can choose a different mark than the one used by the developers and registered by the research institution. Because the licensee is the entity using the new mark in commerce, the licensee can register it in its own name and own it, and the old mark owned by the institution will become abandoned and the registration subject to cancellation for non-use. The only way to protect against the licensee using a new mark of its own choosing, of which it can be the sole owner, is contractually with a specific provision in the license agreement. A licensee could, of course, refuse to agree to such a provision depending upon the value of the mark being licensed.

inspect the goods or services. The licensor must actually have the legal right to require the licensee to make changes to meet its quality standards. In the case of software, requiring the licensee to submit copies of any updates to the technology transfer office or faculty who developed the software for checking minimal attributes of screen presentation and the like and requiring the licensee to implement the institution's suggestions should be sufficient. Similarly, samples of product, or procedure manuals in the case of services, could be required on a periodic basis for review by the technology transfer office or relevant faculty. Again, only a minimum of factors should be checked for quality by the institutions. This is to avoid liability for defective goods and services (discussed in the following section). A trademark license must always recite a quality control provision.

Liability for Defective Goods and Services

Because of the legal requirement that a trademark owner control the quality of the goods or services provided to the public under the mark, courts have in some cases found the trademark owner to be legally responsible for personal injury or property damage resulting from defective products or services. Many of these cases have arisen in the context of franchise situations rather than simple trademark licenses. One basis courts have used for assessing liability is a finding that the licensee was an agent or apparent agent of the trademark owner. Thus license agreements should explicitly state that the licensee is not an agent of the institution and that the licensee must never represent or suggest to the public that it is the research institution's agent.

Another basis for finding liability is the warranty codified in Article Two of the Uniform Commercial Code that may be imposed on anyone having control over the product or acting as a "link" in the business of placing the goods in commerce. The license agreement should disclaim all warranties, express or implied.

Negligence in setting quality standards may also be used to find liability of a trademark owner. In some cases courts will use a

REGISTRATION IN OTHER COUNTRIES

Most foreign countries allow registration of trademarks without showing that the mark has actually been used in commerce. If it is contemplated that technology will be patented and licensed abroad, then trademarks associated with the technology can be similarly protected abroad. Although no proofs of use are required for registration in most foreign countries, it is usually possible for third parties to petition to cancel foreign registrations if the mark has not been used for several years, just as is true in the U.S. The situation abroad as a practical matter is much like that in the United States. Ultimately, continuing trademark rights depend on continuing use of the mark in commerce. Requirements for registration in several countries where markets for technology typically exist are discussed below.

Canada

Unlike most countries, Canada has more stringent requirements for trademark registration and maintenance than the United States. Canada does allow applications for trademarks based on "intent to use." Within six months from allowance of the application or three years from filing the application, whichever is later, actual use of the mark in commerce in Canada must be proved. Actual use may be done by a licensee. Extensions of time are possible only for "substantial reasons," so it is important to make sure the licensee can put the mark in use within the next three years before filing the application. Licenses must contain quality control provisions, and "public notice" of the owner and the fact that the mark is being used under license must be given. This is usually done through marking the goods or advertisements for the services "Registered Trademark [or ®], used under license from [name of institution]." License Agreements should require the licensee to affix such marking. Marks can be assigned without reciting "the goodwill of the business."

CONCLUSION

Technology transfer managers are in a unique position to create value in trademarks not yet being used in commerce and to guide their research institutions to profit from their eventual use by applying for federal registration before marketing begins. In the absence of formal application with the U.S. Patent and Trademark Office by the technology transfer officer, however, the rights will belong to the licensee by default as a result of its actual use of the mark.

Application for federal registration is the only way for an institution to gain property rights in trademarks used with its licensable technology. Despite the effort required on the part of the institution to police the rights, exert quality control over the goods and services, and manage potential risks of tort liability, trademark rights can become extremely valuable assets, well worth the extra attention required for their acquisition and maintenance.

Personal Impressions of China

[Report on U.S. Delegation Visit to the People's Republic of China on Intellectual Property Rights and Technology Transfer (November 28 – December 15, 1998)]

Terry A. Young*

PREFACE

A seven-member delegation,+ of which I was one, traveled to the People's Republic of China (PRC) November 28 - December 15, 1998 "to provide opportunities for Chinese policy makers and administrators to obtain a better working knowledge of how U.S. academic institutions manage intellectual property rights in forming university-industry relationships and in transferring intellectual property to industry for commercial application." The delegation was sponsored by the U.S. Information Agency (USIA), in cooperation with the PRC Ministry of Education, and followed a parallel visit of a Chinese delegation to the United States in September 1998, which included attendance at the AUTM Basic Licensing and TOOLS Course in Kansas City. These citizen exchanges were intended to enable Chinese universities to begin adoption of the U.S. model of university technology transfer.

---

* *Terry A. Young is Assistant Vice Chancellor and Executive Director, Technology Licensing Office, The Texas A&M University System, College Station, Texas 77843-3369.* *This report was originally presented at the 1999 AUTM Annual Meeting, San Diego, CA, and has been adapted for publication in the Journal.*

+ *The closing paragraph of this paper lists all members of the U.S. Delegation.*

This was my first visit to the People's Republic of China, and I was deeply impressed by the country and its people. Four impressions particularly standout. First, the contrast of old and new was startling, such as, the many vendors selling produce from hand-pulled carts in front of Internet service businesses. Second, the tremendous development ongoing in all of the cities visited was impressive, but especially in Beijing. Buildings under construction, advertisements for high-tech products and services, and other commercial development were visible in every direction. Third, China's economy appeared more market-driven than this author originally anticipated; entrepreneurial activities were evident everywhere, from modern department stores to the street vendors to the technology-based enterprises visited. One day during the visit, the headline in the *China Daily* told of the PRC's plan for the military agencies to divest themselves of their enterprises, to "privatize" the businesses. It appears that the PRC Government has set the country on a course for tremendous economic growth and development. And fourth, the great interest and respect that our Chinese colleagues had for the American system of university research and technology transfer was a lasting impression.

RESEARCH & DEVELOPMENT IN HIGHER EDUCATION

The Delegation observed several significant differences between American and Chinese models of university research and development, which impact management of intellectual property rights and technology transfer.

- *Government Planned Economy*. First and most importantly, in the PRC government-planned economy, university researchers are required to focus their work upon research areas directed by the government's plan; scientists appear to have limited autonomy to determine the course of their work. In contrast, in the United States, researchers have autonomy in selecting topics of academic and scientific interest. There was discussion of efforts to move Chinese universities to more faculty-driven research programs.

faculty members and students, schools for the children of faculty members, and the like. Chinese universities own and manage retail businesses that are not related to the educational or research missions of the institutions, such as a jade outlet visited by the Delegation in Xi'an. The outlet was owned by Jiatong University. Such university-owned enterprises, as well as the many technology-based spin-off companies, are simply efforts to provide operational resources needed by the institutions.

INTELLECTUAL PROPERTY RIGHTS IN CHINA

Though recognized for making tremendous progress in its efforts to establish a legal framework for management of intellectual property rights (IPR), China has much work to do. In a recent article entitled, "A Great Leap Forward," a leading legal expert on Chinese intellectual property rights made the following observation, "During the ten years of China's Cultural Revolution (1966-1976), the country's lawyer-based legal service system was totally destroyed. Only in 1979 did the government begin the process of restoring this system. The task proved daunting, as the Chinese government was required to rebuild the entire legal infrastructure, including courts, judges, lawyers and the laws themselves, including intellectual property rights laws." (Billy A. Robbins in *Los Angeles Lawyer*, October 1997, page 28).

The Ministry of Science and Technology made it clear to the Delegation that the PRC does, indeed, value IPR. The Delegation met for several hours with Vice Secretary General Duan Ruichan, who had participated in several international patent cooperation negotiations. China is a member of the Patent Cooperation Treaty (1994), the Berne Convention for Protection of Literary and Artistic Works (1992), and the Universal Copyright Convention (1992). Furthermore, China and the United States signed a Memorandum of Understanding in 1992 that committed the PRC to strengthen its legal IPR framework, as well as an IPR agreement in February 1995 addressing piracy and access to China's markets for the U.S. intellectual property industry.

yet the universities lamented that faculty frequently misappropriated intellectual property in order to transfer it to enterprises. Notwithstanding, each university spoke of the need to better communicate to faculty the value of IPR and the need to protect IPR.

- *Patent Applications versus Research Awards*. University faculty and administrators described patents in the same context as publications and research awards. The number of patents, "Technology Certifications," and research recognition awards from the PRC Government were reported to the Delegation at each stop. An administrator from South China Science and Technology University represented to the Delegation that a minimum of two patents was required for promotion to associate professor at the university, with two additional patents required for promotion to professor. Thus, as a general observation, patents did not appear to be valued as commercial assets of the university, but rather as another means of academic recognition for the university and the individual researcher.

- *Faculty Incentives*. In general, faculty inventors appeared to receive twenty percent (20%) of income derived from the university's commercialization of inventions. However, there were variations on this figure, including one university that shared only three and one-half percent (3.5%) of income with its inventors.

UNIVERSITY TECHNOLOGY TRANSFER

While differences between the U.S. and Chinese systems for research and development and IPR management were striking, the differences in technology transfer were even more surprising.

- *University-Owned Companies*. In all cases of successful technology transfer described to the Delegation, the companies were owned by the university. Furthermore, there was no clear distinction between the university and the university-owned enterprise. Some individuals were introduced as faculty that income from technology transfer in the U.S. was not a major source of support for the operation of U.S. universities.

- *Venture Capital Funding*. Each university spoke often of the need for venture capital funding in China to assist in establishing new companies and to assist in the development of technology with commercial potential. Several institutions asked if workshops could be planned to introduce venture capitalists to opportunities for investment in China. Yet, it was clear that Western venture capital practices were difficult for the Chinese to comprehend within the Chinese model.

FUTURE NEEDS AND OPPORTUNITIES

When the Chinese delegation was hosted in the United States in September 1998, the visit and the needs of the Chinese representatives were framed by this author within the context of the U.S. model of university IPR protection and technology transfer. In other words, it was believed that the Chinese were starting from a similar foundation and were simply seeking to improve or "fine-tune" their efforts by learning additional or better operational tools and procedures from U.S. representatives. The visit to China vividly illustrated to this author that this assumption was not valid. Significant changes will be required before Chinese universities can utilize many of the protocols or tools that technology managers take for granted in U.S. university technology transfer. Many of the differences in U.S. and Chinese models are based upon broad societal differences and national-level decisions that are far beyond the scope of this project, and indeed may never be changed. Thus, it would be inappropriate to suggest that the U.S model of technology transfer could be adopted in total by the Chinese. Instead, certain key principles may be adaptable to the unique Chinese situation.

Our Chinese hosts were very personable and hospitable; they treated the members of the U.S. Delegation with great respect, regarding them as experts in technology transfer. As stated earlier, our Chinese colleagues are under significant pressure to quickly

The USIA Grant for this citizen exchange program was awarded to Texas A&M University. Project Director was Dr. Emily Ashworth, Associate Provost for International Programs, Texas A&M University; Co-PIs were Dr. Roger Elliott, Assistant Commissioner, Texas Higher Education Coordinating Board, and Mr. Terry A. Young, Executive Director, Technology Licensing Office, The Texas A&M University System. In addition to Dr. Elliott and Mr. Young, the members of the seven-person delegation were: Dr. Pierce E. Cantrell, Associate Provost for Information Technology, Texas A&M University; Dr. Richard Bendis, President, Kansas Technology Enterprise Corporation; Ms. Katharina Phillips, Vice President, Council on Governmental Relations; Ms. Carol J. Cantrell, Associate Vice Chancellor, Engineering Program Office, Texas A&M University; and Mr. Sheldon L. Trubatch, Ph.D., J.D., Partner, Winston & Strawn.

Where do the Leads for Licenses Come From? Source Data from Six Institutions

Christina Jansen*
Harrison F. Dillon*

ABSTRACT

Knowing where license and option leads come from can optimize the productivity in university technology transfer offices. This article presents the sources of over 1,100 leads for licenses and options from six different institutions including: The University of Florida; Massachusetts Institute of Technology; Oak Ridge National Laboratory; Oregon Health Sciences University; Tulane University; and The University of Utah. Data from each of the six offices confirm the authors' suspicions that the majority of the leads come from inventors. The methodology used to gather the data is also described.

Introduction and Study Participants

It has long been "office lore" in technology transfer offices that inventors are the best source of leads to licensees and optionees. This study was undertaken initially at M.I.T. to test this hypothesis. The sources for 284 options and licenses executed over approximately 2.5 years were identified. The majority of the successful leads, 54%, resulted from information given to a licensing professional by an inventor. Upon review of the results submitted for consideration for publication in the *AUTM Journal*,

---

* *Christina Jansen is Director and Harrison F. Dillon is a Licensing Agent, Technology Transfer Office, University of Utah, Salt Lake City, UT 84108.*

inventions created with federal money follow the path from laboratory to commercial marketplace.

University Licensing Processes

To the extent possible, most institutions seek to proactively market technologies to a group of targeted potential commercial licensees. The methods used vary from direct phone calls ("cold calls") to letters, lists of inventions on web sites, and lists of inventions made available to companies interested in a particular field of technology. Most universities seek a qualified licensee, not necessarily the best licensee. In general, license negotiations are initiated with the first qualified licensee rather than with an optimal licensee who may not emerge immediately. This process is referred to as "first contact marketing."

Qualified licensees are quickly encouraged to begin a technical dialogue with the inventor and are encouraged to visit the inventor's laboratory to see the results to date. If the company is seriously interested in the invention, an exclusive option agreement is requested or offered. The option allows the company to evaluate such factors as the strength of the technology, the applicability or economics of the market potential, the patent protection available, the development and marketing costs, and/or how the invention can fit into a current business plan. If the company decides to proceed after the evaluation period, the license is negotiated. These steps can take from two weeks to two years, with one year being typical. Finally, the company invests in the development of the product, the product is manufactured, marketed, offered for sale, and sold. The goals of Congress, the technology transfer office, the inventor, and the licensee are thus realized.

Lead Source Survey Methodology

The survey was developed with guidelines and definitions to assure that data were counted and reported consistently by the participating institutions. (See Appendix for Survey Results Form and Definitions and Guidelines.) Each participant, in responding to generally do not record the lead for a license as part of the filing procedure, the number of leads that could not be recalled are likely to be a function of how long the current licensing staff has been employed in the office. Proposed and confirmed reasons for these percentages, which seem to be in the same range for all institutions surveyed, as well as possible reasons for disparities between institutions will be discussed in following sections.

Discussion

Inventors - The Major Source of Licensing Leads

Surveyed institutions reported that the "office lore" is correct—inventors are the licensing professional's best source of leads to licenses. The majority of licensing leads, 56%, come directly from the inventors. There are many reasons that professors have good industrial contacts. Many faculty members have a long history of interaction with industry through sponsored research grants and contracts and consulting arrangements. Through technical conferences many inventors have developed extensive personal networks in the industrial sector. Graduate students who have completed their degrees and have taken positions in industry are another major source of the inventor's network of industrial contacts. In addition, companies seek out professors who actively publish and lecture in fields of interest to the company. Consequently, it is not surprising that inventors are a rich source of leads.

In order to find out about the faculty members' industrial contacts, the licensing professional must be doggedly persistent. We ("we" referring here to licensing professionals at the authors' institution) ask the inventor for a recommendation of a licensee when we receive the original invention disclosure, and again when we return the patent search. We ask when we file the patent application, and again when we receive office actions. We ask faculty members to collect business cards from company representatives who express interest in their work at conferences and to send us copies. One zealous professor at the University of Utah sent copies of ninety-

The Entrepreneurial Inventor - A *Very* Special Case

Some entrepreneurial inventors are interested in starting up new businesses based on their inventions. At the authors' institution each year one or two professors elect to become active participants in their own start-up companies to commercially exploit their inventions. It is very rare, however, for a tenured professor to leave M.I.T. in order to become a company president, although documented examples of success stories do exist. More commonly, professors must learn the skills necessary to form and run successful start-up companies and must be convinced that a company run from a garage is unlikely to lead to success.

On rare occasions, there is an individual with a burning commitment to bring his/her invention to fruition. One such example involves a researcher who had spent his career on Department of Defense-funded aerospace technology. He invented an aerospace-related concept that could be developed as a major improvement to a little used method of cancer treatment. He received internal funding to try out the concept using equipment at a hospital. Over the next four years he convinced additional hospitals to let him test the concept, using instruments made by three different manufacturers. Finally, he convinced doctors to agree to carry out clinical trials. After some successful trials, a licensing professional was able to find a venture capitalist who agreed to raise over $5 million to complete the clinical trials and bring the method to the medical market.

The Licensing Professionals as a Source of Leads

The other major source of leads to likely licensees is the technology licensing professional. For 19% of the agreements, the individual licensing professional directly identified the potential company. Some licensing professionals have extensive industrial experience and thus have an existing network of former colleagues as potential contacts. Some licensing professionals can also make good use of the large network of university alumni available as sources of leads. At the authors' institution, many companies visit or write to the

When the Licensing Company finds the TTO

The good news is that the company finds the technology transfer office 10% of the time. There are several principal ways that companies looking for licenses find the licensing professional. The first is that the company has done a patent search and has located a patent assigned to a particular university. The company phones and a lead drops into the licensing professional's lap. Even very old patents can be licensed this way, and this is really "found" money as most offices never have time to market older patents.

The other way that companies find licensable technology is to write, visit, or telephone licensing offices. Companies often call at six-month intervals to find out if there is new technology in which they might be interested. Finally, companies may hear of an invention through the news media and will call after seeing the invention in print or on a news broadcast.

Again, name recognition may be a primary factor in the varying luck that different institutions have with companies contacting the licensing office. Good media relations also can help this source, as certain university departments routinely call the local science reporters when an important discovery is made. Geographical location may be important as well, as not all universities have high-tech companies nearby.

The Research Sponsor Wants a License

Although less than 10% of most universities' research is industrially sponsored, when a discovery is made, the sponsor is frequently interested in commercializing the invention for its own benefit. This source comprises 7% of the overall leads for licenses. Most universities have sponsored research agreements that give the sponsoring company the right to elect an exclusive license to any inventions arising under their sponsorship.

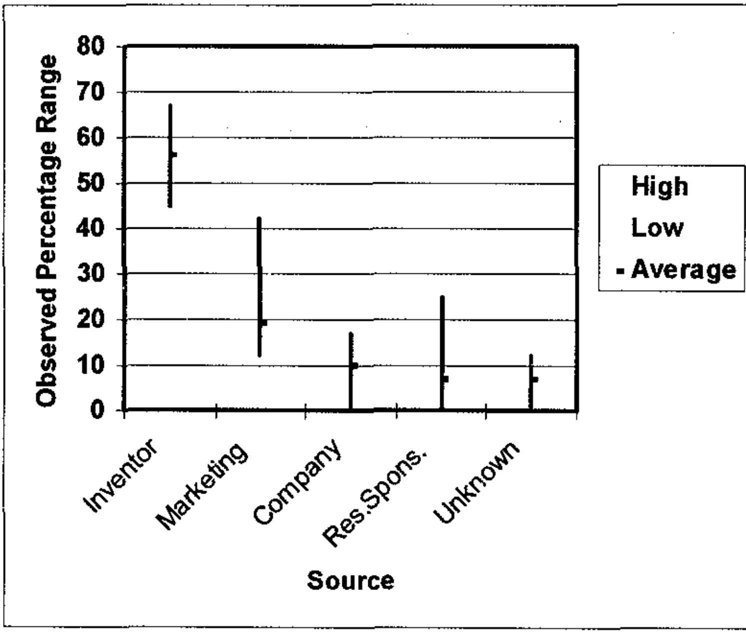
The desire for licenses by sponsors sometimes comes as a surprise to the technology transfer office. One example from the authors'

Companies know their market far better than the licensing professional ever will. For this reason, it is the authors' practice to ask a company for its marketing study as part of a licensing negotiation. One venture capital firm gave permission to the authors to quote from one of the slides the firm uses in its presentations. The slide lists activities the firm does not want universities to do. It says: "[Venture firms] do not want universities to do market studies." Venture firms do their own market studies.

CONCLUSION

Most patented inventions owned by universities are ideas that may have commercial application, even though at the time of disclosure the invention may be little more than a gleam in the eye of the inventor. An actual prototype or "proof of concept" is often lacking. Finding licensees for such immature technology is a daunting task. Working with the leads provided by inventors has been very successful. Fifty-six percent of the licenses reviewed in this study arose from these leads. This is obviously one of the secrets to the success of licensing in universities. The 19% of licensees that arose from the licensing professional are the result of much homework and many phone calls. Merely answering the phone leads to 10% of licenses, and 7% more come about when the research sponsor decides to license. It is the authors' hope that these data will stimulate university licensing offices to reconsider some of their techniques for finding licensees, and perhaps track the sources of their leads over a period of time. With a small amount of effort, valuable data may be found.

FIGURE 1: Percentage Range of Sources



Summary of Results:

Dates: From: **Month** ________ **Day** _______ **Year** ______
To: **Month** ________ **Day** _______ **Year** ______

Source	**Number**	**Percentage**	**Obsv. Range**
Inventor	______	_________	__________
Licensing Pro	______	_________	__________
Company	______	_________	__________
Sponsor	______	_________	__________
Marketing	______	_________	__________
TTO Marketing	______	_________	__________
Other	______	_________	__________
Unknown	______	_________	__________
Total	______	_________	__________

Annual Research Budget: ____
Number of Licensing Professionals: ____________________________________

If any of your results are outside the range observed in our limited studies, please state the reasons or factors that you think are most likely to account for the differences.

Comments: ____

A Suggested Method for Assessing the Economic Impacts of University R&D: Including Identifying Roles for Technology Transfer Officers

Albert N. Link*

INTRODUCTION

Two important trends motivate this paper. One trend is the increasing role that universities are having in supporting our nation's technological infrastructure, and the other trend is the increasing attention that governments are paying toward fiscal responsibility. Both of these trends underscore the importance for universities to demonstrate to their stakeholders the impacts—economic impacts in particular—associated with their research and development activities (R&D); both of these trends foreshadow the role that university technology transfer officers will have in the assessment process.

Before discussing these trends, key concepts must be defined so as to bound the scope of this paper:

- What is a university?
- What is R&D?
- What are economic impacts?

---

* *Albert N. Link is Professor of Economics, Department of Economics, University of North Carolina at Greensboro, NC 27412.*

justified in terms of economic benefits at the time the basic research was conceptualized or even being conducted. But, after the fact—decades later in many cases—economic impacts can readily be quantified.

The views expressed in this paper on assessment processes and on technology transfer officers' roles have evolved over time based on personal involvement in designing and implementing economic impact assessment plans of R&D activity both in universities and in federal laboratories throughout the United States as well as in other industrialized nations, and on advising and assessing the related technology transfer activities in each type of organization. The two constants in each of these undertakings are that assessments will be done, be they initiated by the university or by its stakeholders, and that technology transfer officers will be involved to some degree in the process. Therefore, following on this second observation in particular, this paper intends to suggest to university technology transfer officers a roadmap of the possible roles a technology transfer officer may play in the assessment process and thereby to provide a window of opportunity for them to anticipate their own strengths and weaknesses in meeting forthcoming administrative requests.

BACKGROUND TRENDS RELATED TO ASSESSING UNIVERSITY R&D

Technology Infrastructure

In 1996, the Council on Competitiveness, a "nonpartisan, nonprofit forum of chief executives from the business, university, and labor communities working together to set a national action agenda for U.S. leadership in global markets, technological innovation, and education and training that will raise the standard of living of all Americans" (p.40), published *Endless Frontiers, Limited Resources: U.S. R&D Policy for Competitiveness.* Therein, the Council takes the position that (p. 3):

> The U.S. research and development enterprise finds itself in a wrenching period of change with the end of the Cold War, the globalization of the world economy and the drive to eliminate

representation of the people and by the people. However, as a more modern concept, accountability can be traced to the political reforms initiated by President Woodrow Wilson. In response to scandal-ridden state and local governments at the turn of the century, the concept of an impartial bureaucracy took hold in American government. Accountability, neutrality, and expertise became three of Wilson's reform themes. Shortly thereafter, Congress passed the *Budget and Accounting Act of 1921*, which began a modern tradition of fiscal accountability in public institutions.

Building on the general concept of accountability established in the more recent *Competition in Contracting Act of 1984*, the *Chief Financial Officers Act of 1990*, and a variety of state initiatives, the *Government Performance and Results Act (GPRA) of 1993* was passed. The focus of GPRA is *performance accountability*. The purposes of the GPRA are, among other things, to:

> (1) improve the confidence of the American people in the capability of the Federal Government, by systematically holding Federal agencies accountable for achieving program results;
>
> (2) initiate program performance reform with a series of pilot projects in setting program goals, measuring program performance against those goals, and reporting publicly on their progress;
>
> (3) improve Federal program effectiveness and public accountability by promoting a new focus on results, service quality, and customer satisfaction;...

Under the GPRA, all federal agencies, not just mission-driven agencies, are required to submit to the Office of Management and Budget no later than September 30, 1997:

> a strategic plan for program activities [that contains among other things] a description of the program evaluations used in establishing or revising general goals and objectives, with a schedule for future program evaluations,

Where the Trends Lead

Figure 1 illustrates how the above two trends converge to the conclusion that:

- universities will increasingly face performance evaluation pressures resulting from the growing visibility of universities in the nation's technology infrastructure,
- universities will increasingly be held accountable for their performance.

Not all components of performance evaluation of university R&D involve economic impacts. However, economic impacts should be the focus because they are more directly quantifiable, and thus, more likely to be seen and understood by the university's stakeholders.

Universities have historically, or at least for most of this century, relied on peer review to evaluate the scholarly merits of each faculty member. This is true not only in the United States but also in most industrial nations, as illustrated, for example, by Cooper and Otley (1998) for the United Kingdom. Few administrators have the breadth or depth of technical or disciplinary knowledge to make such judgments on their own; and, certainly peer evaluation is outside of the bounds of expertise of technology transfer officers. The guidelines set forth in the following section are not a replacement for the peer evaluation. Peer evaluation is critical to the integrity of an institution. However, stakeholders, for the most part, are not interested in the results of peer evaluation. That is the reason that administrators should focus the university's evaluation on the subset of R&D for which economic impacts can be articulated. And it may be the case, as it has been in federal laboratories, that university technology transfer officers will be asked to either formulate an "articulation strategy" for the university or even to become its spokesperson in this area.

The above trends aside, performance evaluations, in general, and economic impact assessments, in particular, of university activities are measurement. These imperatives reflect fundamental expectations [that institutions] that receive public funds be accountable. ... This proposition has not been at issue. What is at issue, however, are the means and measures by which outcomes... are to be evaluated.

The five phases of an economic impact assessment process are:

- information
- initiation
- implementation
- interpretation
- iteration

Information

The information phase of an economic impact assessment involves providing information to university personnel, faculty in particular. Administrators must inform faculty that selected R&D activities of the university will be assessed from an economic impact perspective, and the administration must explain why. It is critical to emphasize to faculty during this information phase that the assessment process will not only document to the university's stakeholders the economic value of the R&D undertaken within the institution, but it will also enhance the managerial effectiveness of the university.

For many faculty the thought of having to explain, much less to justify, to outsiders what takes place within the university requires a cultural change. University administrators will have to understand and embrace this culture change, and then convey its importance to faculty.

Also, administrators will have to dismiss the thought by some faculty that the assessment process is nothing more than a convoluted means for resource reallocation. Those most likely to have such a thought are those most involved in R&D and, thus, the economic impact assessment. Seasoned researchers are sensitive to the fact that including the selection of a unit for the pilot exercise, will be scrutinized by all members of the institution and thus should be an open learning process. The steps for conducting this initiation assessment are the same steps that will eventually be undertaken by all R&D units within the university.

Step 1: The university must identify its economic stakeholders, in tiers of "closeness" to the university, and then the unit must similarly identify its economic stakeholders, having learned through demonstration the university's definition of stakeholder.

Why are stakeholders the audience for an economic impact assessment? From a pragmatic perspective, the stakeholders are the ones that fund the university and to whom the university is accountable in both a fiscal sense and a performance sense. In other words, the stakeholders represent political authority. While it is the case that knowledge *per se* does enrich society, and education *per se* does provide society with better citizens, stakeholders rarely think in such altruistic terms. Stakeholders are justified in asking—in fact they should ask—What are the economic benefits, and how am I better off?

For the institution as a whole, its direct stakeholders are those that have made a financial commitment. This group includes taxpayers, directly and through their legislators; contributors; and those who are and who have previously been enrolled. Indirect stakeholders are those whose closeness to the university is measured in terms of their consumption of the outputs of the university. Recall that a university was defined above as a chartered institution, be it public or private, with the educational mission of creating and distributing knowledge. If knowledge, broadly defined, is the output of the university, then those that consume that knowledge are first and foremost students and the community that consumes knowledge-embodied faculty activities; and then second, among others, employers that hire students for their knowledge-based capabilities. Obviously, embedded in this concept of closeness is the implicit assumption that a transfer process has occurred.

Identifying an academic unit's stakeholders will generally be less straightforward than identifying the institution's stakeholders. The

From a general perspective, a unit's outputs include teaching, service, and research, as well as quality improvements in each. Regarding teaching, a department's teaching output could be tabulated, calculated, or recorded in terms of number of students taught, number of courses taught, or in terms of value added, meaning the increase in student knowledge (or added value) from an educational experience. Regarding service, a department's faculty could perhaps measure output in terms of university reports or in terms of journal referee reports. While generally not given the same scholarly status as a research paper, they are none the less important and do represent knowledge-based activity. Regarding research or R&D, which is the focus of this paper, selected outputs include published papers, monographs, and books; test methods; inventions; and databases. These realized *ex post* measures are easily quantified.

Step 3: The third step in a unit's economic impact assessment of R&D is to map its output measures into economic outcomes. What are the economic results associated with a particular output? If, for example, an R&D output is a test method, then the relevant task for the unit is to measure the economic outcomes associated with the test method. Indications of economic outcomes may be revealed by asking: Is the test method being licensed to other universities or companies? If so, how have they benefited?

Not all R&D can be traced into R&D outputs, and not all R&D outputs can be traced into economic outcomes. This is a fundamental characteristic of academic activity and should not be interpreted to be negative in any respect. One must however search for examples that follow the

$$\text{R\&D} \rightarrow \text{output} \rightarrow \text{outcomes}$$

model so as to assess those activities from an economic perspective. As a simple example of assessable R&D, assume the unit is a physics department and assume its test method output relates to the calibration of optical detectors. Further assume that a stakeholder in the physics department is a company that utilizes the test method to increase the accuracy of its calibration process and thus increases the accuracy of its having themselves never exerted the effort or undertaken the action. As a word of caution, such actions can push the assessment process off course.

Step 4 is what many view as an economic valuation exercise, and as with any valuation there is both art and science involved. The science of valuation refers to the implementation of a systematic and consistent methodology; the art of valuation refers to the application of informed judgment. Both elements are important.

Step 4 involves a comparison of the actual resource costs to generate the output's outcome with the economic benefits realized by stakeholders. In the example above related to the test method developed in the physics department, it is an accounting exercise to associate Company A's financial support to the department with the cost-savings/productivity-enhancing benefits that it receives from using the test method. The fact that other companies in the industry also use the test method may or may not impact the economic benefits that Company A receives. The fact that university resources complement Company A's financial support may not be of interest to Company A, although it will be important to the university for resource management.

In the second example above related to the software developed in the civil engineering department, it is also an accounting exercise to determine the state's share of academic support resources devoted to the development of the software, less licensing fees. The harder task is to approximate the economic benefits that the state has received and will receive from having access to the state-funds developed software in comparison to the time-weighted probability of having access to similar software from an alternative source, such as the private sector.

Step 5: The fifth step in a unit's economic impact assessment of R&D is for the university to inform the unit's stakeholders and its own stakeholders about the findings from the pilot economic impact assessment. This step should not be interpreted to mean that the only reason that R&D is conducted is to appease stakeholders. There are many spillover benefits associated with university-based research as process. This interpretation will require the university to standardize on certain evaluation metrics, especially when providing such information to a state legislature that is, in all likelihood, unfamiliar with evaluation metrics. The evaluation metrics should be clearly articulated and well documented. One such metric that is widely understood is a benefit-to-cost ratio: for example, the ratio of economic benefits to the state and its taxpayers divided by the tax revenues to the university to generate those benefits. The technology transfer officer may not only be involved in maintaining an evaluation metric database, but also may need to assume the role of interpreting the data to those both inside and outside of the university.

The university should continually inform the members of the academy of all laudatory feedback that it receives from its stakeholders as they learn about the return that they are receiving on their investments in the institution. Such feedback might take surprising forms, ranging from the obvious of increased industrial giving to the less expected of increased public moneys in response to good stewardship. Likewise, negative feedback is important because it indicates an important stakeholder reaction to the economic assessment. The negative reaction may be valid, which should then cause the university to re-think its mission; or it may be invalid, which should alert the university to re-think its mode of articulating economic impacts.

Recently, the National Association of State Universities and Land-Grant Colleges published the findings from a membership survey that requested data on each university's economic impact on its state and local communities. The specific survey question asked was:

> For every $1 your state invests in your institution, how much total spending is generated in your state's economy?

The Association should be credited for its wisdom in challenging universities to think in such an important dimension. But, the Association's lack of methodological guidance; the vastness, and hence vagueness, of its implied definition of economic impacts; and the inexperience of many institutions in thinking of economic impacts in general, much less in the view suggested by the Association, may have

Three, no assessment process can capture, much less quantify, all of the intangible benefits associated with academic R&D. Spillover benefits within the institution include such phenomena as one unit's research outcomes influencing another unit's research outputs or one unit's research outcomes generating a halo effect on another unit's extramural funding proposal. Still, the process set forth in this paper, in all of its narrowness, has the benefit of being understandable and implementable. Spillover benefits outside of the institution include the success of graduates, or at least the demonstrated value added for graduates. But, when administrators are asked—But *how* do you know this R&D is important?—they must not find themselves either dissembling or simply telling success stories. Through an economic impact assessment they will have conservatively collected information and systematically constructed metrics related to an important subset of their academic R&D. This information and these metrics will be sufficient for an informed response to questions about performance accountability.

Important possible roles for technology transfer officers have been noted herein within the broader context of guidelines for conducting economic assessments. Perhaps more important than simply noting possible roles for technology transfer officers is the charge for this group of individuals to begin to anticipate the form that assessment processes will likely take at their own institutions, the many ways they may be called upon to participate in the assessment processes, and the human capital as well as financial resources that will be needed.

This paper has benefited from comments and suggestions of William Little of the General Administration of the University of North Carolina, Barry Bozeman of the School of Public Policy at Georgia Institute of Technology, Irving Feller of the Institute for Policy Research and Evaluation at The Pennsylvania State University, my colleague Dennis Leyden, and Katherine Chapman and other members of the editorial board of the *AUTM Journal*. All remaining shortcomings are my own.

Converging Trends and the Need for Assessing the Economic Impacts of University R&D

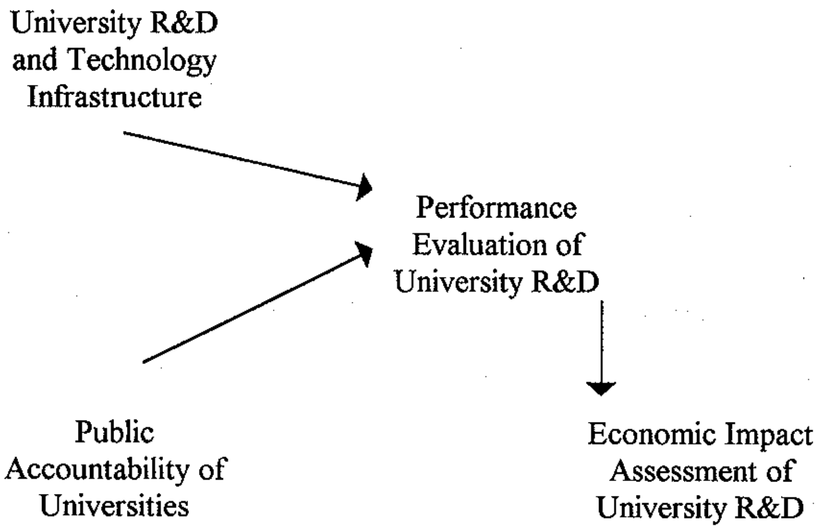


Figure 1

Table 3

Overview of the Phases of an Economic Impact Assessment

Phase	
Information	Academy learns about economic impact assessments
Initiation	Pilot economic impact assessment conducted
Implementation	Economic impact assessments conducted throughout the university
Interpretation	Metrics relating quantifiable R&D outcomes to stakeholders' resources disclosed
Iteration	Economic impact assessment becomes a part of the university's culture

Link, Albert N. and John T. Scott. "Evaluating Technology-Based Public Institutions: Lessons from the National Institute of Standards and Technology," in *Policy Evaluation in Innovation and Technology*, edited by G. Papaconstantinou. Paris: OECD, January 1998a.

Link, Albert N. and John T. Scott. *Public Accountability: Evaluating Technology-Based Institutions.* Norwell, Mass.: Kluwer Academic Publishers, 1998b.

National Association of State Universities and Land-Grant Colleges. *Value Added: The Economic Impact of Public Universities.* Washington, DC, 1997.

Tassey, Gregory. "Lessons Learned About the Methodology of Economic Impact Studies: The NIST Experience." *Evaluation and Program Planning*, publication pending.

Youtie, Jan, Barry Bozeman, and Philip Shapira. "Assessing Methods for Evaluating State Technology Programs," final report to the Georgia Research Alliance, April 1997.

Instructions for Contributors

The Association of University Technology Managers (AUTM) welcomes contributions of original manuscripts to the *AUTM Journal*, covering any aspect of the management of technology and intellectual property. Please submit manuscripts to the Managing Editor, Ms. Diane C. Hoffman, 23 Perrine Path, West Windsor, NJ 08550.

All manuscripts, including those written at the invitation of the Editor, are subject to review by the Editorial Advisory Board or other reviewers. The final decision as to publication will be made by the Editor, and authors will be notified of the decision. Authors may retain title to the copyright of their articles; however, papers are published in the *Journal* with the understanding that they have neither appeared nor will be submitted elsewhere.

Please submit an original and two copies of your typewritten double-spaced manuscript. The first page should contain the title, author's name(s), affiliation(s), address(es), and telephone number(s). An abstract of 100 words summarizing the paper's main points and a 50-word background statement about the author should also be included. Should your article be accepted for publication, you will be asked to provide a copy on diskette compatible with MS Word software.

References should be numbered and listed at the end of the manuscript as Endnotes. Please avoid the use of footnotes. Tables and Figures must be numbered and identified as such, and should be provided in camera-ready format, ready for reproduction.

Letters commenting on the issues discussed in the published articles or on other matters of interest to technology managers are welcome, and will be considered for publication as "Letters to the Editor" or forwarded to the author for reply, at the discretion of the Editor.

REFERENCES

Bailetti, Anthony and John Callahan. "Assessing the Impact of University Interactions on an R&D Organization." *R&D Management*, April 1992:145-158.

Bozeman, Barry. *All Organizations are Public: Bridging Public and Private Organizational Theories.* San Francisco: Jossey-Bass Publishers, 1987.

Bozeman Barry and Julia Melkers. *Evaluating R&D Impacts: Methods and Practice.* Boston: Kluwer Academic Publishers, 1993.

Cooper, Cary and David Otley. "The 1996 Research Assessment Exercise for Business and Management." *British Journal of Management,* June 1998:73-89.

Council on Competitiveness. *Endless Frontiers, Limited Resources: U.S. R&D Policy for Competitiveness.* Washington, DC, 1996.

Hall, Bronwyn, Albert N. Link, and John T. Scott. "Universities as Partners in ATP-funded Research Projects," draft final report submitted to the Advanced Technology Program, National Institute of Standards and Technology, December 1998.

Feller, Irwin and David Roessner. "What Does Industry Expect from University Partnerships?" *ISSUES in Science and Technology,* Fall 1995:80-85.

Gander, John P. "University/Industry Research Linkages and Knowledge Transfers: A General Equilibrium Approach." *Technological Forecasting and Social Change*, April 1987:117-131.

Link, Albert N. *Evaluating Public Sector Research and Development.* New York: Praeger Publishers, 1996a.

Link, Albert N. "Economic Impact Assessments: Guidelines for Conducting and Interpreting Assessment Studies," final report prepared for the National Institute of Standards and Technology, May 1996b.

Link, Albert N. "On the Classification of R&D." *Research Policy,* May 1996c: 379-401.

Table 2

Sources of Differing Viewpoints about the Economic Assessment Process

	Importance of Economic Assessments	Appreciation of Academic R&D
Administrators		
• followed an administrative path	HIGH	LOW
• promoted from a successful academic path	medium	medium
Faculty		
• no administrative experience	LOW	HIGH
• previous administrative experience	medium	medium

Table 1

Academic R&D by Source of Funds

	1996		1990	
	Public	**Private**	**Public**	**Private**
Total ($1000)	$15,531,711	$7,463,752	$10,760,820	$5,424,502
Fed. Govt. %	54.2%	72.2%	52.3%	72.7%
State & Local Govt. %	10.1%	2.2%	11.1%	2.4%
Industry %	6.9%	6.9%	6.8%	7.1%
Institution %	22.5%	9.9%	23.3%	9.0%
Other %	6.4%	8.9%	6.6%	8.8%

Source: National Science Foundation Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996.

created a host of unanticipated problems. Invidious comparisons of responses are waiting to happen.

Iteration

Each subsequent economic impact assessment should be more encompassing than the one before. This is expected as faculty learn by doing, and as administrators learn how stakeholders react to assessment information. Faculty and administration will find over time that assessment of R&D becomes part of the university's culture, and as it does, the iteration phase is begun. As the iteration phase is begun, technology transfer officers may be called upon to take on yet another responsibility, namely documenting the evaluation processes and monitoring them for consistency.

CONCLUDING OBSERVATIONS

Table 3 briefly summarizes the scope of each of the five phases of an economic impact assessment of academic R&D. There are three important points to note about the assessment process.

One, it is not a totally objective process in the sense that there is informed judgment being invoked by the university. Judgments range from what is and what is not R&D to how best to describe and quantify the economic outcomes from a set of R&D outputs. But, who is better than the university to make such judgments? When a university initiates an assessment, the university exhibits leadership and awareness of its accountability. Then, it indemnifies itself to some degree from stakeholders making uninformed judgments.

Two, the economic impact assessment process is not an encompassing process. Only selected R&D activities are being considered. Those activities not considered are not less important to the academic mission of the university, rather they are just different activities. The activities considered are those with observed quantifiable outputs that can be mapped into specific economic outcomes.

discussed below. However, the primary reason for conducting an economic impact assessment of university R&D is to demonstrate accountability, and the secondary reason is to manage internal resources, meaning to understand the R&D process so as to be able to justify resource allocations across departments or projects.

In addition to informing the unit's and the university's stakeholders about the economic benefits traceable to the unit's R&D, the administration must also inform the academy of the findings and demonstrate that the overall institution is better off for having completed the assessment exercise. Being better off has multiple dimensions, one of which could be the involvement of faculty from the pilot unit in the monitoring of the broader university assessment exercise. Another dimension that will demonstrate to faculty that the institution is internally better off from the assessment exercise is an explicit acknowledgment that not all R&D outputs can be mapped into economic outcomes, but that such R&D endeavors are still very important to the academic well-being of the academy. But, the most convincing indicator—perhaps especially to faculty—of the institution being better off is additional resources coming into the university from the university's stakeholders.

Implementation

The implementation phase of an economic impact assessment involves internalizing the economic impact assessment guidelines formulated from the pilot assessment exercise. This will need to be done carefully by the administration, and in a way that develops internal support for the merit of the process.

Interpretation

The interpretation phase of an economic impact assessment involves explaining the findings from the university's assessment process to its stakeholders. When doing so, administrators will have to emphasize the purpose of the assessment process as well as the conservative nature of the economic impacts being reported, as only a fraction of the total academic R&D outputs are included in this stage of the assessment product, say a light meter. In this case, the mapping is relatively straightforward:

- Company A underwrites the cost of equipment in the physics department's R&D laboratory,

- the research in the laboratory results in a test method applicable to the calibration of optical detectors, and this test method is published,

- Company A utilizes the test method in a manner that yields economic benefits, and

- other companies enjoy benefits from the published test method.

As a second example, a faculty member in the civil engineering department develops software for designing expansion bridges. The software package is an output. The university licenses the software, and one licensee is the state's department of transportation. Use of the software not only saves the state millions of dollars in design costs on a new expansion bridge project, but also additional millions of dollars in future repair costs of that bridge and in the design and maintenance of future bridges.

Of all individuals at the university, the technology transfer officers may have the most focused perspective on where such mappings clearly exist in the portfolio of university outputs.

Step 4: The fourth step in an economic impact assessment of R&D is for the unit to quantify the economic benefits that its direct and indirect stakeholders receive from the economic outcomes associated with the quantified R&D outputs.

The word "velleity" (n.) means an inclination without the accompanying effort or action. Implementing Step 4 will, without question, bring forth "velleitious" faculty, referring to those that wish to offer expert opinion about how others should carry out this task, direct stakeholders include those that are stakeholders in the university, such as departmental majors, and those that directly support the research activities of the unit, such as commercial sponsors of research. Indirect stakeholders such as licensees of particular technology can also be identified. In some universities a portion of income from licenses is returned to the research unit from which the technology emanated. Technology transfer officers may draw on their experience and knowledge of transfer activities to assist academic units with this step, in particular to educate academic units about transfer mechanisms and stakeholders' perceptions of them.

Step 2: The second step in an economic impact assessment is for the unit to identify its outputs, and as alluded to in Step 1, this Step 2 is in reality a sequential step because identification of indirect stakeholders requires an understanding of outputs. Alternatively stated, the unit will have to articulate what it does as well as how what it does translates into observable products, processes, or services.

The *Government Performance and Results Act* (GPRA) defines an output measure as:

> ... the tabulation, calculation, or recording of activity or effort [in such a way as] can be expressed in a quantitative or qualitative manner.

It is important to emphasize in this GPRA definition the phrase "qualitative manner." While not all of a unit's activities and their associated outputs can be expressed or are expected to be expressed in a quantitative manner, all can be expressed qualitatively.

This process of identifying and articulating outputs also has management value for the university because it forces faculty to think about—even if only in the most general terms—the relationship between the university's resources and the consumers of the outputs of the university's resources. It will be incumbent upon university administrators to emphasize to faculty that there is no implied value judgment being placed on one category of output compared to another. Hence, an invention is not inherently more valuable than a published paper.

extramural support for research has been waning for nearly two decades. Likewise, administrators will have to separate the assessment process from their reallocation agendas.

Finally, administrators will have to assure faculty that not all university R&D can be mapped to economic impacts, and that an economic impact assessment is not a vehicle to sway faculty to conduct more research assessable as such or to undertake more economic-based consulting within the infrastructure of the university. It is not uncommon for faculty to associate the adjective "economic" with marketability, and marketability with university efforts toward revenue enhancement. Likewise, administrators will have to separate the assessment process from their own biases that it may be in the best interest of the university, or at least selected units, to become more entrepreneurial and commercial with their research activities. And relatedly, administrators will have to lose their biases that the only valid assessment vehicle is one that associates faculty outputs with subsequent external revenue inputs.

This information exchange between administrators and faculty may at times be less than a smooth process owing primarily to differing perspectives both about R&D and the assessment process. Table 2 characterizes such potentially abrasive moments in terms of the R&D/administrative expertise of the two groups. As depicted, the most intense discussions are likely to occur between administrators who have by-passed an academic research career and eminent scholars who have similarly skirted administrative assignments. While such discussions are surely undertaken with the best interest of the academy in mind, there is a natural tension due to the perception by faculty that administrators have promotion and salary control over faculty and the perception by administrators that faculty can be myopic.

Initiation

The initiation phase of an economic impact assessment provides faculty first-hand experience in participating in the assessment process. One unit or department should be "objectively" selected for a pilot assessment exercise. The first assessment carried out at a university, also an effective management tool. Not only is the end result from such evaluations/assessments useful to university administrators, but also the process undertaken can be enlightening in many dimensions, especially those related to strategic planning (Link 1996b, Tassey publication pending).

The remainder of this paper focuses on a set of guidelines for how a university should conduct an economic assessment of its R&D activities. From this discussion of guidelines, technology transfer officers may be able to anticipate better their evolving roles in such an assessment process.

GUIDELINES FOR ASSESSING ECONOMIC IMPACTS

The process for assessing the economic impacts of university R&D set forth here is sequential. It has five phases, with multiple stages in certain phases. However, the process is not a mechanical undertaking to be conducted every n^{th} year. The process of assessing economic impacts should be continual in the sense that it is based on gaining pertinent information and then assessing that information. As new information becomes available, it in turn must be assessed.

Others have set forth guidelines for evaluating university R&D *per se*, but this is the first effort to posit that economic impacts are the relevant characteristic of university R&D that stakeholders can understand and embrace. The literature is replete with studies advocating single-dimensioned evaluation methods that emphasize, for example, counting patents, counting scholarly publication, or counting citations (Bozeman and Melkers 1993). As well, some scholars generalize that industry seeks technology from universities and evaluates the effectiveness of the technology in terms of its transferability (Bailetti and Callahan 1992, Gander 1987). The importance of an economic impact assessment, such as set forth herein, can be inferred from Feller and Roessner's (1995, p. 84) generalizations about S&T program evaluation:

> [Our analysis] has implications for current policy and administrative imperatives for performance goals and

where "program evaluation" is defined within GPRA to mean:

> an assessment, through objective measurement and systematic analysis, of the manner and extent to which... programs achieve indented objectives.

The economic implications of these federal initiatives are broad, as discussed by Link and Scott (1998b) and accordingly a variety of evaluation and assessment programs will result within federal agencies. Whereas GPRA is limited to federal agencies, some state legislatures have begun to mandate GPRA-like accountability exercises for their own agencies. As this continues, all universities, like federal agencies, may be required to undertake systematic program evaluations that will by definition require an assessment of university R&D. Youtie, Bozeman, and Shapira (1998) illustrate this clearly for the state of Georgia.

The title of this sub-section states that all universities are *public* and the paragraph above posits that as mandated public accountability trickles back to states, then *all* universities may be required to mirror GPRA-like processes. Certainly, there are public and private universities from the perspective of ownership authority, but as is clearly illustrated by the data in Table 1, all universities are affected in some degree by political authority and hence to some degree all universities are public (Bozeman 1987).

Only two years of data are presented in Table 1, but over the past three decades there have been some noticeable trends. Industry's share and the institution's share of academic R&D have been slowly increasing, while the government's share has been slowly decreasing. For 1996, the percentage of academic R&D funded by federal, state, and local governments at public institutions was 64.3 percent, compared to 74.4 percent at private institutions (although the dollar amount allocated to public institutions is nearly twice that of private institutions). As a result of such dependency on public funds, private universities may well be publicly accountable in the same sense as are public universities.

One approach to these assessments whether federal, state, or institutionally initiated is to examine economic impacts.

> the federal deficit. ... The U.S. R&D establishment has now entered a pivotal phase of transition—one that will determine our nation's long-term capacity to make and exploit discoveries and innovations in critical areas, while providing world-class institutions, facilities and education in science, mathematics and engineering. As a practical matter, future U.S. economic competitiveness hangs in the balance.

The Council makes clear its position that "R&D partnerships hold the key to meeting the challenge of transition that our nation now faces" (p. 3). These partnerships will increasingly rely on universities to ensure the success of the research being undertaken. In fact, according to the Council, universities are being "viewed by both industry and government as more vital than ever to the nation's future" (p. 21). As such, there is a trend for private and public sector leaders to look toward universities, and especially toward their R&D activities, to support the nation's technological infrastructure. Private and public sector leaders will hold universities accountable for their success, and hence the success of their R&D activities, in providing effective infrastructure support.

The following example illustrates by inference the infrastructure role of universities—a role that is expected to increase. The Advanced Technology Program (ATP) was established within the National Institute of Standards and Technology (NIST) through *the Omnibus Trade and Competitiveness Act of 1988*, and later modified by the *American Technology Preeminence Act of 1991*. The goals of the ATP are to assist U.S. businesses improve their competitive position and to promote economic growth by accelerating the development of a variety of pre-competitive generic technologies by means of grants and cooperative agreements. Since the ATP made its first awards in 1991, approximately 60 percent of all funded projects involved a university either as a research partner in a research joint venture or as a subcontractor to a research project (Hall, Link, and Scott 1998).

All Universities are *Public*

In the United States, there is a clear trend toward increased *fiscal accountability*. This concept is rooted in the fundamental principles of

The term *university* refers herein to a chartered institution, be it public or private, with an educational mission of creating and distributing knowledge.

The term *R&D* is somewhat problematic. Many may associate research and development only with innovative inquiries in the hard sciences. This is certainly the type of R&D that is initially thought of when universities are charged with the role of supporting the nation's technology infrastructure. But, university-based research and development is broader than this. R&D is the fundamental process for generating knowledge. As such, it encompasses the scholarly activities of scientists, humanists, and artists, and all related scholarly activities scrutinized by stakeholders. However, the assessment process outlined in this paper may not apply equally well to the scholarly endeavors of each of these members of the academy. It applies most logically to scientists, including social scientists, and to engineers. Hence, a more narrow definition of R&D is used herein, one that parallels the definition of R&D used by the National Science Foundation for industry reporting purposes (Link 1996c): *research* is the advancement of the discovery of scientific knowledge and *development* is the systematic use of such knowledge.

Finally, the term *economic impacts* refers to the leveraging effects that knowledge, created in and distributed by the university, has on economic activities. The economic impact assessment process discussed herein is an *ex post* process; it is not an *ex ante* process designed to guide a university to allocate budgets between project A and project B based on expected economic outcomes. On the contrary, the assessment process takes as given the university's budget allocation process and the research interests of its faculty; that is, this assessment process is not a capital budgeting tool. The assessment process focuses only on a subset of both research as well as development activities that lead directly to results that can be mapped to economic outcomes so as to demonstrate to the university's stakeholders, in terms that they will likely understand, what they are receiving from their research-support dollars. Such fundamental discoveries as quantum theory; relativity; wave mechanics; magnetic resonance; radioactivity; and atomic, nuclear, or molecular structure determination would not have been

APPENDIX:

Survey Results Form and Definitions and Guidelines

Sources of Leads for Licenses (and Options)
AUTM Meeting Workshop: Feb. 27, 1998

Person Conducting Study: ______________________________

Phone: ____________________ **Fax:** ____________
E-Mail: ______________________________
Institution: ______________________________
Address: ______________________________
____

Identifying and analyzing the source of the leads that resulted in options and licenses can provide information that could be very useful. It is surprisingly easy to collect this data.

1. Choose a period of time for which you are likely to be able to track down the source of the lead.
2. List all the company names for which there are signed licenses and options. It may be helpful to list the date of the agreement, the name of the inventor, and whether or not the agreement was exclusive or non-exclusive.
3. Have the Licensing Professional identify the source of each lead using the categories described below:

Inventor:	Lead from inventor/researcher.
Licensing Pro:	Lead developed by licensing professional contacts, phone marketing, targeted mailing, or from an internal marketing study (web search, Dialogue, etc.).
TTO Marketing:	Lead from <u>other</u> TTO marketing methods such as: printed lists available technology, mass mailing, your web site, newsletter, etc.
Marketing:	Lead from conventional commissioned or purchased marketing study from outside expert.
Company:	Licensee approached the TTO, e.g., found your patent, or called or visited to solicit technology (not as a result of your web site, list, or outreach from your office).
Sponsor:	Research Sponsor requests a license to a sponsored invention.
Other:	Third party referral, ...anything else.

4. Collect, classify, and tabulate the data. Count an option and the resulting license to the same company once. Fill in your results on the other side of the form.

5. Send a copy of your results to:

Chris Jansen
University of Utah
615 Arapeen Drive, Suite 110
Salt Lake City, Utah 84108

Phone: (801) 581-7792
E-Mail: chris@tto.utah.edu
for publication and results:
www.TTO.Utah.edu

TABLE 1: Institutions Surveyed

Institution	Sponsored Research (millions per year)	Medical School	Number of Full-Time Licensing Professionals	Average Number of Agreements Signed per Year
University of Florida	250	yes	3	21
M.I.T.	900	yes*	8	110
Oak Ridge National Laboratory	583	no	5	19
Oregon Health Sciences University	100	yes	1.8	12
Tulane University	85	yes	2	7
University of Utah	200	yes	3	20

*joint program through Harvard Medical School

TABLE 2: Sources of Leads for Agreements

Institution	Total Agr.	Inventor	Marketing by Staff	Company (Licensee)	Research Sponsor	Unknown	Time Period
Florida	212	105 49.5%	27 12.5%	14 7%	49 23%	17 8%	1988-98
M.I.T.	284	153 54%	65 23%	43 15%	20 7%	3 1%	7/90-2/93
Oak Ridge	230	155 67%	37 16%	9 4%	6 3%	23 10%	1984-96
O.H.S.U.	129	59 46%	54 42%	8 6%	1 1%	7 5%	1986-97
Tulane	20	9 45%	5 25%	0 0%	5 25%	1 5%	7/94-6/97
Utah	265	160 60%	31 12%	45 17%	0 0%	29 11%	1985-98
TOTAL	1,140	641 56%	219 19%	119 10%	81 7%	80 7%	Appx. 52 yr.

institution follows: A large chemical company was interested in a new invention that was described to them by a faculty-member inventor. The company asked the inventor if it could file a patent application. With the professor's permission, the company filed. The first knowledge of the invention by the technology transfer office and the company's need for a license was a copy of the patent application in the mail. While not the optimal way to find a licensee, this is preferred to finding the company manufacturing the product without a license.

As the amount of formal and informal university-industry research collaboration grows, these authors expect that there will be an increase in the number of licenses that come about in these unconventional ways, as well as an increase in inventions with industrial co-inventors.

Lists of Inventions Rarely Lead to Licenses

Virtually every caller and every visitor to the technology transfer office at the authors' institution asks if a list of available technologies is available for distribution. We are firm; we say: "We do not send lists." Most universities that use lists claim that the lists generate tremendous amounts of paperwork and no licenses. The authors' institution's inventions are listed on several commercial databases as well as on the institution's website to ensure that there is public access to the institution's inventions and issued patents, but these lists have not resulted in any licenses.

Marketing Studies

With limited licensing staffs, most universities do very few formal marketing studies. M.I.T. hired its first full-time market researcher only within the past few years. Oregon Health Sciences University occasionally hires a consultant to do a study on very promising inventions. At the University of Utah, the State Centers of Excellence program provides funds for marketing state-sponsored inventions.

licensing office to make their needs known. After developing this relationship, the licensing professional calls the company as soon as a suitable invention comes to the office.

One possible scenario of a marketing process for a university-developed invention starts with a web search to identify ten or twenty companies active in the field of the invention. These leads may be followed by phone calls or letters. Very often, an individual at the targeted company has the names of other people to contact. If not, the person may suggest other companies in the business. If an individual is not known, a call to the Director or Vice President of Research and Development may put the licensing professional in touch with the right person. In pursuing this contact, the licensing professional quickly describes the invention being marketed to determine if it is related to the company's business. If there is interest, a confidential non-disclosure agreement is arranged (often by fax) and the licensing professional has the industry scientist speak to the inventor as soon as possible. Occasionally the industrial contact requests written material, and in that case a patent application is sent (without the claims), along with any publications on the invention, and the invention disclosure if it is well written.

The marketing efforts of the six institutions surveyed in this study had widely varying levels of success. It is difficult to determine empirically why this disparity exists without a more exhaustive review of each office's procedures. However, there are some likely possibilities. One is the amount of human resources available to the office. As opposed to taking a telephone call from an interested company or calling a few industrial scientists suggested by the inventor, active marketing is a time consuming process. Most new inventions require a unique marketing survey to identify potential licensees. The use of a technology targeting database helps this effort tremendously, but updating such a database is time consuming in and of itself. Another factor is reputation and name recognition of the institution. It should come as no surprise that M.I.T. is at the higher end of marketing success (23%), and the fact that an invention comes from such a well-known research institution certainly helps to gain the ear of the potential licensee.

four business cards to the technology transfer office from *one* conference. Licensing professionals also ask professors to collect the cards of interested laboratory visitors. Having received these leads, we try to follow up by phone. Of course, if the person called is not interested, we ask if he/she knows of someone who might be interested or another company that may be interested.

During the search for licensees, the inventor is often called to explain his or her invention on the phone to potential licensees. Sometimes the call can lead to a string of visitors who may be interested in the invention and want the inventor to provide laboratory demonstrations and even samples. Sometimes the company wants lab specimens to test or wants the inventor to test their lab samples. Occasionally, it is necessary to carry out several months of experiments to see if the invention is applicable to the company's needs. One example involved an invention that produces fine metal powders, which was tested (at the company's expense) to see if it could be adapted to make fine metal coatings on rods. The test was successful.

Working with the inventors provides many advantages in the quest for licensees. The company representatives provided to licensing professionals by the inventors are a relatively receptive audience. He or she needs little technical information from the technology licensing professional. However, there is often a need for coaching the company researcher on how the university licensing process works. If there is a match of the company's technical needs with the university's technology, most inventor-supplied contacts are willing partners in the licensing process in spite of the other heavy demands on their time. In turn, the inventors who are willing to work with licensing professionals by sharing leads, talking to potential licensees, providing samples, and participating in the technology transfer are the ones whose inventions get licensed. Because successful technology transfer requires the personal interaction of technical experts on both sides, it is necessary to find someone like a graduate student or postdoctoral fellow to perform the university's side of the interaction if the faculty member has no interest in the commercialization of the technology.

the survey selected a period of time, ranging from 2.5 to 13 years. A list of options and licenses executed during that period was made, containing the dates of the agreements and invention titles, respectively. The survey was conducted by interviewing the licensing professional who negotiated the agreement to identify the source of the lead that led to contact with the company.

Results

A total of 1,140 licenses were reported from the six institutions participating in the survey from a combined total of approximately 52 years of research (Table 2). The combined percentage of leads from inventors was 56%. The combined percentage of leads originating from marketing efforts by a staff licensing professional was 19%. The combined percentage from the future licensee contacting the technology transfer office was 10%. The total percentage of leads originating from a research sponsor was 7%, as was the percentage of licenses for which no person could recall the origin of contact with the licensee. A look at the numbers and percentages in Table 2 from the individual institutions does not reveal many striking disparities with the combined averages. However, the relative differences between institutions within each category may reveal a uniqueness about specific institutions and how they license their technology.

The highest, combined average, and lowest observed percentage ranges from Table 2 were plotted in Figure 1 as a function of lead source. For the category of inventor-identified leads, the combined average percent (56%) was almost perfectly between the high (67%) and the low (45%), indicating that inventors are by far the best source of leads at research institutions of varying sizes, budgets, geographical locations, and research missions. For leads identified by marketing efforts from a licensing professional, the high of 42% was substantially higher than the average (19%) and the low (12%). Companies contacting the licensing office as a lead for a license ranged from 17% to zero, with an average of 10%. A research sponsor as a lead ranged from 25% as a high, to zero as a low, with 7% as an average. Because technology transfer offices the *Journal* Editorial Board suggested that presenting data from several institutions varying in both size and research funding would be even more useful than data from one institution. This was achieved by presenting three workshops on this topic at the last two AUTM Annual Meetings. The survey was conducted and presented by the following licensing professionals:

Harrison F. Dillon, University of Utah
Carla Fishman, Tulane University
Zohir Handy, University of Florida
Christina Jansen, University of Utah (formerly of M.I.T.)
Tom Major, University of Utah (now at Allied Signal Inc.)
Russ Miller, Oak Ridge National Laboratory
Sandra Shotwell, Oregon Health Sciences University

Table 1 lists the wide range of the research infrastructures of the institutions participating; some institutions include medical schools while others do not, substantially altering the relative proportions of biomedical-related inventions. Total funding for sponsored research ranges from approximately $900 million per year for M.I.T. to approximately $85 million per year for Tulane. The number of licensing professionals is approximately commensurate with the total funding dollars. The authors' goal was to survey a broad range of research institutions in order to avoid drawing unwarranted conclusions based on data from only one type of institution.

Background

The Bayh-Dole Act

All of the institutions that participated in this study proactively seek licenses to implement the mandate of Congress as expressed in the Bayh-Dole Act, 35 U.S.C. §§ 200-212. That is, these institutions seek companies (licensees) who will develop the inventions that arise from federally funded research into commercially successful products. Only by getting the inventions out into the commercial sector can the inventions be developed, tested, and marketed to benefit the economy through induced investment and job creation. The Bayh-Dole Act was instituted specifically to insure that

ramp up technology transfer efforts to generate significant income to support the infrastructure of their institutions. However, the restrictions on the conduct of research and development, the ambiguity in IPR laws and difficulty in enforcement, the lack of university administrative IPR policies and regulations, the incestuous relationship between the universities and their technology-based enterprises, all work against the success that the Chinese are seeking. Yet, our colleagues embraced the U.S. models of IPR and technology transfer. Accordingly, this author is convinced that the Chinese will adapt their systems to emulate aspects of Western-style models, including greater recognition of and enforcement of intellectual property rights. Change will be required to achieve their goals, a challenge that is not lost to our Chinese colleagues.

There are and will be significant opportunities for members of the Association of University Technology Managers (AUTM) to collaborate with and be of assistance to our colleagues in Chinese universities during this time of change. For instance, discussions are underway for development of a series of technology transfer workshops in key Chinese cities. The Chinese have expressed interest in placing interns in U.S. university technology transfer offices. Additionally, citizen exchange programs would be of value, with focus upon PRC Ministry officials overseeing higher education and intellectual property industries. Such collaboration will serve to enrich individual experiences and to establish an international framework for technology transfer that will be of long-term benefit to both the United States and the People's Republic of China.

members, yet represented that all of their time was devoted to a university-owned company. In one instance, the "Vice President for Research" for Tsinghua University was later introduced as "Vice President and Board Member" for a spin-off company owned by Tsinghua University, implying that the individuals who arranged for the transfer of technology between the university and the company reported to the same individual. It was clear that Western notions of conflict of interest were not recognized in China.

- *Legal Form of Agreement*. No one could articulate or describe to the Delegation the legal form of technology transfer between the university and its enterprises. Was technology licensed to the company, assigned to the company, transferred by some other contractual arrangement, or transferred as a gift? As an example, the Vice President of the Founders Company reported that the company annually paid to Beijing University an amount equivalent to $2 million (U.S.). The Delegation asked direct, focused questions as to the nature of this payment (gift, contract requirement, a function of equity, etc.), but never received a definitive answer.

- *Valuation*. Questions were posed to the U.S. Delegation at every stop as to how U.S. universities established the value of intellectual property in negotiation with industry, including determination of royalty rates. Yet, as stated earlier, the Chinese universities are in weak positions to negotiate with their enterprises because the negotiations are not conducted "at arm's length." Thus the universities feel exploited.

- *Unrealistic Expectations*. Our Chinese colleagues are under significant and relentless pressure to make money through technology commercialization in order to support the vast operational expenses of their universities. There was clearly an unrealistic expectation that income from technology transfer would be the solution to the funding deficits. This author's observation was that the Chinese were disappointed to learn

Despite these documented advancements, there was no clear summary of the intellectual property framework in China provided to the Delegation, despite frequent requests. Rather, many of our Chinese colleagues had difficulty articulating the country's laws and regulations, and in some cases, they provided conflicting explanations. The most striking observation regarding IPR in China was that the very individuals responsible for managing the intellectual property rights of their institutions did not appear to have a clear understanding of the legal framework within which they worked. Other observations were as follows:

- *Complexity of IPR Enforcement.* While the IPR laws were themselves complex and ambiguous, the Chinese legal and administrative system for enforcement of these rights were even more indecipherable. Indeed, Chinese IPR laws are apparently enforceable through civil court proceedings, criminal court proceedings, administrative proceedings in ministries and other national-level agencies, and administrative and criminal proceedings in provincial and municipal levels of government.

- *Inconsequential Judgments.* Despite these many avenues for enforcement of intellectual property rights, documented actions and judgments made by the various courts, agencies, and local governments in cases of IPR infringement would be considered insignificant and ineffective by U.S. standards. For instance, fines for IPR infringement assessed by the People's Court may range from 10,000 yuan to 200,00 yuan (~$1,200 to $24,000).

- *No Protocols.* With the exception of Tsinghua University, the Chinese universities we encountered did not appear to have clear administrative policies and procedures for IPR management; written policies appeared to be the exception.

- *Ownership of IPR.* There were no guidelines respecting ownership of intellectual property between the institution and its faculty inventors. The Chinese could not articulate the rules of ownership despite frequent questions from the Delegation. Faculty were apparently personally funding patent applications,

- *Industry-Sponsored Research.* Our Chinese colleagues were very interested in ways to encourage industry sponsorship of research and development. Yet, all universities lamented that sponsors wanted "finished goods" to result from any collaboration. Furthermore, the companies expected to own all results and prohibited any publication of the research results. The universities did not appear to be in a position to negotiate with the industrial enterprises. They sought advice on how to strengthen their negotiating positions, an especially daunting task when the company funding the research is owned by the university.

- *Use of Funds.* In China, sponsored research funding may be used only for travel, supplies, and miscellaneous expenses, but not for salaries of existing or additional research personnel. Personnel appointments to research laboratories appear to be fixed by the PRC Government, and no amount of third-party sponsorship can increase the staffing levels. Several Chinese faculty members represented that this limitation upon use of funds was a significant barrier to the expansion of research and technology transfer in China.

- *Research Faculty.* Many faculty members within the universities do not teach at all, but only perform research. For instance, at Tsinghua University, the Delegation was told that fifty percent of the university's faculty are research faculty, with no teaching responsibilities. Furthermore, it appeared that some faculty moved to full employment within university-owned spin-off companies, while retaining their university titles and appointments, and possibly even their salaries.

- *University Financial Crisis.* The Delegation sensed that some of our Chinese colleagues felt that their universities were underfunded by the PRC Government and the regional governments. Accordingly, the university presidents were faced with the difficult challenge of finding the money required to maintain expanded services and infrastructure not common to U.S. universities, such as employee hospitals, housing for

INTRODUCTION

The visit of the American delegation ("Delegation") to China well supported the grant's objective. During the two weeks in China, the Delegation traveled to three Chinese cities: Beijing, Xi'an, and Guangzhou. In Beijing, the Delegation received informative briefings from the Ministry of Education and the Ministry of Science and Technology about China's system of higher education, as well as its management of intellectual property rights and technology transfer systems. At the Center of Science and Technology Development, the Delegation learned about research awards and patent activities at Chinese universities, and thereafter visited Tsinghua University and Beijing University and several university-owned enterprises, such as Founder's Company, referred to by our hosts as "the Microsoft of China."

In Xi'an, a large city in Central China, the Delegation participated in two seminars at Jiatong University. These seminars were attended by local individuals, government officials, representatives of industry, and university administrators, faculty and students. One seminar addressed university technology transfer, with presentations on the government's role in technology transfer, the management of a university technology transfer office, public-private partnerships, and venture capital. The second seminar addressed legal protection for intellectual property and intellectual property rights in distance education.

In Guangzhou, the Delegation participated in an extensive "Workshop on University-Industry Cooperation in the Guangzhou Region," which was open to government, industry, and university officials. The Delegation also participated in a half-day discussion with university administrators at Zhongshan University.

Finally, the Delegation participated in additional meetings in Hong Kong, including valuable discussions at Hong Kong Science and Technology University. (This author's travel plans prevented participation in the Delegation's meetings in Hong Kong.)

Europe

Applications for European Community Trademark registrations may be made and registrations granted without proof of use. The application is published and, if a third party opposes registration and wins, the applicant will be liable for all expenses of the opposition including attorneys' fees for both parties. Therefore, a European search should be done for possibly conflicting marks before filing. Trademark registrations may be assigned without reciting "the goodwill of the business." European Community Trademark rights may be separately licensed in the individual member countries but must be recorded in the European Community Trademark Office to be effective against third parties. Quality control provisions are not required. Marking of goods is not compulsory but the "®" may be used.

Australia

Applications may be filed and registrations issued based on "intent to use" without proof of actual use. Applications and registrations may be assigned without reciting "the goodwill of the business." Licenses should have quality control provisions and need not be recorded. Marking of the goods is not compulsory, but the "®" may be used.

Japan

Applications may be filed and registrations issued based on "intent to use" without proof of actual use. Marks may be assigned without reciting "the goodwill of the business." Trademarks may be licensed without reciting quality control provisions, but if the owner allows the licensee to use the mark in a manner misleading as to the quality of the goods, the license may be held invalid. Exclusive licenses (but not non-exclusive licenses) must be registered to be effective against third parties. Marking is not obligatory but may be done stating "Registered Trademark" in Japanese lettering. False marking is a criminal offense.

"strict liability" standard precluding a factual finding of negligence in order to assign liability to anyone who benefited from marketing the product and was a "link" in its marketing simply as a way of reaching the deepest pockets available to pay for a plaintiff's loss. For these reasons, quality control provisions in license agreements should be as minimal as legally possible (see above), should require the licensee to bear costs of defending suits, and require the licensee to indemnify the institution for any tort liability imposed by a court of law. Liability insurance for licensors is also available.

Procedural Requirements

Federal registrations must be maintained by proving that the mark is still in use in commerce between the fifth and sixth anniversaries of the registration. At the same time, if continuous exclusive use of the mark has not been challenged, a Declaration can be filed to preclude certain attacks on the registration, i.e., that it is merely descriptive. Federal registrations must be renewed every ten years, with proof that the mark is still in use. Licensees can be required contractually to bear the costs of these procedures.

Sale of Trademark Rights

The U.S. Trademark Act provides that applications for federal registration based on "intent to use" *cannot* be assigned. Because the public interest component of a trademark, i.e., the public's right to expect the trademark to stand as an indication of the quality control exercised by the owner of the mark, is protected under the law, a trademark does not really exist unless it is coupled with the "goodwill of the business" it symbolizes. Once actual use has been proved, however, and the mark is registered, the registration can be sold like any other property right. Thus, an Assignment should be made only after the mark has been registered and should recite the transfer of not only the mark and the registration, but also of the "goodwill of the business associated therewith."

For this reason, it is not recommended that inventors or technology transfer offices routinely make up and apply for registration of new marks for every technology. Only where there appears to be an already-recognized mark or a mark irresistibly appropriate for the technology should registration be pursued. When the licensee is willing to continue to use marks owned by the institution, the marks can become very valuable. The license agreement should explicitly state that all use of the mark by the licensee inures to the benefit of the institution.

Policing

A trademark is a hybrid creature belonging both to the entity that created and registered it and also, in a sense, to the public whose interest in having the mark stand for a single quality standard for the goods and services is strongly protected under the law. For example, if the owner of a trademark registration freely allows others to use the mark for similar goods or services, a court will hold the mark invalid; that is, no longer able to serve as a protectable mark in which the owner can assert exclusive rights, because the public has been confused and is no longer able to identify the mark with a single quality standard. The trademark license agreement should therefore require the licensee to notify the institution of any unauthorized uses that come to its attention and to take responsibility for costs of pursuing infringers or otherwise stopping infringement. The license agreement should also prohibit uncontrolled sublicenses.

Quality Control

In the distant past, protection of a public interest in identifying a trademark with a single source for the goods precluded the licensing of trademarks because that would allow the user of the mark to be different from the owner. However, this problem was overcome by a requirement that a trademark owner exert quality control over the use of the mark by any licensee(s). Quality control need not be excessively burdensome, but it is recommended that a trademark license require something more than a simple right to against research institutions because by their very nature they are unequipped to actually market products and services bearing trademarks.

An application based on "intent to use" protects against others who adopt the same mark and file a later application based on "intent to use." So long as the first application eventually matures into a registration through showing actual use within thirty-six months of its allowance, a later intent-to-use applicant cannot obtain a registration even though its actual use comes first.

Registering trademarks with state trademark offices (often in the state's Secretary of State's office) is less expensive and faster than federal registration. However, it is not recommended that state filing be done in lieu of federal filing because state registrations serve only as notice to others that trademark rights may exist. Valid perfected trademark rights are only possible when a mark is actually being used in commerce. State trademark offices generally do not require applicants to prove actual use of marks in commerce before issuing registrations and therefore courts generally accord little weight to state registrations.

Federal registrations, on the other hand, provide *prima facie* evidence of trademark rights and allow their owners to sue for infringement in federal court. If infringement is found to be willful, costs of suit, lost profits, triple damages, and attorneys' fees, may be awarded.

A federal registration effectively "reserves" trademark rights for the owner throughout the entire United States. If a third party begins using the mark in an area of the country where the owner or licensee has not yet begun marketing, the trademark owner has the right to move into that area, begin use of the mark, and sue the third party for infringement. Such a suit can only be filed after the trademark owner or licensee has begun use in that area, however, because a trademark owner must be able to show likelihood of public confusion before courts will enforce the owner's exclusivity. If a third party is found to have been using the mark in another

OBTAINING FEDERAL REGISTRATION IN THE U.S. BASED ON "INTENT TO USE"

Applying for federal registration of a trademark based on "intent to use" can be done by filing a simple form (that can be downloaded from the U.S. Patent and Trademark Office website at www.uspto.gov) with the U.S. Patent and Trademark Office, alleging a *bona fide* intent to use the mark in commerce and stating that to the best of the applicant's knowledge, no other party has the right to use the mark. No prior search is required. An extensive search for possibly conflicting marks may be ordered through a commercial search service for several hundred dollars covering both registered and unregistered uses of a mark, but this is not a prerequisite for filing a trademark application. However, a database search of federal registrations and applications, e.g., through the U.S. Patent and Trademark Office website, or the Dialog® database services, which also covers state and selected foreign country registrations and applications, is recommended to make sure there are no obvious impediments to federal registration. It is also important to craft a specific and complete definition of the goods or services for which the mark is to be used.

The U.S. Patent and Trademark Office will examine the application by searching for conflicting registrations or applications and by determining if the mark is generic for the goods or services, unacceptably descriptive, or deceptively misdescriptive. Words that describe the goods or services for which the mark is being registered, or their characteristics, are not registrable. It would be unfair to give a monopoly to one entity on words that are required or ordinarily used to describe goods or services that anyone is free to market. For example, "BREAD" cannot be registered as a trademark for bread because it is the generic name of the goods, nor can "YEAST" or "OVEN-BAKED," because these words describe qualities of the goods. A word that is deceptively misdescriptive, for example, "SEVEN-GRAIN" for a bread made only of wheat, is also unregistrable. Place names and common surnames are usually unregistrable as well. Coined words with no other meaning such as "EXXON®" make the best trademarks, A licensee may have a strong desire to continue use of a nickname for goods or services coined by the developers of the technology. If the technology transfer office has not applied to register the mark on behalf of its institution, a licensee can begin using the mark in commerce and, as the only actual user, can register the mark in its own name. If the license is non-exclusive, the first licensee to begin using the nickname as a trademark in commerce will be the owner and other licensees of the same technology will be precluded from using the mark. This scenario can be prevented. The institution can assert its ownership of the trademark by means of federal registration in its own name before use in commerce by a licensee has begun.

As a licensee continues to use a trademark owned by an institution, the mark becomes more and more valuable with increased public recognition and acceptance. Even after the patents on the technology have expired, the trademark can continue to generate royalties for the institution as long as the mark is still being used. Initial registrations for trademarks carry a ten-year term but can be renewed indefinitely as long as the mark is being used in commerce. Trademarks can be licensed to multiple, non-exclusive licensees, and use by all these licensees inures to the benefit of the institution as the owner of the trademark.

Use of a mark in commerce is essential to complete the creation of enforceable trademark rights. Traditionally, it has been the licensee (i.e., the company who actually markets products or performs services based on licensed technology) that chooses and protects brand names. Indeed, unless the licensee has specifically agreed not to, the licensee can assign any brand name to products and services based on licensed technology. Because the licensee is the entity the public recognizes as the source of the goods or services, the licensee is the entity that legally owns the trademark. Actual use in commerce is so fundamental to the creation of trademark rights that such rights can exist even without registration. Marks that are used in commerce but never registered—called "common-law trademarks"—can be enforced against infringers. Until several years

Intellectual Property Flow

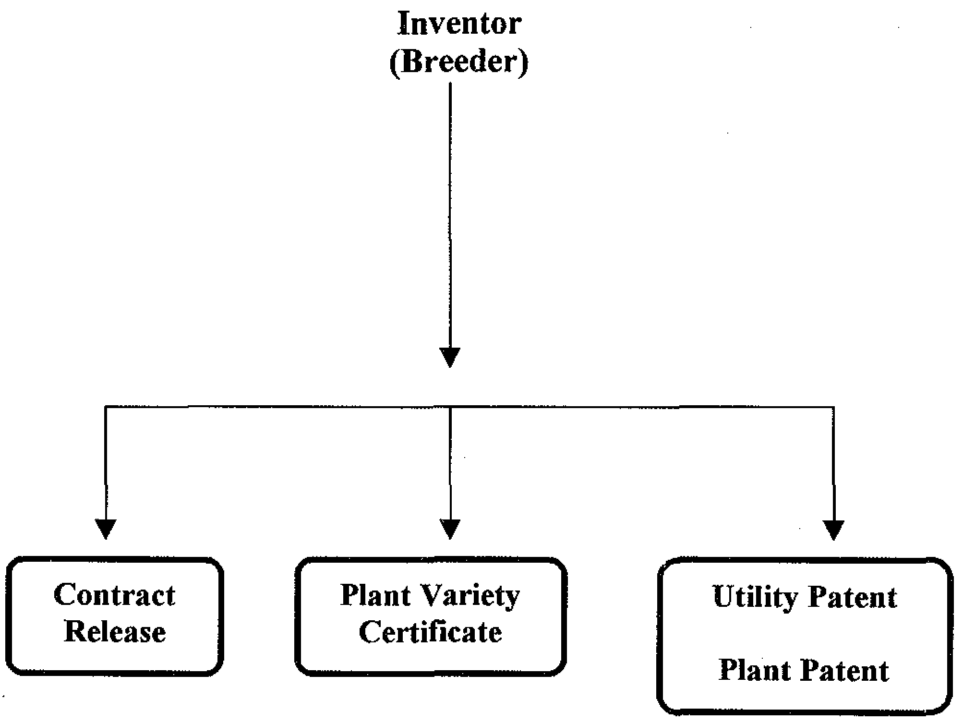


Figure 1

transaction costs, but they reflect the reality and needs of today's marketplace.

is an extremely powerful instrument because it can accommodate differing economic, political, and philosophical concerns of licensor and licensee. The license clauses can set forth the conditions of the relationship in as much detail as desired and can designate the law that will control the interpretation of those clauses. Generally, the license will be enforced as long as it does not conflict with federal and state law and/or public policy. A license agreement can include:

<u>Ability to Conduct Research</u>. There is some question as to whether or not utility patents extend the prohibition of "make, use, or sell" to excluding others from doing research with the patentable subject matter. This is, of course, of critical concern to universities, whose primary mission is to promote research. It is important for university researchers to understand that a patent prohibits all research except research that would replicate the patentable results.

If the ability to conduct research is a concern in a specific situation, then the nature of the experimental use can be handled within the license agreement, wherein such use is either allowed or not allowed.

<u>Access to Genetic Material (Germplasm and/or the Gene Pool)</u>. Another concern is that if genetic material is patented, then it will not be accessible to the general public. However, such allowances can be specified in a license agreement. One can specify whether or not access is exclusive or non-exclusive. If the license is non-exclusive, then by definition, all can have access to the seed according to the terms of the agreement. If the license is exclusive, the licensee may be made to make seed available to all who want it under acceptable sub-licensing terms.

<u>Geographical Limitations</u>. It is important to realize that if one has filed patent applications worldwide, the license agreement can be used to specify where in the world the licensee(s) can use the invention. For example, if a patent was issued in both the United States and in Europe, one can still restrict a licensee to specific regions of the world. Furthermore, one may be able to specify that a royalty is to be collected in countries that do not offer patent coverage.

certified. In addition to verification of seed purity and type, this service can be used to verify production and hence "police" crop production.

Foundation Seed Organizations

Many foundation seed organizations in the United States were organized in the 1930s and 1940s to maintain and increase the foundation classes of seed developed by the state agricultural experiment stations or the USDA and to provide a service for interregional testing. Public releases of new varieties from universities have been done mainly through foundation seed organizations.

The nature of foundation seed associations varies widely from state to state. A foundation seed association may be a private, for-profit organization that operates independently of a state experiment station; it may be a non-profit organization connected to a state experiment station; or it may be an integral part of the state crop improvement association.

Branding and "Variety Not Stated"

Varietal naming can be rather complicated. A variety must be given a name that distinguishes it from other varieties of the same species. Normally, the originator gives the first name. A variety with a name is a "named variety." A basic decision is whether or not a variety will be allowed to be marketed using a company's name, i.e., "branded," as opposed to being marketed by the name given it by the originator on the certificate of plant variety protection. For materials protected by the PVPA prior to 1994, it was not necessary to use the name of the variety given by the originator. However, the new plant variety protection law closed this loophole and states quite clearly that the variety name must be used on material protected by the PVPA, *with the exception* of lawn, turf, forage grass, clover, or alfalfa. The latter exceptions appear to have been made for political, rather than biological reasons.

For these exceptions, if a named variety is branded by a company, it must bear the label "variety not stated" (VNS), signaling to a purchaser

Around the turn of the century, former students of the land-grant colleges began to form "crop improvement associations" to aid the agricultural experiment stations by coordinating seed increases of newly released varieties. Some crop improvement associations assisted those who increased seed by inspecting their fields before harvest. Canada pioneered this service as early as 1905. The first field inspections in the United States were made around 1913 in Wisconsin. Crop improvement associations soon began to develop their own seed inspection standards based on the results of these inspections.

In 1919, representatives from crop improvement organizations in the United States and Canada formed the International Crop Improvement Association (ICIA). One of the main objectives of this association was to provide a forum in which the seed improvement and certification methods of all member crop improvement organizations could be standardized. By 1921, the ICIA had begun to standardize methods of inspection and certification for a number of important crops. In 1929, it approved standard nomenclature for recognized seed classes—foundation, registered, and certified.

In 1939, the Federal Seed Act was enacted to regulate the movement of certified seed through interstate commerce. The law recognized the two commercial classes of certified seed developed by the ICIA—registered and certified. Regulations promulgated under the act stated that only officially-recognized state agencies could certify seed. In Wisconsin, for example, the Wisconsin Crop Improvement Association is the only state certification agency. It is organized as a non-profit corporation and must perform certain duties to retain recognition by the state secretary of agriculture.

The Federal Seed Act did not provide a technical definition of "certified seed." It simply stated that certified seed was that which met a state certification agency's own rules. Nor was there an ICIA rule that required member certification agencies to comply with ICIA standards. Therefore, differences remained between standards of state certification agencies.

Plant Intellectual Property: Utility Patents

It is generally recognized that the strongest form of intellectual property protection that can be offered is that of a utility patent. A utility patent is essentially a legal right that permits the owner to exclude others from making, using, selling, offering for sale, or importing the covered invention. The exclusionary right lasts for 20 years from date of filing in the United States. A patentable invention has four essential elements: it must cover certain subject matter; it must be useful; it must be novel; and it must be an unobvious extension of what is already known to the public. (The test is whether the invention would be obvious to "one skilled in the art.") Two notable features of a patent are: it induces an inventor to disclose and teach the invention to the world (it is not a secret); and it gives the inventor (or inventor's assignee) the right to exclude others from practicing the invention claimed or its substantial equivalent. In return for this right to exclude, the inventor must disclose the invention to the world in such detail that other people will be able to practice it (enablement). For living biological materials such as seeds, the enablement requirement is satisfied by making a deposit of the seed in an internationally recognized seed depository.

Utility patent protection for plants was established in the U.S. in the 1980s through two landmark court decisions. In *Diamond v. Chakrabarty* 447 U.S. 303 (1980), the U.S. Supreme Court held that a genetically modified microorganism was patentable subject matter under the utility patent statute. In *Ex parte Hibberd* 227 USPQ 443 (PTO BA1 1985), the U.S. Patent and Trademark Office's Board of Appeals and Interferences followed this precedent and held that plants, seed, and tissue cultures were suitable candidates for a utility patent.

ISSUES

Deciding between these options may involve considering at least the following points:

1. Is the invention worth the cost of a certificate of plant variety protection or a utility patent? If the variety is of questionable

The development of hybrid maize in the 1920s provided an effective means to maintain exclusive control over seed production and marketing. Hybrid seed can be protected as a trade secret, because as the result of the controlled cross of two inbred parents, it gives the owner an advantage and the identity may be held secret. As public universities began to develop and release inbreds free to the public, many start-up seed companies were established to create and market hybrid seed developed from inbreds. Eventually, successful private firms began to develop their own inbreds.

The extent of private investment in non-hybrid variety development, however, remained limited because of the previously discussed limitations on exclusivity.

The first form of statutory intellectual property protection for plants was a 1930 amendment to the U.S. utility patent statute called the Plant Patent Act (PPA) (35 U.S.C. §§ 161-164). Today, under the PPA, a breeder who develops an asexually-reproduced variety (with the exception of uncultivated and tuberous species such as potatoes and artichokes) which is novel, distinct, and unobvious, will receive patent protection for 20 years from filing an application. Action taken by the United States Department of Agriculture (USDA), however, prohibited inclusion of sexually-reproduced varieties in the act. The USDA successfully argued that because sexually-reproduced species were genetically unstable, a patented variety would eventually differ from its patent disclosure, rendering the patent unenforceable.

One of the most active lobbyists for passage of this act was Thomas Edison. Edison acted on behalf of his deceased friend, Luther Burbank, the prolific plant breeder and inventor of hundreds of new fruit and vegetable varieties. After the PPA was signed into law, Edison told the *New York Times*, "Burbank would have been a rich man today if he had been protected by such a patent bill." Since 1930, over 6,000 plant patents have been issued by the U.S. Patent and Trademark Office.

Plant Intellectual Property: Plant Variety Protection Act

Intellectual property protection of sexually-reproduced plant species was not seriously considered in the United States until the 1950s. By

Various passages in the Convention raised the specter of "compulsory licensing" and uncertain royalty obligations; these uncertainties led many biotechnology companies to oppose the signing of the Convention, and certainly influenced the Bush Administration's decision not to do so. It also confused the issue for many plant breeders who are dependent on access to genes from wild materials, and it greatly complicated the acquisition of plant materials by taxonomists (Price 1998).

Managers of plant intellectual property in both developed and developing countries are finding it necessary to learn about modes of intellectual property protection that are foreign to their past practices. For example, in the United States the application of many instruments such as confidentiality agreements, material transfer agreements, utility patents, and licenses that are normal, routine, and customary from fields outside of plant breeding, may be alien to managers of plant intellectual property. Conversely, managers of technologies outside of plant breeding are probably equally unfamiliar with traditional systems employing seed certification, foundation seed organizations, plant patents, certificates of plant variety protection, and varietal naming.

The movement of many novel plant biotechnologies through universities and other nonprofit channels will require the confluence of these two technology transfer systems. The melding of patents, licensing, confidentiality agreements, and material transfer agreements, with the traditional structure of plant variety protection, seed certification, and foundation seed organizations will be increasingly more common.

The purpose of this article is to discuss these two complementary technology transfer systems for plant intellectual property and to present simple but workable decision trees to be considered along the path from discovery to revenue sharing. These systems are robust enough to handle most university licensing programs.

The decision process can be broken down into two broad categories: one concerning the type of intellectual property protection being sought, followed by another concerning business matters.

Act. Since that time, major efforts have been undertaken at U.S. institutions to introduce and improve crop varieties for U.S. agriculture. Because public money supported this work, new varieties were released free of charge, or at minimal royalty rates, to farmers and farmer organizations. Institutions such as seed certification organizations and foundation seed organizations were developed to support these activities. Various seed classification systems such as breeder, foundation, registered, and certified were developed, as well as a 1970 patent-like system of seed protection by the Plant Variety Protection Act (PVPA).

On the other hand, many universities simultaneously developed technology transfer offices or activities for handling patentable inventions, primarily involving utility patents. The University of Wisconsin-Madison has had such an office since 1925. Iowa State University has had a technology transfer office since 1936. Because these types of offices were mainly concerned with utility patents, they rarely interacted with plant materials except for some perennial plants through the 1930 Plant Patent Act. Major agronomic crops, such as corn, soybeans, wheat, and oats, were not handled because they were not patentable. Consequently, these technology transfer offices concerned themselves with patent prosecution, marketing, and licensing to maximize royalty generation.

Many administrators and plant breeders are now retreating from traditional policies that release new plant varieties to the public free of charge or with minimal royalty. Universities find themselves in this new posture because of deteriorating local economic situations, the need to supplement research budgets, and a growing awareness of the need to handle plant varieties in keeping with practices that will maximize economic return. Obtaining intellectual property rights to new varieties and subsequently licensing them for royalties and research support has become more common. This is also a consequence of several technology transfer laws that were passed in the 1980s that give the right to inventors and their institutions to share in revenue generated from intellectual property developed with federal funds.

In my written testimony I listed some lessons learned and will close with three of these.

1. In order to be successful we must start with excellent science and teaching. Federal funding provides the basis for both.

2. The Bayh-Dole Act works.

3. We must never lose sight of the fact that we are operating at the interface of the for-profit and not-for-profit systems. To be successful we must understand and appreciate both—diminish neither. Accordingly, we must capture a fair value for the assets entrusted to us. It is irresponsible not to as these returns fuel a system, which creates the benefits and economic impact, which are the subject of this hearing today.

The Bayh-Dole Act [35 U.S.C. §§ 200-212] is an example of innovative policy. Enacted in 1980 and amended in 1984, this legislation allowed universities to more easily retain title to inventions made as a result of Federal funding. It provided a tool, in addition to teaching and publishing, to disseminate research results to the public in a meaningful way, and when appropriate, through commercial channels. As a result of this legislation, more than ever, universities and teaching hospitals are a catalyst for a robust U.S. economy.

The Association of University Technology Managers (AUTM) estimates that approximately 30 billion dollars of economic activity and 250,000 jobs each year are attributable to commercializing academic innovation. AUTM further reported an estimate of more than 1,000 products currently on the market that are directly based on university licensed discoveries. These are products with a development time of 6 – 10 years, or more. These are products that would not be available to us otherwise. Furthermore, we are seeing a continued increase:

- in the number of license agreements signed—indicative of future products to reach the market—and
- in royalties returned to universities (though still modest in comparison with the resources it takes to run a technology transfer operation)—indicative of more and more products reaching the market.

Basic science discoveries at academic institutions are often too embryonic for commercialization by large companies. In order to squeeze out risk so more traditional businesses can participate, increasingly universities are looking to the creation of new businesses to further develop and incubate technologies for the marketplace. In fiscal year 1997, AUTM reports 333 new businesses were started to move new discoveries from the laboratory to the marketplace. Since 1980, over 2,200 new entrepreneurial ventures have been created to commercialize university technologies. Of these, nearly half have been formed in the past four years.

The last two articles in this issue are, in my view, thought-provoking for AUTM members. Where do you get your leads to licenses? What is the economic impact of your university's R&D? I wonder if there are two questions that occupy technology managers more.

Christina Jansen and Harrison Dillon have provided an answer to the first question by undertaking and reporting a study of six institutions. Members will be interested in finding out whether their own hypotheses are proven out by the data that were derived from this insightful and original investigation.

And finally, UNC Professor Albert Link has favored AUTM with his scholarly and provocative paper on the technology transfer officer's role in assessing the economic impacts of university R&D. It provides an answer to that second question that technology managers ponder. One of the pluses of Dr. Link's scholarly article was that it generated significant discussion among *Journal* editors and the Editorial Board. I believe this type of discussion enhances the content quality of the *Journal* and the ultimate value of the *Journal* to the members. So I challenge you to read Prof. Link's paper and to share your thoughts with us. A dialogue, however extended in time, would benefit all AUTM members. This invitation to share your thoughts extends to comments on any of the papers included in this issue of the *Journal*. What do you think? We would like to know.

My thanks go to each of these authors. Only members who have researched, written, edited, and re-edited an article after receiving comments from the Editorial Board will understand the work and persistence involved. Each is commended for being willing to provide important information for us in a form that is easy to assimilate.

Managing Editor, Diane Hoffman, and I are constantly seeking original manuscripts or ideas for manuscripts. We invite you to contact Diane for content and review procedures.

Katherine L. Chapman, Editor

JOURNAL OF THE ASSOCIATION OF UNIVERSITY TECHNOLOGY MANAGERS

The *Journal of the Association of University Technology Managers* is provided free to members of AUTM. Single copies are available for $10.00 each, prepaid. Subscription requests should be sent to: Association of University Technology Managers, Attn: Ms. Penny Dalziel, 49 East Avenue, Norwalk, CT 06851, Phone: (203) 845-9015, FAX: (203) 847-1304, E-Mail: autm@ix.netcom.com

JOURNAL OF THE ASSOCIATION OF UNIVERSITY TECHNOLOGY MANAGERS

The *Journal of the Association of University Technology Managers* is provided free to members of AUTM. Single copies are available for $10.00 each, prepaid. Subscription requests should be sent to: Association of University Technology Managers, Attn: Ms. Penny Dalziel, 49 East Avenue, Norwalk, CT 06851, Phone: (203) 845-9015, FAX: (203) 847-1304, E-Mail: autm@ix.netcom.com