Volume 1, Number 2 Summer 2009

TOMORROW'S Technology Transfer

The Journal of the Association of University Technology Managers™

Hot Topic: How has the current economic situation affected your technology transfer office?

Highlights:

Plus:

AUTM®

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Summer 2009

TOMORROW'S Technology Transfer

The Journal of the Association of University Technology Managers™

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AUTM®

The Association of University Technology Managers

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Foreword

Dear Reader:

Welcome to the second edition of the new AUTM journal, *Tomorrow's Technology Transfer.*

Science is proving to be a priority for the United States' new president's administration. Usually, the number of invention disclosures increases in the two or three years following periods of increased federal funding. So at a time when we need to do less with more, we also must prepare to effectively handle the potential results of new funding programs. While this is exciting, efficiency and prioritization are more important than ever. One important resource we all can access is the AUTM contingent. Learn from your colleagues' experiences and ponder ways to apply their lessons to your own operations. Ask questions. Challenge them. Offer your own experiences. The journal is a powerful tool where we all can reach our colleagues.

Our features pieces are intended to be more than news articles. We want to capture the opinions of AUTM members and prompt further discussion on topics that affect university technology transfer professionals. As always, we welcome—and thrive on—your feedback.

We encourage you to submit articles, letters, and reviews to your journal. This is a practical forum for us to reach our colleagues and share our knowledge. Details are at available on the AUTM Web site.

In this issue, Beverly Lyman shares her provocative thoughts on maintaining productive relationships with inventors, and how, as technology transfer professionals, we "live to serve." Stephen Rothman outlines the federal tax laws affecting sponsored research agreements. Eric Guttag explains the recent developments in patent law reform and why we should be concerned. We also feature two book reviews of recent popular publications. And the reviews are not always favorable!

AUTM awards academic technology transfer and commercialization graduate student literature review prizes each year at the AUTM Annual Meeting℠. This year, the first prize was awarded to Peter Bacevice, a doctoral student at the University of Michigan. We are proud to publish his paper on issues of tacit knowledge that inform the development and downstream success of university startup companies. We hope to continue publishing articles from these new researchers studying our field.

In addition, we include three interesting research articles. Krisztina "Z" Holly studies in-depth interviews with geographically and commercially diverse venture capitalists to identify focus areas where universities can improve their interface with investors. Naoki Kato demonstrates how patent classification data can be used to determine what type of technologies a company will consider licensing. Finally, Jon Sandelin investigates a university's potential risks from university–industry relationships. The article includes examples and guidelines for managing conflict situations between university and industry partners.

We hope that you find these articles stimulating and informative. **We encourage you to submit articles, letters, and reviews to your journal. This is a practical forum for us to reach our colleagues and share our knowledge. Details are at available on the AUTM Web site.**

Kristin Rencher, AUTM Vice President for Communications
Oregon Health and Science University

Emily Bauer, Features Editor
Wisconsin Alumni Research Foundation

David Grossman, Research Editor
George Mason University

AUTM Bids Farewell to Editorial Board Member Jeff Armstrong

Ron Kudla, PhD, MBA

Jeffrey R. Armstrong, JD, LLM, 54, a member of *Tomorrow's Technology Transfer* Editorial Board, died on February 4, 2009, at Albany Medical Center Hospital. He was a proud cancer survivor who never gave up, and he fought his illness vigorously.

Jeff was a 1976 graduate of Skidmore College. He attained a juris doctorate in 1979 and, in 2004, earned a master's of law degree, summa cum laude (concentration in intellectual property law), both from Albany Law School.

He was a partner with the firm of Whiteman, Osterman & Hanna LLP and concentrated his practice in the area of transactional intellectual property, sponsored research and compliance matters, and technology transfer. He also was an adjunct professor of law at Albany Law School for intellectual property and technology transfer courses. In addition, Jeff served as external counsel to Rensselaer Polytechnic Institute for matters relating to sponsored research, research and export control compliance, and technology transfer and licensing, and general corporate counsel to colleges and universities throughout tech valley New York. Jeff also published several articles in his areas of expertise.

We are grateful for Jeff's contributions to AUTM and technology transfer, and we will miss him.

Ron Kudla, PhD, MBA, is executive director of intellectual property, technology transfer, and new ventures at Rensselaer Polytechnic Institute in Troy, New York.

Wanted: Real-Life Photos that Represent AUTM

We need your help! In addition to articles, *Tomorrow's Technology Transfer: The Journal of the Association of University Technology Managers* is looking for photos for the cover. Sure, we could use stock photos of outdated technologies or generic business people posed around a conference table, but that doesn't represent what AUTM is about–its members and the amazing technologies that they manage.

So consider submitting a cover photo to TTT. We'd like to see photos of your colleagues in action. (OK, so they are probably still posed around a conference table, but at least we know who they are.) Or submit a photo of a technology out of your university or research institution.

Photos should be digital, at least 300 dpi, and four color. In addition, photos must have permission from the picture subjects as well as the photographer. Please include two to four sentences explaining your photo. E-mail photos for consideration to Jennifer Gottwald at jennifer@warf.org.

Who Leads in Technology Transfer?

Establishing Productive Interactions between Researchers and Technology Transfer Professionals

Beverly A. Lyman, PhD, JD

Premise

Technology transfer offices—whether academic, in house, or government based—need to accommodate researchers. Accommodation involves bypassing organizational hurdles to empower technology transfer professionals to address researchers' needs as they arise, facilitate procedural requirements rather than add to them, and treat researchers unequally.

Background

The raison d'être for a scientific researcher is *not* to invent. A researcher rightfully desires to be in the lab, at the bench, or in the clinic. A researcher readily and openly discusses and disseminates findings, widely publishes papers, and presents data to colleagues at any opportunity—be it on cafeteria napkins or at the podium during platform conferences. A researcher agonizes over grant applications to obtain the necessary funding to survive, furthering scientific discovery for the benefit of all. A researcher writes draft upon draft of manuscripts in an effort to publish or perish.

All of these laudable goals are totally anathema to that which the technology transfer professional expects of the researcher. Why? Because of patents: the bane of the existence (and budget) of a technology transfer office. Insofar as patenting the results of its research in the form of inventions, the technology transfer office is a dark force that makes researchers turn against their very nature.

Can such disparate interests ever be reconciled? Sadly, no.

However, they can be accommodated. The same way that a teacher nurtures a student, the technology transfer office must nurture the researcher. It requires handholding, frequent cajoling, sometimes even bribing. Thus, besides its routine business of transferring technology—difficult enough in itself—the technology transfer office needs to perform each of the following three tasks:

- timely meet its researchers' needs,
- eliminate or minimize red tape, and
- give the VIP treatment to superior researchers/inventors.

The Care and Feeding of Researchers

I LIVE TO SERVE

Imagine the following scenario. You, as a technology transfer professional, receive the following e-mail from a post-doctoral student in Dr. X's lab: "I'm presenting a poster tomorrow and am writing this from the airport. My PI, Dr. X, is out of the country for the next three weeks, but she told me I'd better let you know. I've attached a copy of the poster."

So much for your plans to leisurely check Web sites of potential licensees. Drop everything and scramble—find that provisional patent application cover sheet, track down a patent agent/attorney to draft a broad claim to file with the poster, and moan about the seven poster co-authors from three different institutions, anticipating having to untangle inventorship, ownership, and, more pragmatically, payment for the utility application you will be filing.

You wonder: Why couldn't Dr. X let you know when the poster was accepted? Why couldn't the post-doc have come

to your office yesterday? Why couldn't Dr. X's lab administrator have left you a heads-up voicemail?

Why? Well, because you are a nuisance. A handy nuisance to get a filing date, a priority date, an "in" with industry, but a nuisance nevertheless. You do not even make it on Dr. X's day-to-day radar or lab group meeting agendas. You do not allocate funds. You do not facilitate research. You do not sit on the tenure and promotions committee. You do not provide recognition for a CV bullet point (at least until a patent issues or an application is filed). You, technology transfer professional, are at the beck and call of a lowly post-doc: in some cases, even a lowly graduate student. Is this fair? No. Is this right? Yes.

Yes? YES! You live to serve. That one poster may unlock doors to startups, angel investors, small pharma, big pharma. You cannot afford to not treat each and every disclosure as if it were The Next Big Thing. Because it very well may be.

So what do you do? Hustle to call that post-doc to confirm the exact date when the poster abstract was published and exactly what it discloses. Fill out that provisional application cover sheet. Work with the patent agent/attorney to ensure you have a decent, albeit quick, claim (although you don't really need one to file the application), and file it. Contact Dr. X's lab administrator to report that Dr. X can rest assured that the disclosure has indeed been safely ensconced with a slot at the U.S. Patent and Trademark Office. ("…and next time, ah, if you remember and, if it's not too much trouble, can you possibly, ah, give our office a little more notice? Please? Please and thank you?")

IF YOU'RE NOT PART OF THE SOLUTION, YOU'RE PART OF THE PROBLEM

Dr. X stays busy and productive. That's a good thing. You stay buried in disclosures, material transfer agreements, attorney invoices, etc. That's a good thing too. Now fast forward eleven-and-a-half months. Dr. X. calls your boss, "I was at a meeting and talked to a sales rep; she's going to call you to set up a conference call, and, by the way, whatever happened with that patent you filed?" (Researchers never get the jargon correct and call everything a *patent* instead of a *patent application.*)

Whatever happened? Why—nothing happened. It's a provisional application. Nothing "happens" to a provisional—you have to keep it alive by doing something. And you have to do something quick because, at month twelve, it dies.

You know this. Dr. X should know this, but it's not Dr. X's problem—it's yours. Rightfully so. You've got a docketing system; Dr. X has her own temporal worries, so don't make your problem Dr. X's problem. Dr. X depends on you to keep this calendar. She has a right to do so. She also expects you to sort out the inventorship, ownership, claiming, need for foreign filings, and other requirements that arise at the twelve-month period starting from the provisional's filing date. You must contact your in-house counsel, contact Dr. X, contact your technology transfer colleagues, and proactively initiate a call to the sales rep. And do all these tasks quickly. Very quickly.

From the perspective of your university's chief financial officer and vice president of research, the technology transfer office operates under the mentality of "What have you done for me lately?" No basking in the glory of just having concluded a six-figure option. No lingering goodwill about an executed agreement with numerous and generous milestone payments. Instead, what you hear is, "Good job. That was yesterday—what are you working on now?"

The thing is, you need Dr. X more than Dr. X needs you. You have to accommodate her schedule. You even have to justify why you need to ask pesky questions such as, Assuming we can't afford to file a "world" application (again, researchers never get jargon correct—no such animal exists), who are your contact's competitors

and where are they? You have to plead with Dr. X to really read the application; after all, she is going to have to swear it is accurate and complete.

You cannot afford to be a *problem*, with problem encompassing anything that interferes with research, funding, publications, and other disruptions of lab routine, including clerical routine. Moreover, you must bring a solution, either you yourself or a colleague. ("Our attorney can explain why you can't file an application in Taiwan.") Your time is not your own. Your budget is not your own. Your staff is not your own. You are beholden to the researcher. Get used to it. The researcher is filing disclosures on which you must decide if, where, and how to file applications, maintain as a trade secret, and potentially license, license, and license. The researcher is doing what she should be doing. You need to do the same.

NOT ALL RESEARCHERS ARE CREATED EQUAL

Unequal is not a foreign concept in an academic setting. Some faculty are tenured, others are not. Some are full professors; others are assistant or associate professors. Some are National Institutes of Health-grant funded, others are not. Some have little teaching/administrative responsibilities and get to stay in the lab; others must spend their time in a lecture hall or around a conference table. Why, then, should the technology transfer office seek to treat each inventor equally?

You shouldn't. I've heard many complaints about this or that professor who simply refuses to file invention disclosures. I wouldn't give up on this professor, but I also wouldn't squander all my time trying to cajole him, especially if I had a Prof. Z with a hot tip on a potential licensee leaving me a voicemail. Select your targets wisely, keeping in mind the maxim, "A bird in the hand is worth two in the bush."

I also wouldn't just pick up the phone and call Prof. Z back; I would personally go to his lab and ask when would be a convenient time to discuss the application vis-à-vis the potential licensee. In other words, make yourself *abundantly* available, instead of making yourself difficult to track down. Do more than your fair share of the procedural work. Answer your phone; don't let it go to voicemail. It's a small price to pay for a potential signed-and-sealed deal. Even if the deal doesn't pan out, it may give you the next prospect, or at the very least let you direct your efforts elsewhere. It doesn't do any good to assert your turf and make Prof. Z come to you or wait for you. If Prof. Z doesn't get timely attention, you don't timely move his technology forward. Keep in mind that technology *transfer* or *commercialization* implies action, not maintenance of the status quo. You need to act!

Conclusion

The answer to the title question, who leads in technology transfer? is simple: the power leads. The researcher has the power in this dynamic, not you. You may have to adopt a Southern-belle mentality, which is, I'll let you *think* you are getting what you want, so I can get what I want. So be it. Do whatever it takes however you work best, but *do* it. By accommodating researchers, the technology transfer office positions itself in a win-win situation: happy researchers, happy administration, and potential licensing fees and royalty streams. Who says you can't have it all?

Beverly A. Lyman, PhD, JD, is a partner at Thompson Hine LLP in Cincinnati, Ohio, and Atlanta, Georgia.

Got something you'd like to say in your own words? If so, contact Emily Bauer at emily@warf.org.

Practical Guidelines for Identifying Opportunities and Threats

Lora Frecks, MPA

In these difficult financial times, the future of a technology transfer office (TTO) can be greatly impacted by its ability to quickly identify and act upon opportunities and threats. While most TTO staff would agree with this statement, few have much experience or success in this critical area. When faced with major changes (both good and bad) the initial reaction often becomes the final reaction and not necessarily the best reaction. When small or incremental changes arise, staff are often too busy to notice them and far too busy to take the time to actively look for them. However, time invested in thinking through possibilities and keeping an active watch for new ideas and trends can generate tremendous returns. This process is a skill that can be learned and improved with practice.

The following is a description of practical actions any organization and its employees can take to improve their ability to identify opportunities and threats.

Individual Actions

BE AWARE[1]

- Listen to what others are doing at their organizations or in their fields and consider afterward if these action have any positive or negative implications for your organization.
- Keep abreast of changes in fields that interest you and reflect on how those changes may impact or have relevance to your field.

INTROSPECTION

- Consider the possibility that your opinion has been biased by past experiences or that your initial impression may not be accurate.[2]
- Study your past blind spots.[3] Determine why you failed to accurately perceive past situations and form strategies to diminish these types of mistakes in the future. Do not fall into complacency and later forget these blind spots.
- Think through how someone else considering the situation for the first time would react and what actions he or she would deem appropriate.[4]
- Remember that you always have more options than you first believe. Talk to others, and take a little time to expand your list of options.

IN GENERAL

- Discuss the validity of possible opportunities or threats with one or more individuals outside your immediate office. If they agree with your assessment or if you are more convinced you are correct after the discussion, notify leadership of the opportunity or threat.
- When you perceive a threat, do not presume that someone else is going to report it to management.[5] In the same manner, notify management when an opportunity presents itself.

Organizational and Leadership Activities

PLANNING AND PROCEDURES

- Make a list of likely future events and think through the possibilities of each event and what your TTO might do to mitigate or take full advantage of such events. For instance, if your TTO has a licensed patent portfolio entering litigation, consider what the consequences may be for your TTO and university if the litigation is successful or fails. Contemplate what actions your TTO

might take now and after the litigation is complete to optimize or minimize these potential consequences.
- Compile a list of potential signals that would indicate a predicted future event is approaching.[6] An event can be difficult to identify when your organization is caught up in it. In these instances, benchmarks identified in more rational times can be invaluable.
- Pay attention to gradual shifts in your organization's culture.[7] This can be difficult to do from the inside without benchmarks. Consider using annual reports or goals from several years ago to identify these shifts.
- Treat narrowly avoided disasters with the seriousness a true disaster would receive. Determine what new procedures or changes in practices are needed to prevent such close calls or actual disasters in the future.[8] For example, did your TTO nearly miss a deadline? Unless something changes, this will likely happen again and eventually your TTO will not catch the mistake in time.
- Shift the focus of your organization from past glories to future goals.[9] This will naturally encourage everyone to watch for new opportunities and threats. In other words, do not focus too long on the deal just done. Focus instead on the next deal, new partnership opportunities, and the latest invention.

PEOPLE

- Reward employees who identify credible opportunities or threats.[10]
- Encourage employees with good records for identifying opportunities and threats to meet occasionally with one or two other employees to discuss possibilities. This may be the best means for teaching this skill to another individual.
- Have leadership regularly ask individuals questions such as: What happened last month that was unusual? What surprised you? What puzzled you? [11]
- Listen to the squeaky-wheel employee.[12] Even the proverbial broken clock is occasionally right.
- If it is too painful for leadership to listen to the squeaky wheel, designate someone in middle management to collect and filter office paranoia. [13]
- Hire for diversity. Listen to the resulting viewpoints, and take advantage of the variety of skills. For example, many young interns can identify with a glance that your Web site is dated and provide an electronic facelift in a matter of days.

Conclusion

This is not intended to be a complete list, but merely a starting point for you to find your best means for easily and accurately scanning your environment for approaching opportunities and threats. This is a skill that will only improve with practice. Remember, too, that this is a valuable skill that is well worth the time investment needed to master it.

Lora Frecks, MPA, is the intellectual property manager for the University of Nebraska Medical Center's technology transfer company, UNeMed, in Omaha, Nebraska. She is also a member of Tomorrow's Technology Transfer's *Editorial Board.*

Do you have some practical advice to share with your peers? Let us know! Contact Emily Bauer at emily@warf.org.

Notes

[1]John P. Kotter, *A Sense of Urgency* (Boston: Harvard Business Press, 2008).
[2]Ori Brafman and Rom Brafman, *Sway: The Irresistible Pull of Irrational Behavior* (New York: Currency, 2008).
[3]George S. Day and Paul J. H. Schoemaker, "Are You a 'Vigilant Leader'?" *MIT Sloan Management Review* Spring (2008): 43–51.
[4]Brafman and Brafman, *Sway.*
[5]Marc Gerstein, *Flirting with Disaster: Why Accidents Are Rarely Accidental* (New York: Union Square Press, 1996).
[6]Day and Schoemaker, "Are You a 'Vigilant Leader'?"
[7]Noel M. Tichy and David O Ulrich, "The Leadership Challenge—A Call for the Transformational Leader," *Sloan Management Review* Fall (1984): 59–68.
[8]Gerstein, *Flirting*.
[9]Tichy and Ulrich, "The Leadership Challenge."
[10]Ibid.
[11]Day and Schoemaker, "Are You a 'Vigilant Leader'?"
[12]Gerstein, *Flirting*.
[13]Day and Schoemaker, "Are You a 'Vigilant Leader'?"

Tax-Related Tips to Ensure Compliance for Sponsored Research Agreements

Stephen P. Rothman, JD

United States universities and research institutions that issue tax-exempt bonds must abide by federal tax rules adopted in 1986 to limit the use of government-subsidized financing for projects other than traditional government functions. To remain compliant, the institution *must not* exceed the limits on private business use of facilities that were financed with tax-exempt bonds. This private business use may include sponsored research. To ensure institution compliance while negotiating sponsored research agreements:

- Avoid sponsored research agreements that require the university to transfer patents on resulting inventions to the research sponsor. Such an agreement makes any use of institution facilities for that research a private business use.
- In most cases, avoid granting an automatic license to the research sponsor as part of the research agreement. However, it is acceptable to give the research sponsor a right of first negotiation to license any intellectual growing out of the sponsored research. In general, the license terms should not be determined at the time that the sponsored agreement is adopted, but negotiated later, when the nature of the invention is known.

Failure to follow the safe harbor does not necessarily result in private business use, but because of the vagueness of the all-of-the-facts-and-circumstances standard, departing from the safe harbor involves some peril, and should be done, if at all, only after consultation with tax counsel.

These rules are not absolute. The applicable regulations, enacted in 1997, state that a sponsored research agreement may result in private business use of the property used for the research "based on all of the facts and circumstances."[1] An "all the facts and circumstances" standard is nearly as vague as a standard could be. The statement prohibiting the negotiation of license terms with the sponsored research agreement was conspicuously absent from these final regulations, though it had been included both in the regulations originally proposed by the Internal Revenue Service (IRS) and in a General Explanation of the Tax Reform Act of 1986 prepared by the Staff of the Congressional Joint Committee on Taxation around the time the statute was enacted. Instead, the statements about separating the license and the sponsored research are included in IRS pronouncements that lay out a safe harbor—a set of standards one can follow to be sure a sponsored research agreement will not be treated as resulting in private business use (Revenue Procedures 97–14 and 2007–47).

Failure to follow the safe harbor does not necessarily result in private business use, but because of the vagueness of the all-of-the-facts-and-circumstances standard, departing from the safe harbor involves some peril, and should be done, if at all, only after consultation with tax counsel.

The safe harbor in the revenue procedures applies only to basic research agreements. *Basic research* for this purpose is defined as "an original investigation . . . not having a specific commercial objective."[2] Basic research does not include "product testing supporting the trade or business of a specific nongovernmental person."[3] The IRS pronouncements also approve, as not private business, any cooperative basic research performed for multiple sponsors who are entitled to no more than non-exclusive, royalty-free licenses.

If an institution deliberately or inadvertently fails to avoid characterization of sponsored research as private business use, this will not be fatal to the tax exemption as long as:

- The percentage of the proceeds of the bond financing directed to private business uses does not exceed 10 percent (in the case of a state institution)[3] or
- The percentage of the net proceeds directed to private business uses does not exceed 5 percent (in the case of a private institution).[4]

The IRS has accepted allocation of the exempt and nonexempt use of a facility by means of comparing the revenue from sponsored research that constitutes private business use with the revenue from government-funded research, as well as other allocation methods.[5] But calculation of the percentage of private business use might not be so simple, and many universities prefer to avoid any private business use other than those that are *de minimis*. Hence, adherence to the guidelines of Revenue Procedures 97–14 and 2007–47 is the norm.

European corporations tend to argue that they are being asked to pay twice for the same technology: first with the sponsored research and second for a license to the technology resulting from the sponsored research.

As a result, the typical practice in sponsored research agreements in the United States is to give the corporate research sponsor no intellectual property rights beyond a right of first negotiation for a license on whatever inventions may arise from the research. This doesn't always please the sponsor. Corporate sponsors might believe that the party paying for the research should own the resulting technology. That is usually the practice in the commercial world and also is a model available in universities in Europe. This makes the process particularly tough for a U.S. university seeking funding from a European corporation that is accustomed to European norms.

European corporations tend to argue that they are being asked to pay twice for the same technology: first with the sponsored research and second for a license to the technology resulting from the sponsored research. Even worse than paying twice, in their perspective, is the fact that they can't know the size of the second payment (the license fee) before committing to the first payment (the research sponsorship payment).

Approaches used by some universities to deal with this conundrum include:

- Specifying a range of possible royalties within a defined field of use in the sponsored research agreement. The actual royalty is still determined at the time the license is negotiated, after the invention has been made, but the negotiation is bounded by the two ends of the range. This is intended to assure the sponsor that a license will be available on reasonable terms. Whether this approach still falls within the safe harbor is uncertain. Technically, the exact royalty is negotiated at the time of licensing, as required. But with basic research, no one knows at the time of the research what the emerging invention might be. What if the fair market value of the invention is outside of the predesignated royalty range?
- If specifying a range of financial license terms in the sponsored research agreement does not ultimately qualify for the safe harbor, the particular agreement still might be able to qualify as not-private business use, based on the facts and circumstances test of the regulations, but this is quite uncertain.
- If the use is found to be private, analyze whether the private business use of the bond-financed facility exceeded the 5 percent limit (or 10 percent for a government entity).
- Giving the corporate sponsor a right to require a postinvention binding third-

party appraisal of the intellectual property, if the sponsor and the university are unable to agree on licensing terms. The appraised royalty rate would then become the license rate. This should fall within the safe harbor requirements that the fee be set postinvention and at market rates, but would not leave the sponsor vulnerable to an unexpected, unreasonably high royalty demand.

- Another approach, for corporate research sponsors that are especially sensitive to intellectual property ownership, when working with institutions that allow their researchers to spend a portion of their time on outside consulting, is to have research conducted by the university faculty but at facilities of the research sponsor, avoiding use of facilities that were financed with tax-exempt bonds. This will often not be practical, however, due to geographic constraints or availability of specialized equipment.

To summarize, U.S. universities and research institutions must be careful to remain compliant when negotiating sponsored research agreements. However, this does not need to be a deterrent to corporate research sponsors partnering with these institutions.

Stephen P. Rothman, JD, is an attorney based in Los Angeles, California.

Notes

[1] 26 CFR 1.141.3 (b)(6). The regulations also state that "[a] research agreement with respect to financed property results in private business use of that property if the sponsor is treated as lessee or the owner of financed property for federal income tax purposes." 26 CFR 1.141-3(g)(8).

[2] Rev. Proc. 97-14, Section 3.01.

[3] Internal Revenue Service Revenue Procedure 2007–47. One commentator has observed that "[f]or those universities and hospitals conducting industry-sponsored clinical research, the definition of basic research arguably causes all product-related, safety, and efficacy studies to be considered private business use." Adam P. Rifkind, Esq. "A Challenge for Issuers of Tax-Exempt Bonds: IRS Revenue Procedure 2007 –47," Teaching Hospitals and Academic Medical Centers, Volume 5, Issue 3 (December 2007), p. 7.

[4] See Internal Revenue Code, § 145.

[5] Internal Revenue Service Private Letter Ruling 9125050 (March 29, 1991).

Technology Transfer Exchange Program Provides Multiple Benefits

International Resident Affiliate Program in Technology Transfer at Case Western Reserve University

Michael F. Allan

In 2008, Case Western Reserve University (CWRU) instituted *Forward Thinking*, its five-year strategic plan. With a bold vision "to be recognized internationally as an institution that imagines and influences the future," CWRU's technology transfer office (TTO) has implemented a creative program to help fulfill that vision.

The International Resident Affiliate Program in Technology Transfer at CWRU provides sponsoring organizations with an opportunity to recruit their best people to work side by side with a US TTO and its staff to combine their technical knowledge and business experience and advance superior technology transfer practices. Participation in the program is intended to immerse the resident affiliate in education and training of methods and tools that promise to produce skills, capabilities, and networks in state-of-the-art technology transfer practices.

Resident affiliates have the opportunity to participate in meetings, public courses, and workshops at no cost or minimal cost to their sponsoring organizations. Courses are recommended to help affiliates acquire skills for planning and transitioning new methods and technologies into their home organizations.

Although the position offers no compensation or employee benefits and the individual and/or sponsoring organization are responsible for the candidate's travel and expenses, there is no fee required by CWRU to participate in the program. Candidates must follow their country's visa requirements for international travel/volunteer status.

CWRU's first resident affiliate was Andrea Frosini, PhD, an intellectual property manager in the liaison office at the University of Siena, Italy, who was at CWRU from May through July 2008. In commenting on his exchange experience, Frosini points out that there are many differences in technology transfer between the United States and Europe. Universities in the US have been involved in technology transfer for more than three decades, while those in Europe only started their programs in the last few years. Rather than simply trying to drop the US system into place in Europe, or vice versa, he advocates looking for specific points from one system and applying them to the framework of the other.

Participation in the program is intended to immerse the resident affiliate in education and training of methods and tools that promise to produce skills, capabilities, and networks in state-of-the-art technology transfer practices.

For instance, Frosini says that the US leads Europe in the organization and tracking methodology of technology transfer. "Since I've been here, I've seen how important it is to have a good organizational structure in place," he says. "From when we first speak with the researcher and disclose the invention to the signing of the commercial licensing, all points of the process are tracked."

Frosini's lessons for CWRU also target global dissimilarities. "If you want to be successful at worldwide technology transfer, you have to be aware of the laws and procedures—which can be very different—in the countries you target," he says.

For example, he continues, "Having

a US patent on an invention is fine if you are only looking at licensing partners in this country. But to do business in European countries, Australia, Canada, and elsewhere, you have to be familiar with local patent laws."

According to Frosini, networking is one of the most important components of successful technology transfer.

"The technology transfer office is the interface between the invention and the companies bringing that invention to market," he says. "Knowing who, where, when, and how to address the right people is so important. If you want to do business abroad, you must have a network in place to get things done."

Are you interested in learning more about this topic? Have you participated in such an exchange? Has your experience proved valuable? Are you looking for an opportunity like this? How should AUTM support these types of programs? Discuss these topics and more on the AUTM Web site.

Each new candidate provides unique opportunities for growing and improving the program. CWRU is currently in its third iteration with Maddalena Furlan, a staff member of the technology transfer service at AREA Science Park in Trieste, Italy. AREA, which is one of Europe's largest science parks, has executed a memorandum of understanding with CWRU to cement an ongoing relationship with CWRU's TTO. "We devote a lot of time into furthering the individual's own professional development," states Mike Allan, the program's director. "Going forward, we would like to talk with other institutions that have implemented similar arrangements to share learning experiences."

Are you interested in learning more about this topic? Have you participated in such an exchange? Has your experience proved valuable? Are you looking for an opportunity like this? How should AUTM support these types of programs? Discuss these topics and more on the AUTM Web site.

To join the discussion visit the subscriptions page of the AUTM Web site. Select "Technology Transfer Exchange Programs—Discuss Your Experience!" from the list and subscribe by selecting how often you wish to be notified when your colleagues contribute to the thread. You can select to receive the messages in real time, in one daily digest, or choose "no email" to simply visit the AUTM Web site to read the thread.

Michael F. Allan is director, technology transfer, Biomedical Operations, at Case Western Reserve University in Cleveland, Ohio.

If you have an idea to share, contact Emily Bauer at emily@warf.org.

We all know that the world is becoming flatter. In this changing world, a worldview and insight are essential for those wanting to succeed in business given that the companies best able to commercialize technologies into successful products may not be right around the corner. One of the best ways to improve a worldview is through sharing and learning from colleagues in other countries. These challenges and new realities are being addressed in part through several technology transfer foreign exchange programs, like the one at CWRU. The France-USA Exchange Program on Technology Transfer, for example, has brought together staff from French technology transfer offices (TTOs) such as Hôpitaux de Paris, Université de Nantes, and GRAVIT Grenoble, with staff from American TTOs such as Caltech, University of Chicago, and Boston University. The TTOs of the University of North Carolina at Chapel Hill and North Carolina State, along with the North Carolina Department of Commerce, are partnering with Nagoya University in Japan. Arizona Technology Enterprises (AzTE), the technology venturing arm of Arizona State University, has entered into separate global arrangements to market technologies developed by ASU's partner universities, Dublin City University in Ireland (through its technology commercialization organization, Invent DCU Limited) and Tec de Monterrey in Mexico.

AUTM Foundation Offers Graduate Student Literature Review Prize for Academic Technology Transfer and Commercialization

Technology transfer is increasingly central to the mission of universities, academic health centers, and research institutes. Research and scholarship on the topic have advanced considerably in recent years. Yet this body of research is often written for a researcher-to-researcher audience and is not easily consumable by practitioners.

Recognizing the importance of academic research for informing technology transfer practice, the AUTM Foundation supports the efforts of graduate student scholars with a literature review prize. The goal of this prize is to offer an incentive for scholars to consider new ways that their work can serve the AUTM membership. Eligible reviews provide technology transfer professionals with an understanding of what a particular stream of research and scholarship says about policy, practice, and/or technology commercialization success.

The AUTM Foundation will give a cash award to the top graduate student literature reviews of scholarly literature on some aspect of academic technology transfer and commercialization. Winners will also be invited to present their works at a special AUTM Annual Meeting session. (To read the paper of the 2009 winner, see "Re-Imaging University Knowledge Transfer through Spin-off Firms," by Peter A. Bacevice, on page 21.)

The call for the 2009-2010 awards is on the AUTM Web site. Applications are due **September 15, 2009.** For additional information, contact the chair of the review committee, Joshua Powers, PhD, via e-mail at jopowers@indstate.edu or by phone at +1-812-237-2900.

THE 2010 SCHOLARSHIPS

for New Technology Transfer Professionals from Developing Economies

The Scholarships for New Technology Transfer Professionals from Developing Economies provide up to **$US 4,000** in travel and related support to enable recipients to attend an AUTM sponsored or co-sponsored meeting or educational course in support of their professional development in 2010.

About the Scholarships

The 2010 Scholarships for New Technology Transfer Professionals from Developing Economies are among the initiatives pursued by the AUTM Foundation to enhance learning opportunities for new professionals. The scholarships are available to support the professional development of up to five early-career technology transfer professionals working in countries identified as developing economies. The AUTM Foundation requires that the recipient's home institution guarantee and contribute not less than 20 percent of the total cost of the recipient's attendance at the nominated course or event. All eligible applicants must be new to the profession and come from not-for-profit institutions in eligible countries. For more information about eligibility, nominations, the selection process and more, visit the AUTM Web site.

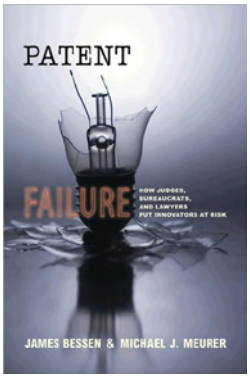
Application Deadline

The deadline for receipt of completed applications and supporting materials is August 21, 2009.

How to Apply

Visit the AUTM Web site to download the scholarship application and instructions, then complete and e-mail application, letter of home institution support and a copy of your resume to the AUTM Foundation at scholarships@autm.net. If e-mail is not an option, please mail or fax the application package to:

AUTM Foundation
DE Scholarship
111 Deer Lake Road, Suite 100
Deerfield, IL 60015
Facsimile: +1-847-480-9282



Patent Failure: How Judges, Lawyers, and Bureaucrats Put Innovators at Risk

By James Bessen and Michael J. Meurer

Reviewed by Caroline Massee

Patent Failure: How Judges, Lawyers, and Bureaucrats Put Innovators At Risk, by James Bessen and Michael J. Meurer, is a sobering analysis of the US patent system. Published in March 2008, the book draws on history, legal scholarship, economic theory, and statistical data to argue that the patent system is not an efficient mechanism for fostering innovation in the United States. The authors assert that, on balance, the US patent system hinders innovation more than it helps and does more harm than good for the health and competitiveness of the American economy.

Bessen,* a former software developer and chief executive officer, and Meurer,* a professor of law, claim that patents fail to provide predictable property rights for their owners, thereby producing costly disputes and litigation, which largely outweigh the net positive incentives of patent ownership.

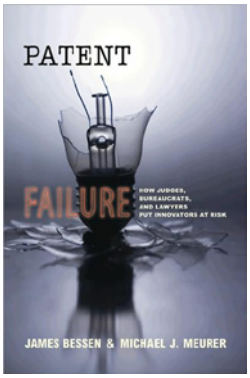
Improving the notice function of patents—i.e., the ability to notify non-owners of a property's boundaries—is a central theme of the book. The opening chapters of *Patent Failure* explore the notion of patents as property. Intellectual property shares certain similarities with real property, of course, but there are also significant differences between them. Bessen and Meurer contend that patent boundaries are fuzzy, abstract, unpredictable, complex, and often unclear and difficult to determine, whereas the boundaries of tangible things (land is an obvious example) are clear and precise.

They cite changes made in the 1990s to the legal methods used to determine the boundaries of patents (primarily specific rulings handed down by the Federal Circuit regarding software patents) as contributing to the increasing ambiguity of patent claims and observe that patent boundaries can be especially unclear in fast-paced industries such as biotechnology and computer software. Writing of the Federal Circuit's various rulings that have essentially had the effect of removing most restrictions on abstract claims in software, they note: "Perhaps the court acted out of a desire to promote patents in this field of technology that has historically not used patents. The result has been both a proliferation of software patents *and* lawsuits."

The authors conclude that the U.S. patent system really only provides positive innovation incentives for the chemical and pharmaceutical industries and, perhaps, individual inventors.

Reviewing economic data for publicly listed firms in the United States, the authors found that patents performed reasonably well as recently as the 1980s for such companies, but by the late 1990s, the costs patents imposed on public firms outweighed the benefits, largely due to huge increases in patent litigation. By the late 1990s, patent litigation costs for the average public firm exceeded the profits from their patent portfolios by a wide margin.

Direct legal costs are not the only costs that patent litigation imposes on firms; the business costs of litigation can include loss of market share, distraction of management, negative public relations, and such. Relatively few firms are sued for patent infringement each year, but *Patent Failure* points out that innovation is affected even



by the risk of a lawsuit—concerns over potential lawsuits, for example, may inhibit investment in research and development.

While US public firms obtain only about 45 percent of the patents granted to US residents, they perform the lion's share of research and development. The risk of inadvertent infringement is particularly high in fields where patent claims tend to be more abstract and complex, such as information technology and software, and act as a real disincentive to technology investors. This problem isn't unique to large firms. Small high-tech firms, for example, often choose trade-secret protection over patent protection to appropriate value from their inventions. Bessen and Meurer write: "Although patents might be critical to some small firms, they do not appear to be particularly important to most."

The authors conclude that the US patent system really only provides positive innovation incentives for the chemical and pharmaceutical industries and, perhaps, individual inventors. Chemical and pharmaceutical companies experienced increased litigation during the 1990s along with other industrial sectors, but the benefits of chemical patents still substantially exceeded the costs of litigation. Statistical data indicates that chemical patents are more valuable than other patents, in part because they are less apt to be involved in litigation. The estimated mean value of a US chemical patent issued in 1991 was $332,800; whereas the mean value of US patents granted in 1991 across all other industry groupings averaged about $78,000. Chemical patents are litigated at roughly half the rate of other patents. Again, clear boundaries are a major factor.

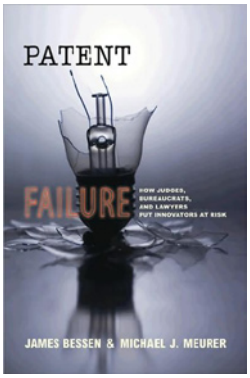
Arguing that patent policy has long been the domain of entrenched interests that have the most to gain from patents, such as patent lawyers and the pharmaceutical industry, Bessen and Meurer suggest a number of reforms that might improve the US patent system and, hopefully, rein in abuses.

From the standpoint of the technology transfer profession, some of the least appealing of these may be their suggestion to sharply increase US Patent and Trademark Office (USPTO) renewal fees and claim fees. They feel this would reduce the total number of patents, thus reducing the costs of prior art and other types of patent searches. They warn that successful reforms will be difficult to enact, though, in part because so much new technology is being developed in precisely those areas where clear property rights are inherently difficult to define, such as the software industry; and partly, too, because many of the current problems stem from institutional inadequacies (the USPTO and the Federal Circuit, for example, have "all but ignored the claim definiteness requirement in the Patent Act"), and institutions are difficult to change.

Technology transfer professionals will note that academic technology transfer is not brought into the discussion very often. This is deliberate. The authors state in an endnote that the subject of university technology transfer and patents is broad and lies outside the scope of *Patent Failure*.

More importantly, they suggest, is that, in order to be an effective policy instrument, patents need to do more than provide positive incentives—they need to provide incentives that are sufficiently large, and they need to do so at relatively little cost to society. The incentives provided by things like procurements, subsidies, and tax credits, they contend, might be substantially larger than those provided by patents.

Patent Failure has its limitations. Most of the economic data and statistical analyses cited date from the late 1980s and the 1990s. Occasionally, the book relies on anecdotal evidence, although the authors make clear in the beginning they will "move beyond anecdote" and provide objective, empirical evidence to show just how much the US patent system's overall economic performance has deteriorated.



Technology transfer professionals will note that academic technology transfer is not brought into the discussion very often. This is deliberate. The authors state in an endnote that the subject of university technology transfer and patents is broad and lies outside the scope of *Patent Failure*. On the rare occasions when it is brought up, academic technology transfer is portrayed as being more problematic than helpful. Consider, for example, the book's assertion that too many patent applications are being filed on early-stage inventions by inventors from academic institutions, particularly in the area of biotechnology, contributing to a growing "patent flood." A brief sidebar entitled "Do Patents Facilitate Technology Transactions?" concludes that "patents can facilitate licensing transactions when they have clear boundaries, but not otherwise"—a statement that those in the university technology transfer profession might challenge.

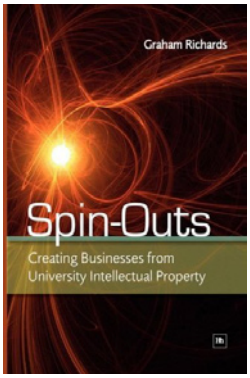
A brief sidebar entitled "Do Patents Facilitate Technology Transactions?" concludes that "patents can facilitate licensing transactions when they have clear boundaries, but not otherwise"—a statement that those in the university technology transfer profession might challenge.

Nonetheless, despite these shortcomings, *Patent Failure* provides a comprehensive, in-depth look at the U.S. patent system that is both thought-provoking and instructive. Clearly, the patent system is flawed and needs repair. The fact that it provides positive innovation incentives to some industries but not to others, however, raises troubling questions as to what sorts of reforms should be enacted.

**Reviewer's note:* James Bessen, a former software developer and chief executive officer, is a lecturer at Boston University School of Law. Michael J. Meurer is the Michaels Faculty Research Scholar and professor of law at Boston University. They are both principals at Research Innovation, a nonprofit organization that conducts research on technological innovation.

Caroline Massee is a licensing liaison at Stanford University's Office of Technology Licensing.

If you have a book you'd like to see reviewed or would like to review a book. Contact Emily Bauer at emily@warf.org.



Spin-Outs: Creating Business from University Intellectual Property

By Graham Richards

Reviewed by John Hardiman

Normally I assess whether a book is worth my time to read by reviewing the biographical information of the author. The fact that Graham Richards* has significant experience starting a high-profile university technology transfer group, founding a successful spinout company, and serving in director positions with numerous spinouts piqued my interest.

The book is a summary of extensive biographical details with limited analysis of the spinout process. The detailed listing of names and resumes became tedious and added little insight into a university spinout company formation.

In the press release announcing the book, the publisher states in reference to university spinout company formation: "This book provides an insight into how this has been achieved and gives guidance on how this success can be replicated elsewhere." This statement was only partially factual. The book is a summary of extensive biographical details with limited analysis of the spinout process. The detailed listing of names and resumes became tedious and added little insight into a university spinout company formation. The bulk of the book was the telling of a specific experience without the analysis to translate the story into guidance or learning.

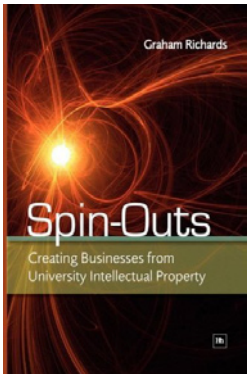
The book summarizes Richards' role in the formation of Oxford University's technology transfer company, as well as the spinout company from his research. With the exception of one brief chapter, "Starting a Spin-Out Company," the book is a diary-like compilation of names and mundane details. Excessive focus was placed on the individuals involved, rather than the company and the actual process of spinout formation. I could quote numerous instances of unnecessary details, but by far my favorite is a section entitled "Sex."

> One unforeseen problem in the thriving company was sex. Nearly all our employees were in their 20s or early 30s, with a near equal number of male and female employees. Hormone levels were dangerously high, and we had a number of problematic relationships that resulted in us losing some otherwise excellent employees. Even if people had important talents, we could not countenance someone spending much of the working day sending mildly pornographic e-mails to someone on the other side of the room. Even our gym failed to divert some people's energy.

Humorous, but inappropriate. Equal time to analyzing more pertinent issues, such as management, capabilities, financing options, the effects of market conditions, product definition, and other aspects that normally thwart a company's path to success would have been appreciated. Even the sex issue could have been analyzed in the context of hiring practices and issues, or as a deficiency of management or human resource practices, but the excerpt above is the extent of the discussion.

I could quote numerous instances of unnecessary details, but by far my favorite is a section entitled "Sex."

I expected a book that offered insight on how a spinout company could avoid



the expected and unexpected pitfalls that Richards faced in his endeavors. I hoped for a frank discussion of the conflicting aspects of sitting on both sides of the negotiation table. Instead what I read was a shallow personal account that lacked any significant analysis or depth.

**Reviewer's note:* Graham Richards was one of the founders of the University of Oxford's technology transfer company, Isis Innovation Ltd, where he was a director for two decades. In 1989, he founded his own spinout company, Oxford Molecular Ltd, which was sold in 2000. He has also been a director of Catalyst Biomedica Ltd and a chair of IP2IPO Group Plc, which later became the publicly quoted IP Group Plc. He is now a senior nonexecutive director of that company. Richards recently retired from Oxford University, where he was head of the Chemistry Department.

John Hardiman is a licensing manager with the Wisconsin Alumni Research Foundation.

If you have a book you'd like to see reviewed or would like to review a book, contact Emily Bauer at emily@warf.org.

True Patent Law Reform: Why the New Proposed Legislation Is Not

Eric W. Guttag, JD

Congress again has proposed legislation (S 515 on the Senate side, HR 1260 on the House side) to reform patent law. This newly proposed legislation is better in some respects and worse in others compared to predecessor bills (HR 1098, which passed in 2007, and S 1145/S. 522, which did not). But like their predecessors, this proposed legislation does not constitute patent law reform that provides incentives for innovation, investment, and job creation.

A modified version of S 515 was passed (15–4) by the Senate Judiciary Committee on April 2, 2009.[1] The key (and most controversial) provisions in modified S 515/HR 1260 are the following three:[2]

- *Additional postexamination review (section 5 of S 515, section 6 of HR 1260):* Like the predecessor bills, S 515/HR 1260 provide for postgrant oppositions similar to those provided by, for example, the European Patent Office. But unlike the predecessor bills, the new legislation provides only one window (within twelve months after patent grant) for instituting such an opposition. One concern is whether smaller organizations and universities might be overwhelmed by larger, wealthier organizations in such oppositions. A much greater concern is whether the United States Patent and Trademark Office (USPTO), which already has a backlog of more than 1.2 million applications, can handle the additional workload. In addition, inter partes reexamination has been expanded to allow a third-party requestor to file written comments in response to any action on the merits by the USPTO or any response filed by the patent owner files, as well as to ask for an oral hearing before an administrative law judge, which could greatly increase the cost of such proceedings. Also, the third-party requestor would no longer be estopped from later raising in a subsequent patent infringement suit any invalidity defense that could have been raised during the reexamination.
- *First to file (section 2 of S 515, section 3 of HR 1260):* Like the predecessor bills, S 515/HR 1260 would change the US patent system from a first-to-invent system to a first-to-file system like the rest of the world. By going from first to invent to first to file, the US patent system would be a race to file at the USPTO. Changing to first to file raises concerns about patent quality, including whether the scope of patent coverage might be adversely affected by the need for the race to file. The current bills also eliminate the one-year grace period adopted in the predecessor bills by members of the Senate and House trying to protect universities *unless the disclosure relied upon as prior art is made by the inventor or others who obtained the disclosure from the inventor.*

A much greater concern is whether the United States Patent and Trademark Office (USPTO), which already has a backlog of more than 1.2 million applications, can handle the additional workload.

- *Damages (section 4 of S 515, section 5 of HR 1260):* This was the most controversial provision, but not any longer. The proposed damages provision focuses on how the judge (or jury) determines damages (reasonable royalty) for patent infringement. S 515 originally required (and was

controversial because) the judge had to select one of three methods for making this calculation: (1) entire market value, (2) established a royalty based on marketplace licensing, or (3) a valuation calculation. The modified version of S 515 now only requires the judge to be the gatekeeper on damages by identifying the methodologies and factors for determining damages no later than the final pretrial order.

The current statute[7] uses language from the nineteenth century that is hard to apply to twenty-first century technology, such as computer software, information technology, and biotechnology.

Provisions that were part of the predecessor bills, but currently are not part of S 515/HR 1260, are the following:

1. *Applicant quality submissions (AQSs):* The absence of AQSs from S 515/HR 1260 should be welcomed by university/nonprofit research technology transfer offices. AQSs would completely change the historical role of the USPTO as to how patent applications are examined and would have created damaging admissions regarding scope and validity of the patent, as well as another basis for inequitable conduct allegations.
2. *Defining inequitable conduct:* Sadly and astonishingly, S 515/HR 1260 does not address the defense of inequitable conduct. As acknowledged by the Federal Circuit in the 2006 case of *Digital Control v. Charles Machine Works*,[3] there are at least four or five different standards for inequitable conduct, including USPTO's Rule 56.
3. *Fee diversion is not prohibited:* Predecessor S 1145, as adopted by the Senate Judiciary Committee, banned fee diversion so that fees paid to the USPTO would remain with the agency to address the significant backlog of patent applications and all of the additional responsibilities created in S 515. That is currently not part of S 515/HR 1260.

Support for S 515/HR 1260 primarily comes from large computer, software, and information technology businesses. Opposition to S 515/HR 1260, especially the damages provision, is already mounting. Diverse organizations that have opposed the original version of these bills include the Intellectual Property Owners Association, the Biotechnology Industry Organization, organized labor,[4] green technology companies,[5] and manufacturers.[6] Most of these opposing organizations point out the adverse impact this proposed legislation will have on American innovation—and particularly American jobs.

Beyond the issues created by these specific provisions in S 515/HR 1260, this newly proposed legislation suffers from (and shares with its predecessors) two very fundamental flaws. One is that the proposed legislation is unbalanced in addressing the perceived problems with the current US patent system. For example, one glaring area in need of reform is what subject matter may be potentially patentable. The current statute[7] uses language from the nineteenth century that is hard to apply to twenty-first century technology, such as computer software, information technology, and biotechnology. In fact, the Federal Circuit's recent confusing (and conflicting) decision in *In re Bilski*[8] has made painfully apparent how out of date the current statute is.

The other glaring flaw is that this proposed legislation, at most, addresses only problems (or symptoms) that occur *after* patent examination occurs (the backend of the process), but does little, if anything, to address improvements *during* the patent examination process (the frontend of the process). Most significantly, S 515/HR 1260 do not address the significant issues affecting the USPTO examining corps responsible for handling patent applications.

For these reasons, it is very important that university/nonprofit research

technology transfer offices make known (and quickly) to their senators, congressman, and others having potential impact on the passage of S 515/HR 1260: (1) why these bills will adversely impact American innovation and, thus, American jobs, and (2) what really needs to be done to address the significant issues facing the USPTO. As they say in sports, the time is now.

Eric W. Guttag, JD, is principal of Eric W. Guttag IP Law in West Chester, Ohio. He is also a member of Tomorrow's Technology Transfer's *Editorial Board.*

All views expressed in this article are those personally of the author.

What do you think of the proposed patent legislation? Let us know by writing your letter to the editor and sending it to Emily Bauer at emily@warf.org.

Notes

[1]Chairman Conyers in the corresponding House committee has said the House will not take up HR 1260 until the Senate is finished with S 515.

[2]Other provisions of S 515/HR 1260 not specifically addressed here include pre-issuance art submissions by third parties of prior patents and publications only, changing the venue requirements for filing patent infringement actions, interlocutory appeals from district court claim-construction decisions, allowing the USPTO to set its fees, and easing the requirements for filing patent applications on behalf of the inventor.

[3]437 F.3d 1309 (Fed. Cir. 2006).

[4]International Association of Machinists and Aerospace Workers; the Communications Workers of America; the Department for Professional Employees; AFL-CIO; the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers, and Helpers; the International Brotherhood of Teamsters; the United Steelworkers; International Federation of Professional and Technical Engineers, Metal Trades Department; the United Association of Plumbers and Pipe Fitters; the International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers; the Sheet Metal Workers International Association; and the International Union of Painters and Allied Trades.

[5]Informally referred to as the *Cross Coalition*.

[6]Manufacturing Alliance on Patent Policy.

[7]35 U.S.C. § 101.

[8]545 F.3d 943 (Fed. Cir. 2008).

Calendar

JULY 2009

July 19–22
Bio World Congress
Montreal, Canada

July 27–29
AUTM Central Region Meeting
Madison, WI

July 30–Aug. 4
ABA Annual Meeting
Chicago, IL

AUGUST 2009

Aug. 19–22
STEM Professional Development Program and Annual Summit
Hyderabad, India

SEPTEMBER 2009

Sept. 13–15
AUTM Western Region Meeting
Vancouver, BC, Canada

Sept. 13–15
IPO Annual Meeting
Chicago, IL

OCTOBER 2009

Oct. 15–17
AIPLA Annual Meeting
Washington DC

Oct. 18–22
LES USA and Canada Annual Meeting
San Francisco, CA

JANUARY 2010

Jan. 27–30
AIPLA Mid-Winter Institute
La Quinta, CA

MARCH 2010

March 18–20
AUTM Annual Meeting
New Orleans, LA

MAY 2010

May 22–26
INTA Annual Meeting
Boston, MA

SEPTEMBER 2010

Sept. 12–14
IPO Annual Meeting
Atlanta, GA

Hot Topic

We want to know!

How has the current economic situation affected your technology transfer office? Share your thoughts, opinions, and experiences by posting to the interactive discussion board on the AUTM Web site.

To join the discussion visit the subscriptions page on the AUTM Web site. Select this discussion from the list and subscribe by selecting how often you wish to be notified when your colleagues contribute to the thread. You can select to receive the messages in real time, in one daily digest, or choose "no email" to simply visit the AUTM Web site to read the thread.

If you have a topic you'd like to discuss, contact Emily Bauer at emily@warf.org.

Re-imagining University Knowledge Transfer through Spin-off Firms

Peter A. Bacevice, MBA

This paper was the winner of the 2009 academic technology transfer and commercialization graduate student literature review prize. For more information about this award, see "AUTM Foundation Offers Graduate Student Literature Review Prize for Academic Technology Transfer Commercialization," on page 11. Or visit the AUTM Web site.

Abstract

University technology transfer professionals work under the mission of doing what is best for the technologies within their portfolios and for using those portfolios to position their respective universities as agents of innovation and economic development. The complexity of this knowledge transfer task puts technology transfer professionals in the role of broker between higher education and industry in that they are responsible for the interinstitutional transfer of knowledge resources.

Sometimes the most appropriate knowledge transfer action for a particular aspect of scientific research is the licensing of a patent to a company that has the absorptive capacity to develop and commercialize the intellectual property. Alternatively, the most appropriate path to commercialization is the launch of a spin-off company—the purpose of which is to cultivate the knowledge of the founding scientists through the help of business professionals to develop a proof of concept for the marketplace.

This latter route of academic spin-off formation is an emerging topic for both knowledge transfer scholars and technology transfer professionals alike. Unlike patent licensing, which involves the transfer of codified knowledge, the launching of an academic spin-off company is a socially and organizationally complex phenomenon and involves the complex transfer of tacit knowledge.

The universities from which spin-off firms emerge continue to play a key role in the success of these firms. Innovation is not a solitary activity. A spin-off firm is, by definition, innovative because of its work in developing new technologies from abstract form into commercial proof of concept. These firms owe their success, in part, to the ties they maintain to the university as well as to other networks in the business community. This paper is a review of relevant academic literature on the complex relationship between universities and their spin-off firms. This is a complex knowledge transfer

Re-imagining University Knowledge Transfer through Spin-off Firms

Peter A. Bacevice, MBA

relationship that is rooted in the networks that people maintain for the sharing of complex knowledge.

The paper is organized as follows. It begins with a brief overview of the concepts of *knowledge* and *knowledge transfer*. It is then followed by an overview of the link between knowledge and innovation to illustrate the collective aspects of innovation. Given this collective perspective, the paper then reviews a variety of *structural* and *relational* conditions drawn from organizational and network research that coincide with knowledge transfer between universities and spin-off firms. Each condition is summarized with practical considerations that will hopefully spark useful discourse among technology transfer professionals—especially those concerned with the successful cultivation of spin-off companies in their portfolios.

Knowledge and *Knowledge Transfer*

This paper works with deceptively simple constructs—*knowledge* and *knowledge transfer*. Knowledge can be captured in forms such as books, articles, formulas, patents, and equations. Knowledge in this form is easily reproduced and can be transferred among individuals and organizations as much as technology can facilitate the reproduction and transfer process (i.e., through e-mail, shared databases, video conferencing, etc.). However, knowledge also resides with the knower—as people often know more than they can articulate.[1] In this case, knowledge is not so much reproduced as it is learned.[2]

Organizations, especially new business ventures, face market and contextual uncertainties, and they are, inherently, problem-solving, information-seeking, and sense-making entities.[6]

Among the most commonly cited variance in the nature of knowledge is the distinction between *tacit knowledge* and *explicit knowledge.* Tacit knowledge is the deep know-how that is not easily articulated, but it is that which affects actions.[3] Explicit knowledge is that which can be codified and is often synonymous with the transfer of *information* (for example, in the form of books, journals, magazines, patents, etc.). Possession of codified information does guarantee that the possessor has learned or has a tacit understanding of the material.

Tacit knowledge affects organizing around the transfer of deep know-how, while explicit knowledge affects organizing around the transfer of information. Tacit knowledge transfer involves a more complex social process than explicit knowledge (or information) transfer because knowledge is tightly coupled to a knower and cannot stand independent of the knower, while information is loosely coupled to the knower and can stand independent of the knower.[4] A writer can publish a book about something but cannot articulate and reproduce everything he or she knows about that topic—as Dorothy Leonard and Sylvia Sensiper note, "The marvelous capacity of the human mind to make sense of a lifetime's collection of experience and to connect patterns from the past to the present and future, is by its very nature, hard to capture. However, it is essential to the innovation process."[5]

Knowledge is both an organizational and interorganizational construct. Organizations, especially new business ventures, face market and contextual uncertainties, and they are, inherently, problem-solving, information-seeking, and sense-making entities.[6] As such, network organizational scholarship has conceived of the organization as a body of knowledge.[7] It means that an organization is a collection of people sharing information and learning from one another. Effective interorganizational relationships, which include those between universities and business firms, are organized as such that they facilitate and simplify the access of

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knowledge resources in both codified and tacit forms among individuals.[8] This is the concept of the *knowledge-based view of the firm*.[9]

John Seely Brown and Paul Duguid posit that an organizational knowledge base is not limited to organizational boundaries but instead exists within "its embeddedness in broader structures."[10] As such, a university is a local organizing mechanism for a vast knowledge base that exists in wide communities of scholars across disciplines. Additionally, a university is a regional knowledge hub that focuses on the recombination of tacit knowledge.[11] Universities have traditionally categorized, controlled, and legitimized knowledge.[12]

A particular university knowledge base is embedded in communities of disciplines. Likewise, the knowledge base of a particular firm that was spun off from a university is embedded in the university community and relevant disciplinary communities from which it emerged. Successful spin-off firms depend on these connections to the university, especially connections with the faculty community.[13]

A working definition of *knowledge transfer* is the way in which organizational actors share or exchange that which they know by way of reproduction or learning to meet specific organizational learning needs. In the context of university technology transfer activities, licensing agreements and patent filings reproduce and codify specific aspects of scientific research. Likewise, the organization of networking events that brings scientists, venture-capital professionals, and other university personnel together is a form of knowledge transfer facilitation because it allows people to form connections and share ideas and resources and learn from one another.

Thus, the technology transfer office is an important agent of university knowledge transfer. The transfer of a patent in the form of a license is the transfer of explicit knowledge. The deal-making of patent licensing is a relational process, but the license itself represents explicit, codified knowledge. The practice of launching new companies from a university is also a very relational process that involves significant relational interaction. The actual transferred knowledge between the university and the spin-off firm is ambiguous, and it is an ongoing process and a back-and-forth exchange between the university and the firm. University researchers who launch their own companies and maintain a role in the university community often blur the boundaries between the university and the business firm, but this blurred boundary is critical for knowledge transfer.

Universities wishing to engage in and prioritize the transfer of tacit knowledge should pursue the launching of new companies from within their academic communities.[15]

Tacit knowledge is critical for successful university technology transfer offices, especially those that involve themselves in business-venture creation. Technology transfer offices must draw from management school expertise, intimate knowledge of faculty research, connections to the venture capital community, and a talent base from which to draw and form management teams for new companies.[14] This is highly tacit knowledge that draws upon relationships and social exchange. Spin-off companies are a form of knowledge transfer that is unique in their organization around specific expertise and tacit knowledge. Universities wishing to engage in and prioritize the transfer of tacit knowledge should pursue the launching of new companies from within their academic communities.[15]

Because academic scientists bring their expertise to their own spin-off firms, their tacit knowledge moves between the university and the firm. These firms are rooted in what Dorothy Leonard and Walter Swap refer to as the *deep smarts* of the founding scientists. Deep smarts are

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highly personal to the individual mind and makes knowledge all the more valuable, especially when it is difficult to codify and cogently articulate.[16]

The transfer of tacit knowledge, which is indicative of academic spin-off companies, is heightened by the complex interinstitutional relationship between higher education and industry. Higher education and industry have different cultures, norms, expectations, time frames, motivations, and they often have mutually different uses for knowledge.[17] Thus, it's helpful to consider these complexities and the ways in which academic spin-off firms relate to both the university and business communities.

Knowledge and Innovation

Knowledge is an antecedent of innovation.[18] Several empirical studies indicate this trend by showing that the quest for knowledge sharing and mutual learning brings organizations together.[19] This trend brings a diversity of perspectives together. Diverse perspectives make for a cacophony of viewpoints. Well-managed cacophony creates positive energy and results in what Dorothy Leonard and Sylvia Sensiper describe as *creative abrasion*: "intellectual conflict between diverse viewpoints producing energy that is channelled into new ideas and products."[20] Bringing scientists and businesspeople together for interaction can create cacophony (technology transfer professional are well-aware of this), but successful interactions do yield insights, discoveries, and business opportunities.

Innovation is the product of networks of people from different organizations and institutions that mutually diversify otherwise disconnected knowledge bases for shared benefit. This is consistent with the concept of *requisite variety*. Requisite variety posits that external disruptions to a system are more adequately confronted by that system when its own resources are more evenly matched to the disruption.[21] An organization—for example, a university spin-off firm—is unable to singularly meet ever-evolving market challenges within its own system. Thus, as an organizational system, the spin-off firm must broaden the requisite variety of its system. It can do so by broadening its knowledge and innovation base through its alignment with other organizational systems, including those within universities.[22]

Many entrepreneurial startup firms have emerged in recent years to confront major societal challenges. On a micro level, individual business firms increase their requisite variety by broadening their knowledge bases. They do so by ensuring that they have access to university communities of expertise and skill and that they have access to marketplace partners such as investors who provide access to capital and the knowledge of market intelligence.

Therefore, technology transfer professionals must consider their role as agents of the public good through their ability to broker relationships that strengthen firm-level requisite variety at a micro scale and community-level requisite variety at a macro scale.

On a macro level, large-scale innovative challenges—for example, the confrontation of rising energy costs—require an alignment of networks among universities, business firms, and governments. Collaborative efforts of spin-off firms and universities highlight the power of requisite variety that exists at the community level in that clusters of firms and universities have more resources at their disposal when they ally themselves in the fight against certain challenges. Requisite variety at the community level stimulates the sharing of knowledge and learning across organizational boundaries, and this is the fuel of innovation.[23] Therefore, technology transfer professionals must consider their role as agents of the public good through their ability to broker relationships that strengthen firm-level requisite variety at a micro scale and community-level requisite variety at a macro scale.

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Conditions that Facilitate University–Firm Knowledge Transfer

The argument thus far is that organizational innovation does not happen alone. A university spin-off firm, like any other business firm, is strengthened through its collaboration with other organizations and the mutual sharing of knowledge. The university remains a key partner to these spin-off firms because of the knowledge that continues to flow among the networks of academic and industrial scientists. Thus, the remainder of this literature review explores the various conditions that facilitate this knowledge transfer.

As a practical matter, readers might want to consider these various conditions as the basis of new metrics for the measurement of university knowledge transfer impact.

Some scholars have noted sets of conditions that facilitate interorganizational knowledge transfer.[24] However, little is known about the specific conditions of university–firm knowledge transfer. After an extensive review of the literature streams on interorganizational knowledge transfer as well as university–firm relationships, two thematic categories emerged as conditions worthy of further inquiry. This literature review covers *structural* and *relational* conditions of interorganizational actor networks that facilitate university–firm knowledge transfer. In simple terms, this literature review will explore the ways in which individuals from both universities and spin-off firms are linked (structural) as well as the nature of their interactions when linked (relational).

As a practical matter, readers might want to consider these various conditions as the basis of new metrics for the measurement of university knowledge transfer impact. Some scholars have argued that technology transfer professionals must begin to consider metrics beyond the traditional financial metrics of technology transfer licensing.[25, 26, 27] The conditions presented in the subsequent sections of this paper can be approached as managerial heuristics for developing a broader array of knowledge transfer metrics. The theoretical description of each knowledge transfer condition in the subsequent sections will conclude with a summary table, which includes questions of practical consideration that can be used to stimulate discussion around the development of metrics.

Structural Conditions

A university–firm relationship is a dyadic, interorganizational relationship. A dyadic interorganizational relationship is a function of its organizational actors. Actors organize and establish boundaries that become organizations. When actors from one organization establish ties to actors of another organization, these organizations form ties with one another to the extent that the actors facilitate those ties. Structure is a way of understanding the way in which organizational actors connect or could potentially connect to one another in network space. This section will explore the literature on organizational structure and how variance in the structure of organizational actors relates to the transfer of knowledge between their respective organizations.

NETWORKS: THE STRUCTURE OF CONNECTIONS

Network analysis offers a partial explanation of the relationship between organizational structure and knowledge transfer. In simplified terms, network analysis "is rooted in the empirical observation that patterns of interaction of many actors can be looked at as networks"—an aspect of which is the study of structure and the belief that social structure explains social phenomena.[28]

Two often-contrasted views of networks and the way in which information flows within them offer some insight into the

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relationship between organizational structure and knowledge transfer. The work of Ron Burt and James Coleman suggests that the redundancy of network ties coincides with the redundancy of information available from those ties.[29] In Burt's *structural hole* model, networks that are structured such that they contain inroads and access points to other networks yield nonredundant information for those within such networks.

In contrast, Coleman's *closure* model suggests that networks that are structured such that the ties within them are close and redundant yield redundant information (and, thus, tacit knowledge) for those within such networks. Thus, knowledge transfer between two organizations is a function of the redundancy of ties among the organizational actors and their respective interpersonal networks. "From the perspective of the knowledge creation view, the more collaborative ties an organization has, and the greater the diversity of its partners, the more likely it will be successful at generating new knowledge."[30]

Networks of actors can solely exist within the organization (i.e., networks that don't exceed the organizational boundaries) as well as between the organization and the outside (i.e., networks that exceed organizational boundaries). A physics department faculty body, by itself, would be an intraorganizational network that exists solely within the university organization. However, a network of condensed-matter physicists from within one university might also be part of a professional network of condensed-matter physicists from other universities, thus exceeding the boundaries of one particular university. The variation of interorganizational networks as well as intraorganizational networks of the actors of a particular organization are important to knowledge transfer.

The networks of organizational actors are never static. They continuously evolve as people change cities, change jobs, or change careers. An organization's turnover rate coincides with its ability to retain knowledge.[31] Tacit knowledge is linked to the knower and, if someone leaves an organization and falls away from that organization's network, then that tacit knowledge is potentially lost.[32] Yet turnover can be a good thing for an organization in that it exposes the organization to new sources of knowledge. In a sense, knowledge transfer depends on dynamic organizations. A static organization would yield a static number of knowledge inputs.

BOUNDARY SPANNING: INDIVIDUAL LINKS BETWEEN NETWORKS

Of particular interest to the study of knowledge transfer between universities and spin-off firms is the concept of boundary spanning. Boundary spanning

Table 1. Summary of the Relationship between Network Variance and Knowledge Transfer

Network Variance of Knowledge Transfer	Practical Considerations
Network redundancy: structural holes or closure	• Consider the spin-off firm's network. • With whom do firm scientists collaborate? • Is collaboration bringing the firm in contact with new sources of information?
Network boundaries: internal or external to the organization	• How many scientists are involved in networks that exist solely within the company itself? • How many scientists are involved in networks that go beyond the company (i.e., networks of scientists from multiple universities or professional associations)? • Each of these internal and external networks will yield different kinds of idea sharing. How do these ideas differ?
Network turnover: static or dynamic	• How often do people come and go from the firm? • What sorts of insight do new people bring to the business of the firm?

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is a specific aspect of network structure because of its focus on the individuals who cross organizational and institutional boundaries. Thus, this area of scholarship focuses on the individuals who bring universities closer to business firms.

The crossing of such boundaries can be a major change in routine for the boundary spanner as they go from a state of certainty to a state of ambiguity. Manuel Crespo and Houssine Dridi note that spin-off creation "constitutes an important transformation of university researcher practices since they cross the bridge that insulates them from the world as they enter rapidly into an industrial change."[33] Nevertheless, these individuals can serve as network ties that bridge organizations and bring them together, and they can serve to pave the way and reduce some of the ambiguity for those who follow as boundary spanners. In this context, boundary spanners are those who maintain a position in both the university and business firm and bring two otherwise disconnected organizations together.

Boundary spanners are individuals who understand the idiosyncrasies of both parties and who act at the knowledge interface of the relationship—especially when the relationship seeks the transfer of tacit knowledge.[34, 35, 36] Boundary spanners are important for building trust in interorganizational relationships, but they also hold somewhat contradictory roles in that they foster trust between organizations while simultaneously protecting the interests of their own organizations.[37, 38] Technology transfer office staff play the role of boundary spanner between the university and the business community, but they also rely on entrepreneurial academic scientists with first-hand experience in both the academic and startup environments to act as boundary spanners.[39]

Increasingly, venture capital firms are looking to universities for the next big technological breakthrough. As an example of boundary spanning, some venture capital firms hire university insiders to scope out students whose research has commercial potential. These insiders are usually students who have an entrepreneurial track record of starting their own companies and also understand the nature of university culture.[40]

Some empirical research has addressed issues of boundary spanning between universities and business firms through specific programmatic efforts. One study of various boundary-spanning initiatives at Georgia Institute of Technology demonstrates how the university is positioning itself as a hub of tacit knowledge transfer.[41] For example, the university's Yamacraw Initiative focuses on the launching of spin-off companies in the area of broadband communication technology that enable the ongoing mutual transfer of tacit knowledge with the university.

A separate study of biomedical departments at a group of universities in the United Kingdom considered the impact that fellowship programs had on serving as a bridge between academic and business networks and found that fellowship programs build bridges that strengthen the trust and entrepreneurial literacy of academic scientists.[42]

Technology transfer office staff play the role of boundary spanner between the university and the business community, but they also rely on entrepreneurial academic scientists with first-hand experience in both the academic and startup environments to act as boundary spanners.[39]

Other areas of empirical research explore the boundary spanning impact of individual researchers. A study of university spin-off companies demonstrated the importance of entrepreneurial faculty members who remain at the university in legitimizing academic entrepreneurship and serving as entrepreneurial role models.[43] Another study of university spin-off firms notes that many spin-off company founders maintain some position with the

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Table 2. Summary of the Relationship between Boundary Spanning Variance and Knowledge Transfer

Boundary Spanning Variance of Knowledge Transfer	Practical Considerations
Academic and industrial networks linked by programmatic efforts	• Are there certain programs between the university and industry that make both sides mutually aware of each other's idiosyncrasies? • How do these programs enable the back and forth sharing of ideas?
Academic and industrial networks linked by individual researchers	• Who are the key individuals that bridge the university community with the business/industrial community? • How do these individuals legitimize or clarify the nature of the work of one side to the other? • How do these individuals enable the back-and-forth sharing of ideas? • What are some specific projects in which university and firm scientists are mutually involved? • What sort of mutual insight is gained by such efforts?

university (either part time or full time).[44] It suggests that these boundary-spanners maintained such ties because of the long-term relationships they had established within their departments. These relationships were built on trust. As time progressed, these relationships were a conduit for knowledge.

Two studies by Fiona Murray offer some insight into these boundary-spanning individuals.[45] She finds that science and industry networks often center on individuals with dual roles in the academic research community as well as the industrial community.[46] Knowledge spillover in these networks often occurs through joint research and publication efforts. She also finds that the presence of academic scientists in spin-off firms is a source of tacit knowledge for the firm.[47] These individuals are also an important source of human capital for the firm in that they build networks between their academic and industrial contacts.

Scott Shane and Toby Stuart's study of MIT-based spin-off firms and their academic inventors found that these boundary-spanners also benefited from additional ties to the venture capital community.[48] Their study is an elaboration on what it means to span boundaries. There is a benefit to spanning boundaries between the university and the firm, but it is also important to have ties to others in the business community. In this study, additional ties by the founder to the venture capital community meant that these academic spin-off firms had a higher likelihood of success than firms whose founders did not have ties to the venture capital community.

GEOGRAPHY: THE PHYSICAL SPACE BETWEEN NETWORKS

Another structural variable is the geographic, or spatial, distance that exists between organizations and their actors. One study suggests that there is a spatial variable to knowledge transfer.[49] Various business firms, social institutions, and universities cluster at the local and regional level. This sort of clustering brings educated and diverse people together, which stimulates creativity to create knowledge and innovation.[50]

A long line of research holds that the transfer of knowledge between individuals and organizations becomes more difficult as distance between them increases and, conversely, becomes easier as proximity between them increases, in part because of the contextual nature of knowledge, the demonstrable qualities of tacit knowledge, and the interpersonal nature of tacit knowledge transfer.[51]

David Audretsch and Paula Stephan conducted a study of firms and the university-based scientists affiliated

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Table 3. Summary of the Relationship between the Variance in Geographic Distance and Knowledge Transfer

Geographic Variance of Knowledge Transfer	Practical Considerations
Physical proximity between individuals from universities and spin-off firms?	• What is the distance between the university and its spin-off firms? • How easily do university and firm scientists connect and interact with each other? • Given the proximity between the university and its spin-off firms, what is the level of complexity of the knowledge that is shared? • How does the region in which the university is located generally interact with entrepreneurial firms? • Are spin-off firms regularly engaging with the university? • Do university spin-off firms stay in their home region, or do they leave for other regions?

with those firms.[52] Their sample of firms consisted of biotechnology companies that underwent an initial public offering during a specific time frame. In doing their study, they found that firms varied widely in their use of localized talent.

For example, the San Diego, San Francisco, and Boston regions utilized a higher percentage of university-based scientists than several other regions. They hypothesized that the use of localized university-based talent depended on the role that scientists were expected to play. They further hypothesized that, when firms wanted to tap into the tacit knowledge of scientists, they tended to reach out to local talent. Such tacit knowledge represents access to the knowledge of local university research labs.

Peter Lindelöf and Hans Löfsten studied science parks that house new university spin-off firms and found that firms that were in proximity to universities enjoyed the intangible benefits of being in a networked environment with those universities.[53] They argue that networks, including those with research universities, are valuable to firms for the discovery and testing of new ideas.

One caveat to this line of study is the variability among regions. Clusters organize in various ways depending on the local norms of a city or region.[54] There are many studies of urban regions in the United States such as Boston, the San Francisco-Bay Area, San Diego, and the North Carolina Research Triangle. Yet regional dynamics vary even among these bellwether regions (see, for example, AnnaLee Saxenian's 1994 comparative ethnography of Silicon Valley and Boston).[55] An increasing number of studies are looking at other regions, both within and outside the United States, to determine the geographic-spatial conditions of university–firm knowledge transfer in different contexts.

For example, one qualitative study looked at three different universities in noncore areas in Australia and the roles that each university played on the innovative activities of each respective region.[56] The study concluded that the university–

Table 4. Summary of the Relationship between the Variance of Tie Strength and Knowledge Transfer

Variance of Tie Strength in Knowledge Transfer	Practical Considerations
Strong-weak	• How intense is the relationship between the university and its spin-off firms? • To what extent is the university–firm relationship an ongoing source of new insight for either party? • To what extent does the university–firm relationship create opportunities for the mutual learning of deep insights? • To what extent does the university–firm relationship create opportunities for the mutual sharing of information resources?

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firm dynamic varies based on a number of regional, industrial, and university characteristics. Thus, geographic proximity between universities and firms matters to knowledge transfer, but the variability among regions highlights other relational dynamics of knowledge transfer.

Relational Conditions

The structure of interorganizational relationships provides insights into the channels through which knowledge transfers. However, structure is only part of the knowledge transfer picture.[57] The structure of interpersonal and interorganizational ties does not describe how individuals relate to one another within those ties. This section is a review of literature on the relational variation within interorganizational relationships and how such variation coincides with knowledge transfer.

STRENGTH OF TIES: THE INTENSITY OF RELATIONSHIPS

One particular aspect of network research focuses on the structure of ties. Yet the structure of ties—or the ways in which actors organize in network space—is not a sufficient explanation of how networks vary. Networks also vary based on the intensity of the relationships that people have with one another. Thus, the strength of ties differs from the structure of ties.

The scholarship of Mark Granovetter discusses ways in which the strength of ties varies and how such variance coincides with the transfer of knowledge.[58] The variability in the strength of ties coincides with the redundancy of knowledge as evidenced by the transfer of either new information or existing information. On the one hand, *weak ties* are beneficial because they are easily acquired and because many weak ties are access points to new information.

On the other hand, *strong ties* yield information overlap, which can lead to the transfer of tacit knowledge.[59] Strong ties lower the transaction costs of knowledge transfers, but over time, the strong ties can become problematic in that knowledge shared within these strong ties becomes as homogeneous as the ties.[60]

FORMALITY OF TIES: THE STRUCTURE OF INTERACTION WITHIN RELATIONSHIPS

University–firm relationships can also be classified by the formalities of the ties between them. Some relationships can be quite formal and mirror the characteristics of a formal alliance in that the organizations and their respective actors are bound to adhere to the provisions of a formal contract such as a technology license. A formal alliance can encompass "a constellation of agreements characterized by the commitment of two or more partner firms to reach a common goal, entailing the pooling of their resources and activities."[61] Despite the formal agreements that bring organizations together, many of the ties that exist between individuals and their respective organizations may be very casual and informal and not bound by any agreement other than the basic norms of trust and reciprocity.

Table 5. Summary of the Relationship between the Variance of Tie Formality and Knowledge Transfer

Variance of Tie Formality in Knowledge Transfer	Practical Considerations
Formal-informal	• How structured are the interactions between individuals from the university and from business firms? • To what extent are ideas and insight spontaneously shared (i.e., through informal networking) in the context of university–firm interactions? • To what extent are ideas and insight sought through rigid or controlled interactions (i.e., formal brainstorming sessions) between individuals from the university and from business firms?

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Research that has explored university-based spin-off firms has looked at the formality of the ties between firms and their universities, ranging from formal to informal. University-spin off firms depend on the university for a variety of knowledge resources. Small numbers of strong ties, characterized by high levels of trust and informality, are typical of these university–firm relationships.[62]

The formality of ties also matters in the context of physical proximity and knowledge transfer. In David Audretsch and Paula Stephan's study of firms and the ties that they have with university-based scientists, they argued that physical proximity between the firm and the scientist mattered when knowledge transfer was informal.[63] However, when knowledge was transferred within formal ties between firms and scientists, physical proximity was less important because the transfer of knowledge was a planned activity. This suggests a relationship between the formality of ties and the spontaneity of knowledge transfer.

TRUST: THE ORGANIZING PRINCIPLE OF RELATIONSHIPS

In much of the research on the relational aspects of interorganizational relationships, the issue of *trust* frequently emerges. Trust is a complex phenomenon, with consensus in the literature regarding this complexity. While recognizing this

One study of university–firm relationships suggests that trust is the glue that holds such relationships together, whether the relationship is based on the transfer of tacit or explicit knowledge.[77] It suggests that trust is an area for future research, specifically its temporal nature and the way in which trust interacts with other contextual factors.

complexity, Bill McEvily, Vincenzo Perrone, and Akbar Zaheer define trust as "the willingness to accept vulnerability based on positive expectations about another's intentions or behaviours."[64] They note that *trust* and *trustworthiness* are not interchangeable in that trust is an expectation while trustworthiness is a behavior. Placing trust in another entity (the expectation) never comes with a foolproof guarantee of trustworthiness (the behavior) by the other entity.

Relationships between organizations require some degree of trust. Differing information sources can create conflict and trust mitigates the accessibility and interpretation of information.[65, 66] Trust is an organizing principle a precondition, and a product of collaboration.[67, 68] Trust minimizes malfeasance, reduces transaction costs, and ensures that both parties to the partnership act responsibly and meet the expectations that the other party expects.[69] University–firm relationships are no different in this respect. Knowledge-sharing relationships between organiza-

Table 6. Summary of the Relationship between Variance in Trust and Knowledge Transfer

Variance of Trust in Knowledge Transfer	Practical Considerations
Trust or lack of trust	• How much trust exists between the university and its spin-off firms? • Do individuals from the university and from business firms mutually share ideas and insight? • To what extent is it easy or difficult for parties from the university and from business firms to share ideas and insight? • To what extent do individuals from the university and from business firms engage in the sharing of deep insight?
Temporal variance of trust	• How long has the university been a trusted knowledge partner to business firms? • How much knowledge has been mutually shared between the university and business firms?

tions such as universities and business firms follow this same pattern.[70]

Trust is a precondition for informal communities, or self-authorizing groups that exist outside the constraints of formal organizational hierarchies and bring people together with shared expertise or passion for join enterprise, and mutual learning.[71,72] When communities of individuals are embedded in the relationships between their respective organizations, interorganizational relationships benefit from a long-term outlook in that individuals forgo short-term personal gain for the long-term good of the interorganizational relationship.[73]

The scholarship of interorganizational trust describes its temporal variability. Trust has temporal variability in that there are levels of trust that vary at the formation of a relationship as well as levels of trust that vary at any given point throughout the duration of the relationship.[74] Trust evolves sequentially and intensifies throughout the relationship.[75] Mutual knowledge sharing and innovation intensify as trust deepens over time. [76] One study of university–firm relationships suggests that trust is the glue that holds such relationships together, whether the relationship is based on the transfer of tacit or explicit knowledge.[77] It suggests that trust is an area for future research, specifically its temporal nature and the way in which trust interacts with other contextual factors.

Some research considers variability between trust and the absence of trust. Rikard Larsson, Lars Bengtsson, Kristina Henriksson, and Judith Sparks argue that a lack of trust erects a barrier to the formation of interorganizational knowledge.[78] In a study of university–firm alliances, Michael Santoro and Patrick Saparito argue that relational trust is a more significant facilitator than self-interest in knowledge transfer.[79] Relational trust's association with knowledge transfer became stronger as the tacitness of the knowledge increased.

Likewise, Arthur Sherwood and Jeffrey Covin's study of firms engaged in technology transfer relationships with universities found that the firm's trust in the university was a significant predictor of tacit knowledge acquisition but was not a significant predictor of explicit knowledge acquisition.[80] Trust is also is necessary in the sharing of privileged information among entrepreneurial academic researchers.[81]

Summary

This paper has suggested several conditions that influence the transfer of knowledge between universities and academic spin-off firms. Each of the major sections described one of these conditions and concluded with a list of practical questions for technology transfer professionals to consider. By asking these questions, technology transfer professionals can hopefully generate answers that can subsequently influence their practice of launching spin-off companies.

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Re-imagining University Knowledge Transfer through Spin-off Firms
Peter A. Bacevice, MBA

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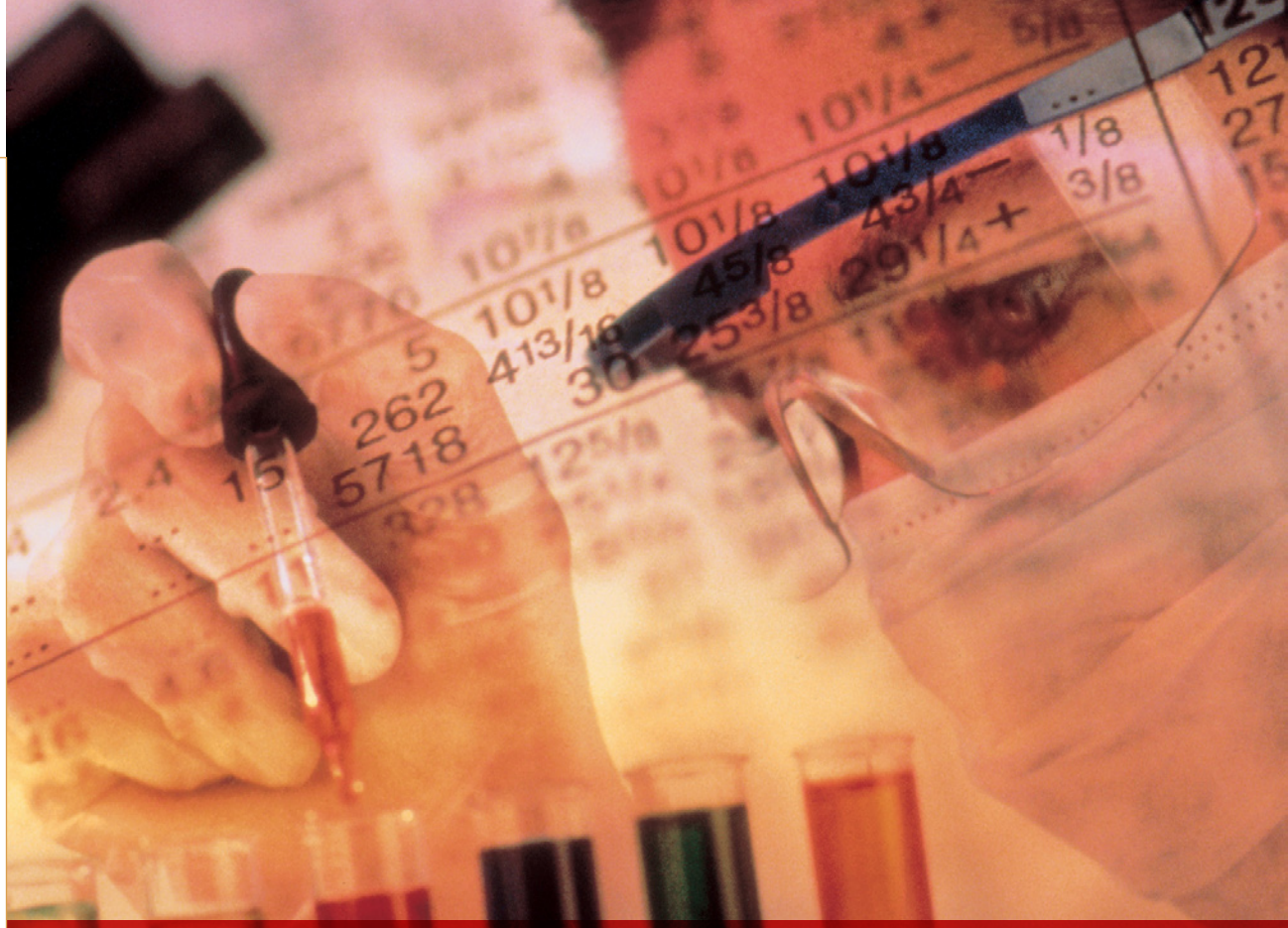


Venture Capital–University Interface: Best Practices to Make Maximum Impact

Krisztina "Z" Holly

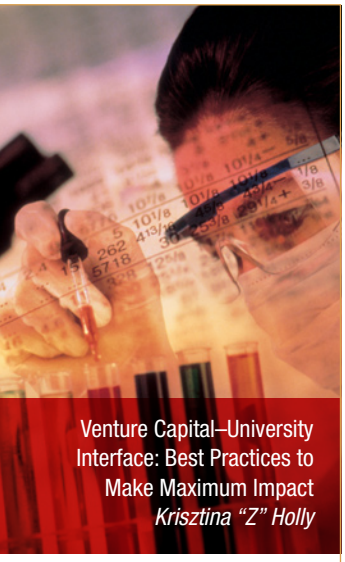
Abstract

Entrepreneurial startups—whether in biotechnology, clean energy, or telecommunications—have left an indelible mark on much of the United States' recent economic history. As hotbeds for technological innovation, university research labs create groundbreaking innovations that have been at the heart of many successful startups. But powerful ideas do not necessarily beget successful companies. Great ideas must be identified, acquired, and developed into successful businesses using a unique blend of skills.

Venture capital funds exist to perform this valuable—and lucrative—role in the economy. Some venture capitalists try to scour the campuses of major research universities in search of the next big idea, but it is not as straightforward as discovering an inventor at a lab bench. A range of practical, personal, and legal hurdles must be cleared before an idea can begin to transform into the core of a new company.

With these common hurdles in mind, the USC Stevens Institute for Innovation at the University of Southern California at the conducted ninety-four in-depth interviews with geographically and commercially diverse venture capitalists to better understand the relationship between the academic and venture capital communities: what motivates the various stakeholders, which are the most pressing problems facing university–venture relations, and what can be done to improve the process for everyone involved.

While many factors play into startup success, five main focus areas emerged



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for universities looking to improve the university–investor interface: understanding investor motivations, supporting entrepreneurs, streamlining bureaucracy, improving access and visibility, and fostering a culture of innovation on campus.

Introduction

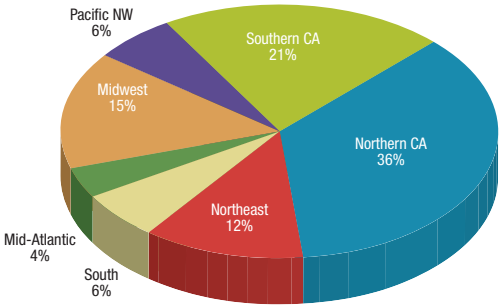
Venture capitalists (VCs) are eager to share stories of their successes, but they are also vocal about their disappointment dealing with universities. They view academia as a rich source of lucrative deals, but are often frustrated by how difficult it is to identify, extract, and develop those ideas into thriving businesses:

> Even though the academic and his co-founder CEO were in agreement on the deadline terms, once it got caught up in the endless cycle of university bureaucracy, we literally lost nine months, plus a lot of sweat equity. But I've pushed our limited partners into dealing with universities anyway because I feel like research lab ideas are really interesting and often worth the hassle.
>
> — *managing partner, life science venture fund*

With this in mind, the USC Stevens Institute for Innovation set out to explore the issues affecting university–VC relations in an effort to better understand—and ultimately improve—the spinout process for all of the stakeholders involved. The goal was to understand how universities can better serve the investment community by more effectively connecting innovations bred in university classrooms and labs with venture capital funding.

From November 2007 through February 2008, an independent research team conducted ninety-four in-depth interviews among a geographically and commercially diverse sample of VCs to gain deeper insight into the current model for academic spinouts and which

Figure 1: Geographic Distribution



elements of that process help or hinder the efforts of VCs to develop those ideas into thriving businesses. (See Figure 1.) All of the interview subjects were senior managers of active venture funds (partner or managing director level) that invest in seed- and early-stage companies.

The research identified many areas where investment professionals think universities can improve, from internal education and training within technology transfer offices about the investment world to better packaging and marketing of ideas for VCs to review. This paper presents the major findings from the research and offers recommendations for ways to improve university–VC relations.

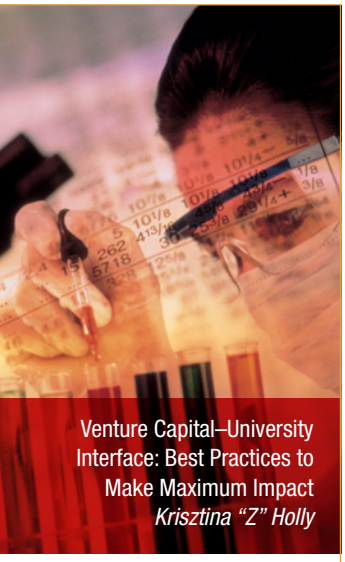
These recommendations can be summarized into the following five key areas:

- Know your VCs.
- Support your entrepreneurs.
- Make it easy: Streamline the bureaucracy.
- Get out there: Improve access and increase visibility.
- Foster a culture of innovation.

Know Your VCs

UNDERSTAND HOW YOU FIT INTO A VENTURE CAPITAL FUND'S BUSINESS GOALS

The structure and goals of VC funds determine what types of inventions will be of interest to them. In the broadest sense, a VC fund is a pool of private equity used by third-party investors to grow new busi-



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nesses. Funds are composed of general partners, who make decisions about where to invest, and limited partners, who contribute capital to the fund. Like other alternative investment vehicles, venture capital funds have a fixed lifespan in which to provide the venture and the limited partners with a cash return on their investments.

To VCs, universities are a potential source of truly unique innovations and inventions that, if given capital and strong management, can become successful standalone companies within a reasonably short period of time. These are the *only* types of ideas from universities that are relevant to VCs.

Venture capital funds make investments in growing businesses in the interest of generating above-market returns for their partners. These returns depend on a successful exit strategy through a liquidity event—typically an initial public offering (IPO) or acquisition. Venture partners generally receive 2 percent of the fund's committed capital as an annual management fee and an additional 20 percent of the fund's net profits, a so-called 2-20 arrangement. This creates heavy incentives to make successful investments.

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BE AWARE OF THE TICKING CLOCK

A venture fund has a finite lifespan of only a few years to identify investment opportunities and guide its portfolio companies to a successful exit event. Venture capitalists are always mindful of the ticking clock—the faster a company matures, the quicker to exit and the higher its internal rate of return (which affects its ability to raise money for future funds). Venture capitalists look at a company's likely time to market, time to profitability, and time to exit through a liquidity event.

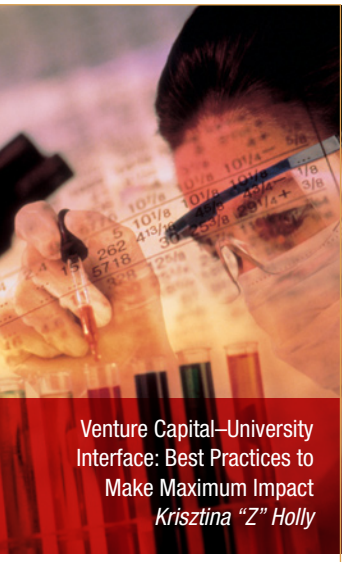
Eight out of ten VC investors interviewed said that university-generated business plans miss the mark when it comes to addressing the question of timing, and that VCs typically add on two to three years to the stated time to market for a university venture. The interviews revealed that, in terms of investment horizons, VCs consider university technologies longer-term bets than industry investments, which makes them less attractive and riskier.

EXPECTATIONS VARY BY INDUSTRY VERTICALS

Venture funds can be loosely grouped into categories based on a fund's industry focus, and they have very different expectations for university relationships depending on the area of the investment they are making. For instance, venture capital firms specializing in software and technology expect a relatively low initial investment and quick time to market, with a clear path to exit within five years. Funds that manage life sciences portfolio companies expect to participate in multiple investment rounds as the idea matures and is proven over a longer investment horizon on the order of seven to ten years.

DEAL FLOW COMES FROM THE VCs' NETWORKS

In the research, the opinion was unanimous among VCs that their preferred source of deals is a trusted person in their networks—not showcases, over-the-transom business plans, or bulletins. As a result, VCs want better personal networks and continual access to new investment opportunities. These networks may encompass technology transfer office professionals, faculty members, and other external advisers, but they rarely include students, even at the graduate level.



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VCs ASSESS INVESTMENTS IN TERMS OF RISK

A venture fund takes a gamble that a small number of its portfolio companies will do exceedingly well, many will do reasonably well, and some will fail. Venture capitalists assess ideas by calculating the likelihood of these outcomes, and once the deal is made, they spend the next several years managing and mitigating known risks (such as inexperienced management teams).

According to the VCs surveyed, this point is often lost on would-be entrepreneurs and technology transfer professionals. Understanding a potential company's risk profile—including the possibility of failure due to competition, inaccessible markets, and other factors—creates a stronger pitch for investors who too often hear unrealistic claims such as, "We'll get to $10 million in revenues in two years and $100 million in three."

VENTURE CAPITAL FUNDS ARE NOT ATMS

Venture capitalists are not an endless source of cash for unproven or infeasible inventions, nor are they in the business of writing blank checks—they expect to be highly involved in their portfolio companies. This is especially true of the early- or seed-stage investments that characterize the majority of ideas originating in university labs.

Support and Educate Your Entrepreneurs

THE PERSON BEHIND THE IDEA IS AS IMPORTANT AS THE IDEA ITSELF

Without exception, the VCs we spoke to said that people—innovators—are a central consideration of venture deals and that universities do not always understand this or create the right support and incentives for student and faculty innovation. One venture capitalist from the Northeast put it best, saying that, "It's not about the technology alone; at the end of the day, it's about people and it's about the business team surrounding these technologies—you have to have people who are thinking through the technological and business sides of things."

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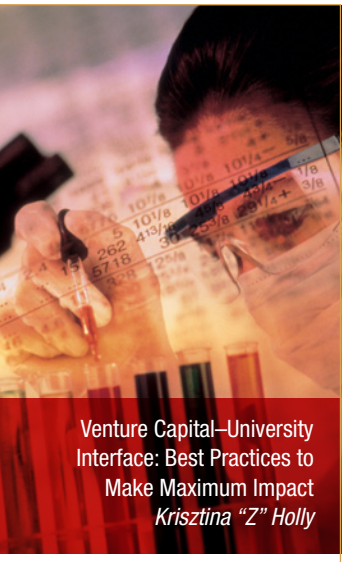
Too often technology licensing offices get so caught up in managing the spinout of compelling new technologies that they lose sight of the *people* who bring these ideas to life. Introducing VCs to talented people can be more powerful than showcasing specific innovations. It is possible that a faculty member will be invited by a VC to serve in an advisory capacity for another portfolio company, regardless of whether or not he or she was involved in the formulation of the original idea behind it. This type of entrepreneurial crosspollination can broaden a university's professional network and increase its visibility in the venture capital community.

THE ROLE OF THE INNOVATOR WILL DEPEND ON THE MATURITY OF THE COMPANY

Although there certainly are successful, high-profile companies that are run by chief executive officer (CEO) inventors, this is not the spinout norm. The people behind an idea are expected to go with it—they will leave the university to actually start the company and be highly involved in the early stages—but they will probably *not* run the company through its maturation.

Venture capitalists stressed it is important that inventors understand their likely role in a startup in light of their scientific expertise and business experience. Researchers should be prepared to take time off to follow their technology from the lab to the startup. If they are unable to or unwilling to make that commitment, they



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should be prepared for the departure of graduate students familiar with the technology who can help guide it to market. They should also expect that their board will begin to recruit a management team around them from day one, which may include an experienced CEO at some point.

PROVIDE BUSINESS EDUCATION FOR STUDENTS AND FACULTY

One surprising finding of the research was that the old stereotype of ivory tower academics has been put to rest—venture capitalists mostly deal with academic entrepreneurs who are reasonably sophisticated about the markets they propose to enter. Still, faculty and students' relative inexperience at founding, growing, and managing successful companies can impede the smooth execution of a VC deal.

Our interviewees had a number of suggestions for ways that technology transfer offices can mitigate potential delays and misunderstandings during the spinout process. They fell into two major categories: education and team support.

Education

Prepare entrepreneurs for the pace and probable terms of the deal. The VC will want it to move very quickly—often more quickly than the inventor is comfortable with—and will come to the table with aggressive ownership and equity demands.

Venture capitalists have been through this process dozens of times, but the majority of academics have not. One angel investor in California was quick to segment faculty members into "entrepreneurial dynamos, ivory tower academics, and a grey middle." To his thinking, it was absolutely critical that universities support and educate the grey middle, since dynamos are entrepreneurially self-sufficient and the ivory tower-types are a "lost cause."

Team Support

The research repeatedly found variations on the same theme: "We don't trust a lone-wolf inventor—it makes us wonder whether he will be able to build a management team around him." Encourage faculty members who are experienced in the spinout process to reach out to their peers to serve as a resource and sounding board. Do not confine the search for a peer mentor to one university alone. Take proactive steps to reach out to faculty members at other universities whose particular experiences bear a close resemblance to the inventor's situation.

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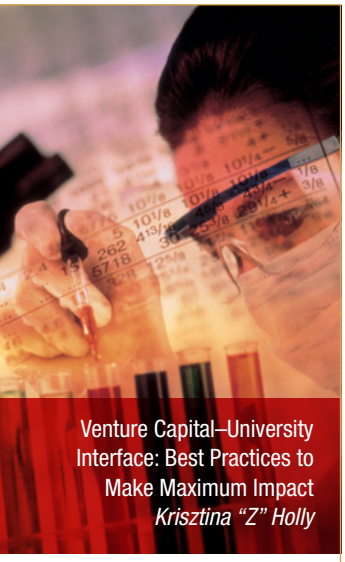
Make it Easy: Streamline the Bureaucracy

Technology transfer and technology licensing offices (TTOs), much like venture capital funds, are home to staff with a myriad professional backgrounds, including legal staff with a strong orientation around intellectual property protection. In addition, many TTOs have a stronger history of licensing than connecting capital to ideas for standalone companies. This means they are more oriented around controlling the use of an innovation than spinning off innovations that may grow in unpredictable ways.

ACT AS A BUSINESS INTERMEDIARY, NOT A PARTISAN LEGAL TEAM

The research confirmed that VCs are extremely understanding about a university's need to protect its investment in promising technologies. They are accustomed to entering into negotiations with counterparties who have very divergent points of view, then finding mutually agreeable deal terms in short order.

Once VCs decide to make a deal happen, they are impatient for it to move ahead immediately, and many have an aversion



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to intellectual property attorneys who can get in the way of a deal that they are very eager to execute.

> Technology transfer should screen and package the technology, make the introduction, then step back and get out of the way.
>
> — *partner, technology venture fund in Southern California*

BE READY TO MAKE A DEAL

It is critical that universities chart a course away from the defensive or fortress mentality that characterizes many TTOs that are staffed by overzealous attorneys rather than individuals with a more a opportunity-oriented business development mindset. Technology transfer offices must strike a balance, maintaining a business-like relationship without sacrificing legal protections for the university and its entrepreneurs. What investors would like to see from universities is a genuine effort to make the deal process as smooth and expedient as possible, including a *standardized, transparent deal process*.

Get out There: Improve Access and Increase Visibility

PACKAGE IDEAS IN VC-FRIENDLY WAYS

One of the most clear and consistent opinions that emerged in the research was that universities need to get better at gathering, translating, and packaging new ideas. This involves more than simply eliminating academese from business plans presented to VCs—it means

Unfortunately, the opportunities that come out of universities are not usually as well-developed in terms of what matters most to VCs.

coaching would-be entrepreneurs on how to discuss their ideas in business rather than technological terms. Prominent investors receive hundreds of solicitations for capital each week, many of which are highly professional business plans written by entrepreneurs with a good working knowledge of finance.

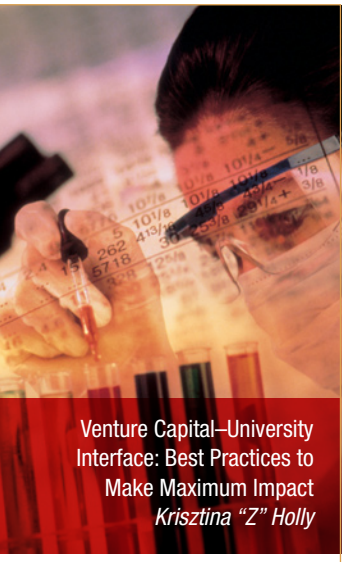
Unfortunately, the opportunities that come out of universities are not usually as well-developed in terms of what matters most to VCs. This includes a strong understanding of the potential business' capital requirements, path to market, and expected return on investment. Technologies without markets are not attractive targets for VCs. Investors are frequently frustrated by solutions in search of problems coming out of research settings that are simply too far removed from the markets.

It is important that entrepreneurs understand that VCs are not in the business of finding customers for esoteric technologies. Every idea that gets presented to a potential investor should include a clearly identified existing market need and a plan for capturing meaningful market share. Technology transfer offices can help entrepreneurs chart a very basic commercial trajectory.

BE PROACTIVE

Universities cannot wait for the VCs to come to them—investors do not have time to scour the halls of your university in search of new technologies. Instead, proactively approach investors with succinct, summarized information about potential deals. Building strong professional networks will allow universities to target the distribution of potential spinouts to the appropriate VC firms.

A number of examples of this were cited in the interviews: Some universities regularly send a senior staff member to meet with VCs who are interested in their universities' potential investment opportunities, some have quarterly newsletters tailored by industry focus, some have professors employed as entrepreneurs in residence at venture funds, and some have excellent showcase events. These initiatives send the message to VCs that the university is actively thinking about providing them with good deals.



Venture Capital–University Interface: Best Practices to Make Maximum Impact
Krisztina "Z" Holly

DEVELOP RELATIONSHIPS

Venture capitalists value their networks and see value in anyone who can make quality introductions at the right time.

Seed-stage venture funds covet exclusivity, so targeted offerings that are not perceived as having been blindly shotgunned to every VC in the surrounding four states will be better received.

DISTINGUISH LICENSING DEALS FROM SPINOUTS

In the interviews, VCs repeatedly voiced the opinion that the majority of technologies coming out of universities are not appropriate as standalone businesses—they are licensing deals, not startups. Venture capitalists appreciate technology transfer offices that understand their business model and filter out the ideas that will never work as venture-backed spinouts.

EMPLOY A DEAL-FLOW BENCHMARK

In addition to tracking the number of successful ideas that are either licensed or spun out from year to year, keep tabs on the number of potential leads on campus. It is understood that the overwhelming majority of raw intellectual property on campuses is unsuitable as the foundation for a new company. Technology transfer offices should keep track of deals that fold on account of unworkable technologies.

These failures, as much as the spinout successes, are a testament to the health and vibrancy of entrepreneurship on campus and provide a more complete picture of the deal-flow pipeline at your university. This ultimately goes hand in hand with keeping a fresh pipeline of innovations visible to VCs and, once there is a deal to be made, do everything possible to streamline the process.

Foster a Culture of Innovation

SUPPORT THE CREATION OF AN ECOSYSTEM OF ENTREPRENEURSHIP

Venture capitalists talk about universities that have an ecosystem of entrepreneurship, which is a top-to-bottom culture that breeds and fosters innovation. This does not start and stop with what happens in the TTO; it goes through every part of the university system. It has implications for admissions, faculty promotions, grants and fundraising, and, of course technology transfer and licensing. Faculty members and graduate students are increasingly inclined to pursue entrepreneurial opportunities.

However, these opportunities are not formally supported at many universities; the time a faculty member might dedicate to turning ideas into businesses competes with the time it takes to teach, publish, and pursue tenure. At some point, this is a strategic question about a university's identity and mission—whether or not and to what degree it wants to function as an incubator for venture capital funds' portfolio companies.

CAPITALIZE ON EXISTING STRENGTHS

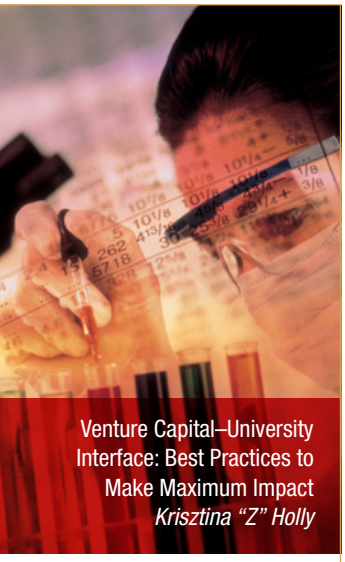
> For many VCs, an innovation that requires a multimillion-dollar lab for research and development is a nonstarter, but with access to existing infrastructure, the deal makes sense.

Find new avenues and sources with which to fund research, because external funding is incredibly attractive to venture firms. Venture capitalists love ideas that have been heavily supported by university and government funding—it means they do not have to bear the costs of early development.

OFFER UNIVERSITY RESOURCES TO SPINOUTS

One of the most frequently mentioned items on the VCs' wish lists was continued access to cutting-edge laboratory facilities for startups. This sweetens the creation of new companies by reducing the capital expenses associated with building laboratory facilities from the ground up.

For many VCs, an innovation that



requires a multimillion-dollar lab for research and development is a nonstarter, but with access to existing infrastructure, the deal makes sense. They suggested implementing a charge-back model to drastically reduce a fledgling company's capital expenses while compensating the university at the same time. That said, these sorts of arrangements are tricky for universities and issues such as conflict of interest and tax codes can make these arrangements problematic, or impossible, for most nonprofit academic institutions.

DRAW ON THE EXPERIENCES OF OTHER TTO PROFESSIONALS

Some universities have been more successful at facilitating spinouts than others. In any discipline, it pays real dividends to study what has made similar organizations successful in an effort to establish some baseline best practices. Since VCs typically operate within a small geographic region, it is worth reaching out to your peers at other institutions to share information and leverage your university's visibility and reputation by partnering with others to expand your reach.

Universities should not be competitors in this regard and can build on each other's successes and connections. A number of the interviewed VCs were impressed by joint conferences organized by universities in Southern California. The culture of innovation should not stop where the campus ends.

Conclusion

Venture capitalists and universities can gain a great deal from working together as long as each party understands the other's needs. The suggestions in this study, from insights shared by VCs, uncovered five key factors on the university side: (1) understanding investor motivations, (2) supporting entrepreneurs, (3) streamlining bureaucracy, (4) improving access and visibility, and (5) fostering a culture of innovation on campus.

Although this paper is not a roadmap for spinout success or a comprehensive set of solutions to some of the issues facing technology transfer professionals, the hope is that this research sparks a productive, long-term dialogue within and between the university and venture capital communities and serves an important first step toward refashioning university technology transfer as a more straightforward, productive, and mutually beneficial process to maximize the impact of university innovations.

Acknowledgements: Special thanks to Richard Hull, PhD; Joe Koepnick; Juan-Felipe Vallejo; and Elisa Wiefel Schreiber of the USC Stevens Institute for Innovation at the University of Southern California.

Photo by Phil Channing

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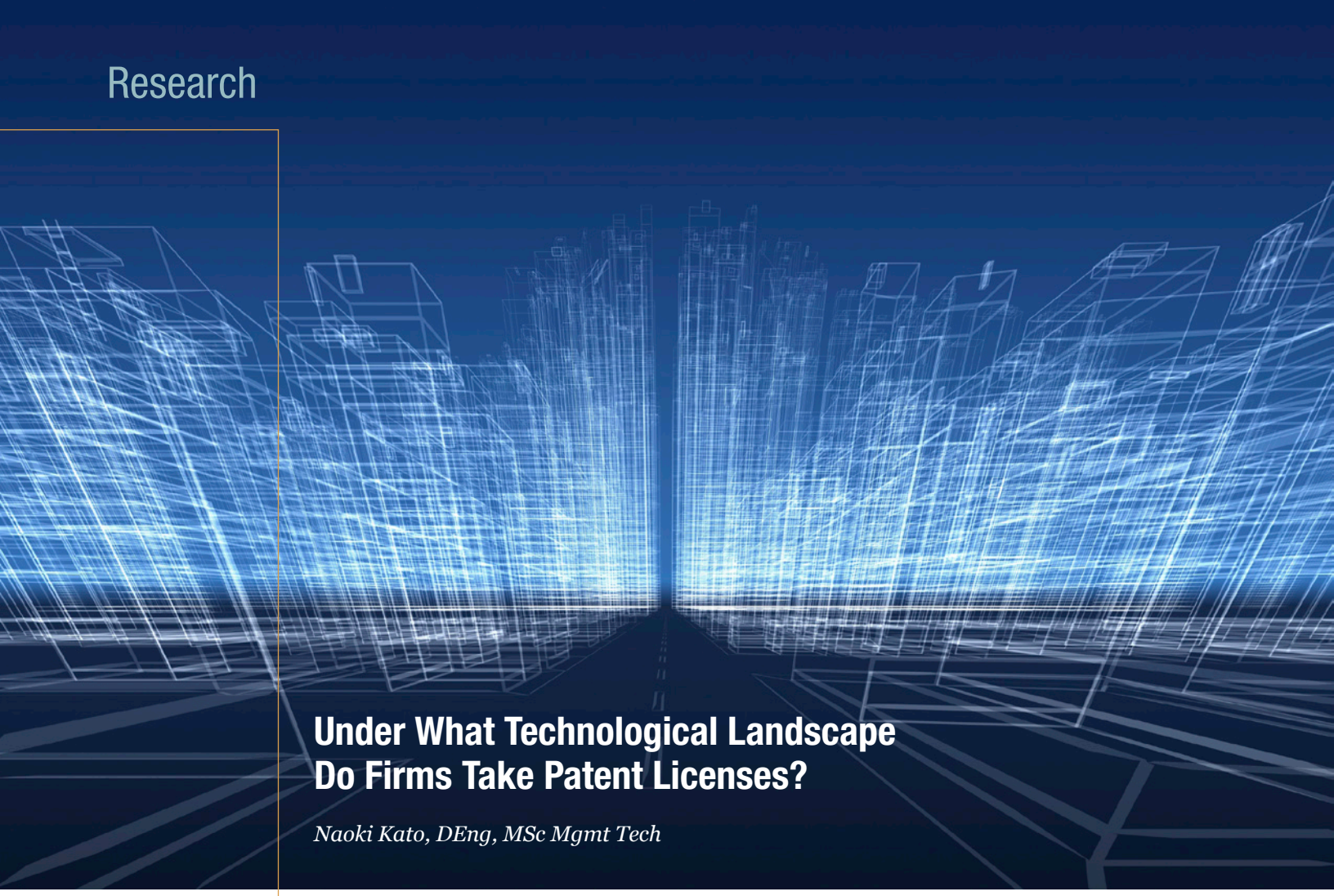


Under What Technological Landscape Do Firms Take Patent Licenses?

Naoki Kato, DEng, MSc Mgmt Tech

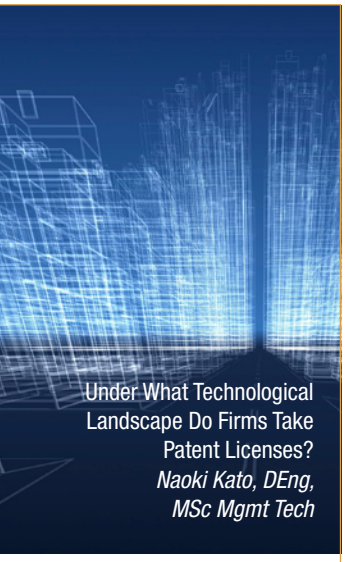
Abstract

Analyzing in-licensing activity with the help of the United States Patent Classification System at the subclass level of in-licensed patents provides interesting insight. The author found a relationship that is typical of successful technology transfer between the in-licensed patent and the firm's filed patents. The findings are: (1) a firm typically has filed nearly no patents in preceding years in the same subclass as that of the licensed patent and (2) a firm often has filed patents in preceding years in technologically related subclasses.

The phrase *technologically related* means closeness of two technological fields described by the number of patents granted in two such technological fields at subclass level. The interpretation of these findings could be that firms do not need to in-license the technology they already own, but do so in fields in which they have developed capability to absorb owing to technological relatedness to the in-licensed patent. The implication that therefore logically follows is that careful analysis of a firm's technological landscape can be used to determine whether successful technology transfer is likely to occur.

The technology transfer process from universities to corporations has been analyzed in numerous literature. Some focus on license leads viewed from the perspective of a licensee. Thursby and Thursby[1] report in their survey of industrial executives that personal contacts between corporations' research-and-development staff and university personnel are the most important source of leads to university technologies.

This observation is in line with Jansen and Dillon,[2] who showed that licensing leads usually come from university inventors. These works demonstrated an important role played by inventors during



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the technology licensing process. Another important role is played by a mediator between a potential licensor and a potential licensee, such as the technology transfer office of a university or a license broker.[3, 4]

Hsu and Bernstein,[5] proposing successful marketing strategies for university's technology transfer office, have also suggested the use of a captive current licensee as a licensing lead and customer-driven approach to existing firms. The captive current licensee is a firm that has already licensed from a university and is willing to help with a future license.

Other studies have explored the effectiveness of a technology transfer office through the analysis of the reputation of the university or the quality of faculty;[6] the organizational structure of technology transfer office;[7] faculty salary or the number of staff of the technology transfer office;[8] or industry difference, funds, or patent effectiveness.[9]

But little has been reported on the technological factors that may act as a driver for successful technology transfer. A licensing firm needs the technology from outside, and this need, the author believes, is directly related to the firm's technological landscape. This article discusses this topic and is based on findings derived from successful technology licensing cases. The technological landscape is described in terms of filed patents relative to the patented field where the field is a particular subclass of the United States Patent Classification System.

Methodology

Breschi, Lissoni, and Malerba[10] used the cosine index defined as:

$$C_{ij} = \frac{\sum_{k=1}^{n} w_{ik} w_{jk}}{\sqrt{\sum_{k=1}^{n} w_{ik}^2 \sum_{k=1}^{n} w_{jk}^2}}$$

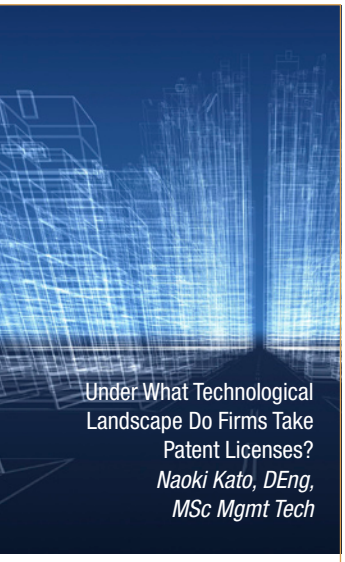
to build similarity or relatedness indexes, where w_{ij} is the number of patent applications classified in both technology fields i and j, which are supposed to be proxies for sharing a common knowledge base. C_{ij} is a matrix where all C_{ii} values on the diagonal are normalized to unity and off-diagonal C_{ij} (i is not equal to j) values are between 1 and 0. Breschi et al. classifies all technologies into 30 broad fields and calculates $C_{ij,}$ which represents a 30 x 30 matrix.

This paper extends Breschi et al.'s work by expressing relatedness using the Breschi et al.'s cosine index. The technology field here is represented by specific subclasses of the United States Patent Classification System. As described in the literature,[11] the number of subclasses are approximately 130,000.

Therefore, one might think there is a need to calculate using a 130,000 x 130,000 matrix, which would surely be a formidable task. Instead, this paper proposes a rough estimation approach for C_{ij} values using a limited number of subclasses. For example, one might use only subclasses containing the licensed patent(s) plus subclasses containing patents held by licensee. With this approach, the number of C_{ij} values one would need to calculate could be as few as the order of tens.

In this way, one can calculate C_{ij} values with ease. However, the C_{ij} values thus calculated are subject to errors generated by selecting only particular subclasses. The author experimented on how C_{ij} values might fluctuate as follows. First, the author calculated C_{ij} values using several subclasses, then the author deleted one subclass and recalculated to see the change in the C_{ij} values, and then repeated the calculation. The author found that the C_{ij} values could change by 30 to 40 percent, indicating C_{ij} values are subject to 30 to 40 percent error.

This magnitude of error is not so bad because all one needs to know is whether there is strong or weak relatedness or



none between a pair of subclasses. If the C_{ij} values have a significant magnitude, there is strong relatedness between the pair. In other words, the pair of subclasses are related or close to each other. If the two subclasses or the two areas are related, it can be implied that the two areas share a common knowledge base.[12]

In practice, the author calculated C_{ij} values by using a limited number of subclasses containing the patents filed by a firm and the subclasses containing the patent to be in-licensed. The patent data was taken from US patent applications between the years 1990 and 2005, the period that covers at least five years before licensing took place for the observations studied here.

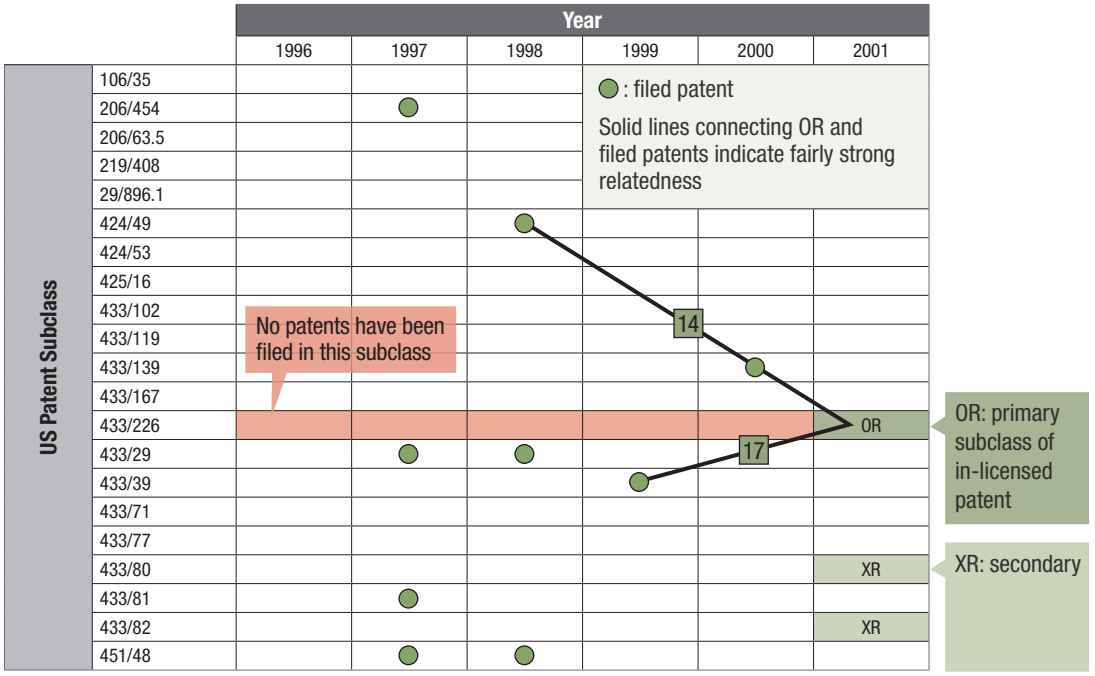
The United States Patent and Trademark Office (USPTO) assigns each patent only one original (OR) classification and a variable number of reference (XR) classifications. The OR classification is based on the claims in the patent. The XR classification is based on the description of the invention or other information.[13] Typically one can calculate relatedness between the OR of the licensed patent and the OR of patents held by licensee before the licensing.

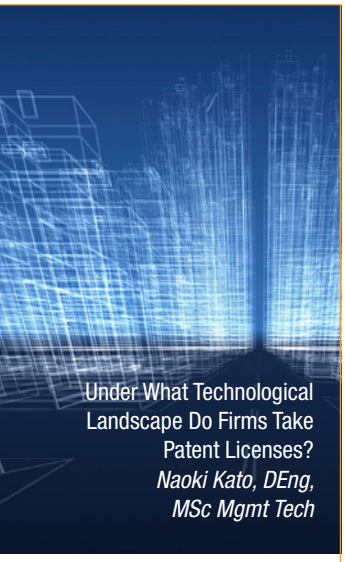
Data Set

The data discussed here are taken from "New Products and Technologies" section of the Association of University Technology Managers (AUTM) reports and other AUTM literature.[14] Cases were selected where all of the following conditions were met: (1) patents are main motives in technology transfer, (2) the literature specifies or one can at least infer the patent(s), (3) the licensee is a corporation existing prior to the licensing, (4) the literature specifies the year the licensing took place, and (5) the licensee filed at least one patent before the year of licensing.

This selection process resulted in a data set of existing corporations (not ventures or spinoffs based on the patent) taking a patent license from a university/research institution/hospital that one can trace patents before the year of licensing. This results in a data set comprised of twenty-one licensed patents or nineteen corporations. While the quantity of the

Figure 1: An Example Illustrating Technological Landscape-Filed Patents in the Year of Application and in US Patent Subclass





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data set is too small for statistically conclusive results, one can certainly still obtain good insight into the behavior of technology transfer.

Findings

First, Figure 1 illustrates, as an example, a view of technological landscape in terms of the United States Patent Classification System at the subclass level where a firm accepted a patent license.

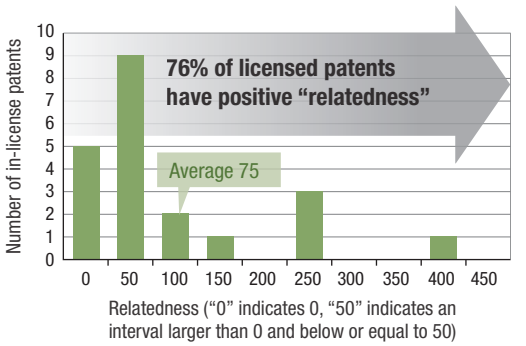
This sample landscape shows that no patents have been filed in the same subclass as that of the licensed patent prior to the year the patent was licensed. The figure also demonstrates that the firm filed some patents that have been filed in subclasses other than the subclass of the licensed patent. The subclass of the licensed patent 433/226 and subclasses of firm's past-year filings 424/49 and 433/39 have been found related with magnitude of relatedness of 14 and 17 each (values are normalized to 100 instead of one for ease of view).

To confirm this finding, the author extended this analysis to the whole dataset of licensing. Out of nineteen firms, only one firm (5 percent of the sample) has filed patents in the same subclass of the licensing patents. The other 95 percent of firms have not filed any patents in the same subclass as that of the licensed patent. From the review of the whole dataset, it can be concluded that firms do not take a patent license whose technological field matches the fields they developed on their own.

Turning to the relatedness index, the magnitude of relatedness summed over a plural number of patents filed by licensing firms is shown in Figure 2. Although some firms show 0 relatedness, 76 percent of licensed patents have positive relatedness with patents filed by licensing firms. The average of relatedness was 75 with a standard deviation of 110. The distribution is broad and skewed with a tail toward the positive side. With this average and deviation values, one cannot conclude that the relatedness is statistically conclusive, but can conclude that it is very probable that the relatedness has a positive value.

In other words, firms may take patent licenses to fill in a gap (meaning the firm has filed no patent in such subclass) in technological landscape. Some fields (subclasses) in which firms have previously filed patents have a high magnitude of relatedness with that of the in-licensed patent.

Figure 2: Distribution of "Magnitude of Relatedness" (Here Normalized to 100 for East of View) Between the Licensed Patent and Patents Held by a Corporation

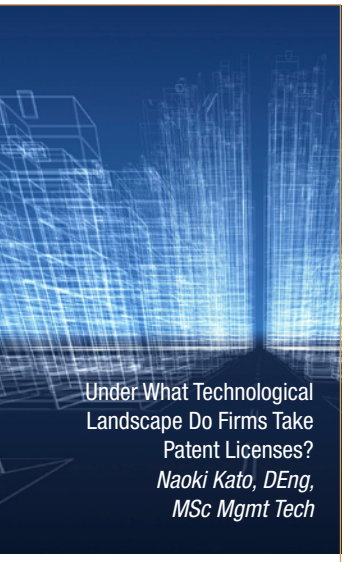


Discussion

One can say if a firm is active in some technological fields, it might be interested in acquiring the technology of the same kind to strengthen its capability, fill in technological gap, or avoid patent infringement.

However, the findings in this article actually contradict the above assumption because the licensing was successful if the field (subclass) of the incoming patent does not match those subclasses firms have developed. If one reviews Figure 1, no filed patents exist in the subclass 433/226 (which is equal to the subclass of the licensed patent). On the other hand, if one reviews the broader class level 433 (i.e., first three digits) it is clear that the licensee accepted the patent in the same class where the licensee is actively filing patents.

Therefore, the findings in this article hold for technological field of the subclass of the patent classification, but do not hold if one considers the class level, which



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The implication of the findings is that there appears to be a peculiar pattern in successful technology transfers involving patents.

is broader in the hierarchy of the patent classification system. It looks as if the subclass level is just appropriate for the findings to hold true. But it is still unclear why the subclass is appropriate, so it should be left to further study.

One can interpret these findings by way of firm's developmental capability and a need to acquire technology exogenously. Firms do not need to license technology in the same subclass because they have already obtained knowledge in that subclass by doing the developmental work and are, therefore, already able to develop similar but legally different technology by themselves if they want to.

On the other hand, firms do not have capability to develop on their own in the subclass in which they have not yet done developmental work. Therefore, it is possible that firms may choose to take technology from outside to fill in the gap to market a product, employ a process, etc.

The implication of the findings is that there appears to be a peculiar pattern in successful technology transfers involving patents. A licensee tends to in-license those patents that are not classified in the same subclass of the United States Patent Classification System but classified in different but related subclasses. One can therefore draw a criterion that one can use to know if a particular firm is likely to take a patent license or not. This conclusion provides a useful tool for technology licensing community such as university technology offices and commercial corporations involved in technology licensing business.

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Notes

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[14]See *AUTM Licensing Survey*, FY1999-2004 (Northbrook, IL: AUTM). See also *Technology Transfer Stories: 25 Innovations that Changed the World* (AUTM, 2006), *Technology Transfer Works: 100 Cases from Research to Realization* (AUTM, 2006), *Building a Stronger Economy: Profiles of 25 Companies Rooted in Academic Research* (AUTM, 2007), and *Technology Transfer Works: 100 Cases From Research to Real-World Application* (AUTM, 2007).

University–Industry Relationships: Potential Risks

Jon Sandelin

Abstract

University–industry relationships can bring significant benefits to the university, the company, and the individual researcher, but there is also the potential for risks to all parties. This paper presents the potential rewards and risks from university–industry relationships and the related opportunities for economic growth and job creation. It describes how conflict of interest and conflict of commitment (COIC) can have potential adverse effects for society, research institutions, and the individual researchers. It provides information on managing COIC in a way to avoid risks and gives examples of COIC situations and how they might be dealt with. It provides references to policies and procedures for dealing with COIC that may be helpful in creating or upgrading COIC policies and procedures.

Introduction

This paper reviews the potential risks from university–industry relationships from the university perspective. Some examples of conflict situations are presented and guidelines offered. The examples present issues that require careful thought and discussion when defining policies and procedures. They also portray situations that may arise and describe how they might be addressed. The guidelines could be applicable to any public research organization that is protecting the intellectual property rights related to research results of its employees for potential commercialization. This can include government research laboratories and nonprofit research institutes. Risks are viewed both for the university and its constituents and for the larger society in which it exists and to which it contributes.

Books by Derek Bok[1] and Jennifer Washburn[2] and articles in journals by people such as Arti Rai and Rebecca Eisenberg[3] and Sheldon Krimsky[4] have identified the actual and potential problems that may arise from university–industry relationships. Yet much good benefiting all parties (universities, industry, and the general public) can and does result from such relationships. Governments worldwide are encouraging and promoting such relationships in recognition of their importance

University–Industry Relationships: Potential Risks
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for economic growth and development in the knowledge economies and to improve standards of living through enhanced food production and health care. In the context that imitation is the sincerest form of flattery, the features in U.S. Public Law 96-517 (known widely as the Bayh-Dole Act) are being enacted into law in countries in Asia, Europe, and elsewhere.

Thus the need for policies, procedures, and practices to identify potential conflict problems from such relationships very early and provide a process to modify or correct such situations so they do not bring harm to the individuals involved, their institutions, or to the advancement of science for public benefit.

The Potential Rewards

In the context of risk-reward analysis, it's important to recognize the potential rewards when balancing against potential risks. Such rewards include the opportunity:

- For the efficient conversion of research results and discoveries into goods and services to stimulate economic development and growth, create jobs, and improve the standard of living
- To demonstrate that investment of public funds into research support at universities produces tangible benefits for society
- For the university to acquire income from license royalties or the sale of equity from licenses to startup companies to support teaching and research activities
- For employees of universities (such as university professors) to supplement income through a share of royalty income from the licensing of their inventions, paid consulting work for licensees, or compensation for serving on advisory boards of licensees
- For private sector licensees to fund research projects in the laboratory of the inventor, when such research funding conforms to the policies of the university
- For private sector licensees to provide gifts and donations (with related tax benefits) to the university
- For private sector licensees to hire students (frequently, but not always student contributors to licensed inventions) when they graduate

Summary of Risks

Offsetting potential rewards are potential risks, which include the risk:

- That patenting and licensing by universities may inhibit rather than promote the progress of science and production of innovation
- Of a loss of public trust in the university and/or its employees
- Of unfulfilled commitments to research sponsors, students, or the university
- Of bias when reporting research results or not reporting research findings that would be adverse to the interests of an industry patron
- Of exploiting the work of students to benefit personal interests of their supervising professor
- Of adverse and embarrassing reports in the media, whether actual or perceived, that affect the reputation of the university
- That new discoveries made by university employees are not reported to the university or to a federal funding agency as invention disclosures, but are instead diverted to a company in which the employee has a financial interest

Thus the need for policies, procedures, and practices to identify potential conflict problems from such relationships very early and provide a process to modify or correct such situations so they do not bring harm to the individuals involved, their institutions, or to the advancement of science for public benefit.

Opportunities: Economic Growth and Job Creation

Most attention on the impact of university licensing on economic growth and job creation has centered on licensed products sold. And indeed, that impact has been significant. Since 1991, the *AUTM Licensing Survey*™[5] has documented the growth

University–Industry Relationships: Potential Risks
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in a number of areas for U.S. and Canadian universities and teaching hospitals.

There were a number of other surveys done prior to 1991. Ashley Stevens, director of the Office of Technology Transfer at Boston University, has collected many of these and compiled the information in an article published in *les Nouvelles* in 2003.[6] He reports that, over the time period 1979 through 2002, royalty income has grown at an average compound growth rate of 26.8 percent per year.

Another source of economic growth and job creation is the preproduction investment by companies in bringing licensed products to market. A study was published in 1995[7] based on MIT data, and reaffirmed in 1997[8] based on University of Pennsylvania data, that, on average, about $1 million is invested in preproduction each year per exclusive license granted. In 1995, it is estimated that for all US universities, exclusive licenses produced $4.6 billion in preproduction investment and 27,000 new jobs.

Universities vs. For-Profit Industry

Clearly, there are significant differences in the mission and operation of a university and for-profit industries. The primary role of a university is education of students and creation and dissemination of new knowledge. The primary role of industry is to increase shareholder value through successful competition in the local, national, or global marketplace.

University presidents and senior administration are entrusted with maintaining and enhancing the reputation and goodwill in the university's name and trademarks. This is critical in recruiting the faculty and graduate students necessary in building and maintaining a strong university.

Academic research should be curiosity-driven basic research extending the boundaries of knowledge. Faculty set research directions and priorities, and freedom to publish and discuss research results freely with others are fundamental. Work in industry laboratories is normally guided, monitored, and directed by company management, with results held confidential and the objective of creating products and profits for the company. It is, therefore, not surprising when these two very different cultures seek to collaborate, compromises are needed.

Industry has found that building allegiance and dedication of key people can be facilitated by financial participation in successful outcomes. Thus, profit sharing or issuance of stock options is used to create allegiance and motivate people toward high performance.

Universities cannot provide such financial participation, but industry (and especially newly formed companies) can offer such inducements to university faculty, creating potential problems of conflict of interest and conflict of commitment to university responsibilities.

University presidents and senior administration are entrusted with maintaining and enhancing the reputation and goodwill in the university's name and trademarks. This is critical in recruiting the faculty and graduate students necessary in building and maintaining a strong university. Thus, any potential situation that threatens the institution's integrity and reputation is treated very seriously. And, thus, policies and operating guidelines that provide education of faculty as to what is permissible and what is not, coupled with early warning systems that ensure prompt detection of potentially serious conflict situations, are carefully considered and crafted.

The *Webster's II Dictionary*[9] defines conflict of interest as: "A conflict between the private interests and the official responsibilities of a person in a position of trust." The National Institutes of Health (NIH) provides a somewhat different definition as follows: "A conflict of interest exists when the designated official(s) reasonably determine that a significant financial inter-

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est could directly and significantly affect the design, conduct, or reporting of government-funded research."[10]

Conflict of interest is associated with financial issues. Conflict of commitment is associated with time-management issues. This document refers to them collectively as COIC.

Conflict of Interest and Commitment: Societal Impact

Innovation is the lifeblood of economic progress. The rapid and efficient dissemination of new knowledge from public research organizations (such as universities) creates the knowledge commons upon which further new knowledge is built. Actions that inhibit or restrict such flow of knowledge would be of serious societal concern.

Likewise, the sharing of research materials and tool-sets that permit more rapid advancement of knowledge is important to the efficient production of new knowledge. Actions that inhibit or restrict the free sharing of such materials or tools would be of serious concern. As university researchers build ties to industry that provide the opportunity for financial gain from product success, the opportunity to influence the availability or the content of research results related to such products becomes a concern. There is also the opportunity to withhold research materials and/or research tools that might aid development of a competitive product.

There are also some who believe a focus on commercial gain from university discovery, especially in the biomedical area, is causing the patenting (and potential exclusive licensing) of very early-stage inventions. As asserted by Rai and Eisenberg,[11] "The tradition of open science has eroded considerably over the past quarter century as proprietary claims have reached further upstream from end products to cover fundamental discoveries that provide the knowledge base for future product development." They suggest universities are filing for patents on discoveries that should instead be placed in the knowledge commons, and that the NIH should review invention disclosures linked to NIH funding to identify those where patent applications are not appropriate.

Donald Kennedy, former president of Stanford University, shares a similar concern with regard to "the precious storehouse of public germplasm—seed banks, landraces—developed by nations and by the international research centers."[12] He worries that public firms can patent genetic discoveries based on this knowledge base and disrupt widespread crop development to feed the developing world.

Derek Bok, former president of Harvard University, in his book, *Universities in the Marketplace,*[13] expresses his concerns as follows: "Universities have paid a price for industry support through excessive secrecy, periodic exposes of financial conflict, and corporate efforts to manipulate or suppress research results" and "in the face of pressure from corporate sponsors to influence the results of high-stakes clinical research, institutional safeguards have proved inadequate in a disturbing number of cases. Most universities have not done all they should to protect the integrity of their research. Many have not even shown that they are seriously concerned about doing so."

Bok also references a study done be Deborrah A. Barnes and Lisa A. Bero that found 94 percent of authors of studies done on the effects of passive smoke on human health with ties to the tobacco industry reported no harmful effects. Of those authors doing similar studies, but without ties to the tobacco industry, only 13 percent reached the same conclusion.

Sheldon Krimsky, a policy analyst at Tufts University School of Medicine, is highly critical of the growing intimate relationships between university researchers and the pharmaceutical industry,[14] He claims it is common for university attendees at scientific conferences to receive

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gifts, travel reimbursement, payment of fees, and evening entertainment from corporate sponsors. He also claims about a quarter of scientists working in medical research have some sort of financial relationship with industry.

The chapter, "Are Conflicts of Interest Hazardous to Our Health," in Jennifer Washburn's book[15] provides a number of examples of problems in research studies by people with direct linkages to the pharmaceutical industry. However, her assertion that "not infrequently, the university scientists who shill for the drug companies most aggressively are also the biggest-name professors in their fields, a fact suggesting that academic medicine is becoming tainted to its core" seems somewhat exaggerated. But it is true that this is an area of acute concern within many universities leading to dedicated people and policies overseeing potential conflict situations in the medical area, and especially with clinical studies.

Such concerns have led the Stanford University Medical School to join a number of other medical schools in banning the acceptance of any form of gift by faculty or staff from a for-profit organization.

Conflict of Interest and Commitment: Institutional Concerns

Conflict of interest and commitment can occur at both the institutional and individual level. Institutional conflicts may occur when developing research agreements with industry, when developing licensing agreements with industry (especially when equity is taken), and in gifting arrangements with industry. The company providing a contribution to the university (normally money, but could be other things such as equipment) may seek to influence the design, conduct, or reporting of research in ways that are beneficial to the company, or the researcher may be tempted to alter research activities in a way that might attract contributions from industry. Companies may seek to have delays in publication of research results, or the right to approve the content in publications, or even the right to edit information so only the company has access to it.

With regard to licensing, the institution may provide the first opportunity to license important inventions to selected individuals or companies (referred to as *pipelining*) or may give very favorable licensing terms to selected individuals or companies.

There is also the issue of use of the institutions name and goodwill for the benefit of the business or access and use of university facilities for company benefit. These potential conflicts would be even more troubling if any of the officers of the institution have a financial interest or connection to the company or if the institution holds a significant equity position in the company. And the institution must be especially diligent about conflicts when human subjects are involved in the research program.

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There is also the danger that an employee of the university may not disclose new discoveries to the university through the filing of invention disclosures, but instead diverts the invention to a company in which the employee has a financial interest. As most research work is funded by outside entities (e.g., the federal government), there is an institutional obligation to notify the sponsor of the research of such inventions and honor contractual

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obligations concerning intellectual property rights. If such situations arise, it can be difficult and costly if legal action is required to regain such rights.

This was the case with *Fenn v. Yale University*.[16] In this case, it is alleged that John Fenn, PhD, a Nobel laureate chemist, did not disclose an invention he made under funding from the NIH when on the faculty of Yale University. He did file for a patent in his own name, financed by a company he had founded. He then exclusively licensed his patent to the company and received royalty payments. When Yale learned of the patent and the license, it demanded Fenn assign the patent to the university. When Fenn refused and sued Yale for interfering with his company's commercialization of "his" invention, Yale countersued. The court found in favor of Yale on its breach of contract, breach of fiduciary duty (to file an invention disclosure with the university), and fraud claims.

Another potential source of legal problems are the agreements to protect proprietary information or materials that university researchers enter into when receiving such proprietary items from companies with which they have a relationship. Universities are open environments, and university researchers like to show or tell people about their work. If they do not properly protect such proprietary items, it could lead to embarrassment, or worse, legal action against the individual and the university.

Conflict of Interest and Commitment: Individual Concerns

With regard to individual COIC, faculty members have considerable leeway in structuring their research programs and in the allocation of their time. They also have considerable influence over the graduate students they supervise and, in most instances, to whom they provide financial support. Faculty members also have control over when and how research results are reported.

If suitably motivated, a faculty member can take actions in the design, conduct, or reporting of research that would be highly beneficial to a company and perhaps not in the best interests of the university or his or her graduate students. Such actions include: (1) directing graduate students to work on solving problems of a company, (2) deviating from basic to more applied research that is of value to a company, (3) provide access to and use of university facilities for the benefit of a company, and (4) editing or altering data in a way that benefits a company when publishing research results. A faculty member may also become so committed to tasks for a company that there is not sufficient remaining time to fulfill university responsibilities.

Managing Conflicts of Interest and Commitment

Stanford University is one example of a university that has given significant attention to creating policies and guidelines related to conflict of interest and commitment. Separate policies exist for faculty, staff, and students. The policies can be found at the Stanford Web site.[17]

Underlying Stanford's approach is the recognition that, for effective management of potential and actual conflicts, you must have an early warning system that demands full disclosure. Potential conflict situations must be identified at or near the time of inception, so that review and adjustments (if needed) can be taken before the situation advances to a stage that can bring harm to the individual, the institution, or both. Stanford requires an annual conflict review for all faculty and those staff in positions where conflict might arise. This review requires the identification of all outside activities that could produce conflict situations. In addition, the policies identify ad hoc situations that would require a one-time conflict review tied to that unique situation.

An example of an ad hoc situation is

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when a university employee, such as a professor, will be involved with a startup company that is seeking a license from the university. An ad hoc conflict review must be completed and approval given before the license will be granted. As part of an ad hoc conflict review related to the licensing of a startup company, the Technology Licensing Office must supply information about the proposed license arrangement, including the assurance that the startup is the best alternative for developing and marketing the licensed invention.

Stanford policy is that a faculty member can only provide consulting services and serve on an advisory board, within the permitted consulting hours allowed, if he or she is to remain with the university. If his or her involvement is any greater, he or she must take a leave of absence or resign from his or her position.

Situations that involve human subjects in research programs are especially sensitive. The results from human clinical studies can have enormous impact on the profits and stock price for the companies conducting such trials. Thus, universities that conduct such clinical trials must be especially vigilant to ensure no conflict issues can arise. Stanford University has a policy of not holding any shares of stock in companies that have commissioned clinical studies at its medical school. If Stanford should have any shares of stock, they will be sold before the clinical studies can start.

The policies at the Howard Hughes Medical Institute (HHMI) as reported by Cech and Leonard[18] are more stringent than most U.S. universities. Its scientists cannot hold more than 5 percent equity interest in a company that is a consulting client or equity received for services to a startup company. Scientists cannot be consultants to a company that has a collaboration arrangement with HHMI. And HHMI requires that every agreement with a commercial entity, including consulting agreements, must be reviewed and approved before being signed. It is the review of consulting agreements by the institution that differs from the practices of most U.S. universities.

Harvard Medical School in 2004 revised its polices on conflict to permit Harvard faculty to own up to $30,000 in stock from public companies that benefit from their research.[19] They cannot have any stock from companies with which they have ongoing research collaborations or in private companies related to their research. They can, however, receive up to $20,000 in consulting fees from companies tied to their research. Faculty also cannot hold management positions with firms, such as chief scientific officer or chief medical officer.

In August of 2005, the NIH announced final ethics rules for its more than 18,000 employees conducting research at twenty-seven institutes and centers.[20] The NIH is the primary federal agency for conducting and supporting basic, clinical, and translational medical research in the U.S. Its 2005 budget was more than $27 billion, with more than 80 percent (or more than $22 billion) distributed as research grants to universities and other research organizations. It is the largest source of research funding for U.S. universities and, thus, what actions it takes are followed closely.

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The announced NIH ethics rules included:

1. A basic prohibition on outside consulting by NIH staff with substantially affected organizations, such as pharmaceutical, biotechnology, or medical device manufacturing companies, health-care providers or insurers, and supported research organizations.
2. All senior NIH employees (and all others in a potential conflict situation) must divest all holdings in substantially

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affected organizations in excess of $15,000 per company.
3. Any monetary awards from outside organizations must be prescreened and approved in advance.
4. Any outside activities such as service with professional or scientific organizations, service on boards, teaching courses at universities, writing textbooks, providing lectures, or performing journal reviews require prior approval.

Conflict Examples

EXAMPLE 1

The following example is from the first of a series of symposia held at Stanford University in 1982 on the topic "Universities, Industries, and Graduate Education," as reported by Lee Randolph Bean in the *Hastings Center Report*.[21] Stanford's then president, Donald Kennedy, presented this example to illustrate the problems that arise as faculty members move from the role of teacher/investigator to that of entrepreneur.

> Prof. X and his graduate students work on a basic molecular biology project. Prof. X also is a consultant and shareholder in Clotech Inc., which has built a scaled-up facility for producing and testing a useful protein that is the primary gene product from a plasmid Prof. X first got from bacteria cells. Stanford, which has an assignment to the patent on the product, is now considering offers to invest in Clotech and also plans to offer an exclusive license to Clotech for a related process on which Stanford holds patent rights. Meanwhile, Mr. Y, a graduate student good at purifying the protein, has complained to the university ombudsman that Prof. X is using every means at his disposal to induce him to undertake outside employment with Clotech.

The issues Kennedy wished to bring forward for discussion at the symposia were:

- *Conflict of interest:* Is Prof. X devoting undue time and effort to Clotech because of his profitable consulting and equity arrangements to the neglect of his teaching responsibilities? Do his outside ties create competing loyalties between Stanford and Clotech?
- *Secrecy:* Has Prof. X kept past research results to himself, because his colleague, Prof. Z, works for a competitor company? Did Clotech ask that he delay publication of his work in order to secure an exclusive license from Stanford? (*Author's comment:* Should Stanford have marketed the license to the patent(s) to others to determine if another party, perhaps better qualified, would develop licensed products? Or should Stanford seriously consider offering nonexclusive licenses to all interested parties?)
- *Patents:* Should scientific knowledge be owned and traded for profit? Should the university share in that ownership?
- *Research priorities:* Does Prof. X's involvement in a commercial production facility indicate a shift in his focus from basic to applied research? Will the future direction of scientific research be skewed to respond to the needs of private industry?
- *Graduate students:* Have Mr. Y's time and talents been exploited for the gain of his adviser's company?
- *Public perception:* Will extensive ties to the private sector erode public confidence in the detachment and trustworthiness of university research?
- *Scientific norms:* The open and free sharing of information and a disinterested approach to research that puts the advancement of science first are norms that have traditionally governed science, according to sociologist Robert Merton.[22] Are those norms disintegrating as the pull for commercial application of research and consequent profits intensifies?

Example 2

To take Bean's example further, let's now say that Clotech has expanded and up-

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graded the scale-up facility to the point that it will now permit Mr. Y to run experiments in pursuit of his doctorate qualifying research work that he cannot do with the facilities in Prof. X's lab. Mr. Y's research is fully funded under a U.S. government grant. Clotech is willing to make its facilities available for the research project of Mr. Y, as such work will be very relevant to its product plans. Clotech has requested a right to help guide the research work of Mr. Y and also requested a document signed by the university stating that any intellectual property created by Mr. Y resulting from the use of its facilities will be owned by Clotech.

Prof. X is encouraging Mr. Y to utilize Clotech's facilities in his research and is urging the university to accept the requests of Clotech. Clotech has also indicated that it would be willing to hire Mr. Y as a paid consultant as long as he follows the guidance of Clotech in his research and that any intellectual property created from the research would be owned by Clotech. Prof. X is supportive of Mr. Y being a paid consultant for Clotech under these terms.

Ms. EF in the Office of the Dean of Research has been asked to review the situation and inform Prof. X and Clotech what the university's policies will allow in this case. After a careful review, including discussions with Prof. X and Mr. Y, her response is as follows:

1. Any intellectual property created by Mr. Y that is related to his research program for his doctoral degree, as specified under the work statement in the government grant funding, will be owned by the university. This is regardless of where and with what facilities Mr. Y conducts such research.
2. Mr. Y cannot be a paid consultant for research work that is also funded by the government.
3. A designated professor in the department of Prof. X will become a coadviser for Mr. Y and will be charged with ensuring the research work of Mr. Y is in full compliance with progress toward his doctoral degree.
4. A collaboration agreement will be negotiated between the university and Clotech that will spell out clearly the terms of the proposed collaboration, including university ownership of intellectual property created by Mr. Y and the right of Mr. Y to freely publish at any time the results of his research.
5. A meeting will be held with Prof. X and the dean of research to discuss the situation and ensure Prof. X understands that the university would not allow, under any circumstances, an outside company to direct the research of a graduate student and that ownership of any intellectual property created by a graduate student as part of his funded research work will be owned by the university.

Example 3

In another, unrelated example, based on Stanford's experience, Prof. AB in the university's Ophthalmology Department, a renowned eye surgeon, disclosed an invention four years ago to the technology licensing office. This invention holds great promise for eye surgery. A patent assigned to the university has issued. It is exclusively licensed to the startup company EyeCare Inc., to which Prof. AB is both a consultant and the chair of the Scientific Advisory Board. Prof. AB has been given 100,000 shares of the company stock for his services. The university received 200,000 shares of stock as partial compensation for the exclusive license. In addition, EyeCare has sponsored research in Prof. AB's lab for the past three years (ever since the company was formed). When EyeCare first proposed supporting the research of Prof. AB, the university established an oversight panel to review research proposals and results, the involvement of graduate students with the company, and advise Prof. AB of potential conflict situations.

Because of this sponsorship, EyeCare

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has exercised its right to exclusively license three improvement patents resulting from the research. A separate conflict review was required before the exclusive license could be granted. The university licensing office also submitted a report on its marketing the invention to other parties and a statement that EyeCare is the best alternative for commercialization of the invention in a timely manner. This conflict review very carefully evaluated how the relationship with EyeCare might impact the graduate students conducting research in Prof. AB's lab, as the potential for altering the work of students to benefit the company was a major concern.

The invention licensed to EyeCare has now reached the stage where clinical studies, with human subjects, will be required to obtain the government approval to sell the medical device in the U.S. The lab of Prof. AB is clearly the best source for coordinating such trials, with Prof. AB and his colleagues performing the procedures.

However the relationship of Prof. AB with EyeCare, where he could profit handsomely if the clinical trials are successful, is a cause of great concern. The university must, therefore, carefully review the situation to determine if it will conduct the trials or not and, if it will permit conducting the trials, with what level of oversight and controls.

The university, following a review, decides to conduct the trials with the following oversight conditions:

1. Prof. AB must sell all his shares in EyeCare and agree not to acquire any shares in the future, including options to acquire shares.
2. The university will sell all its shares in EyeCare and agree not to acquire any shares in the future, including options to acquire shares.
3. Prof. AB will participate in the clinical trials, but will not be the principal investigator for the trials.
4. An oversight committee will be formed that will review the results from the trials and any publications related to the trials. The committee will include Prof. CD, a respected eye surgeon from another university medical center.
5. Prof. AB will fully disclose his relationship with EyeCare in any publications or presentations related to any research connected to EyeCare.
6. Prof. AB's relationship to EyeCare must be fully disclosed and explained on the informed consent agreement signed by every human subject participating in the trials.

Developing Policies for Conflict of Interest and Conflict of Commitment and for Technology Transfer through Licensing and New Business Formation

The conflict policies created at Stanford University over the past several years governing conflict situations can be found at the Web site.[23] There are separate policies for faculty members, staff members, and students.

The Association of University Technology Managers' Web site and its *Technology Transfer Practice Manual™* also have sample technology transfer and conflict of interest policies.[24]

Still other good sources of information when constructing conflict of interest[25] and other policies[26] are given in the notes.

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Notes

[1]Derek Bok, *Universities in the Marketplace: The Commercialization of Higher Education* (Princeton, NJ: Princeton University Press, 2003).

[2]Jennifer Washburn, *University Inc.: The Corporate Corruption of Higher Education* (New York: Basic Books, 2005).

[3]Arti K. Rai and Rebecca S. Eisenberg, "Bayh-Dole Reform and the Progress of Biomedicine," *American Scientist* 91 (2003): 52–59.

[4]Sheldon Krimsky, *Science in the Private Interest: Has the Lure of Profits Corrupted Biomedical Research*? (Lanham, MD: Rowman and Littlefield, 2003).

[5]The *AUTM Licensing Survey* can be found on the AUTM Web site at www.autm.net/AM/Template.cfm?Section=Licensing_Surveys_AUTM&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=6&ContentID=2409.

[6]Ashley J. Stevens, "20 Years of Academic Licensing: Royalty Income and Economic Impact," *les Nouvelles* 38 (2003): 133–140.

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[7]Lori Pressman, Sonia K. Guterman, Irene Abrams, David E. Geist, and Lita Nelsen. "Pre-Production Investment and Jobs Induced by MIT Exclusive Patent Licenses: A Preliminary Model to Measure the Economic Impact of University Licensing," *Journal of the Association of University Technology Managers* 7 (1995): 49–82.

[8]Peter B. Kramer, Sandy I. Scheibe, Donyale Y. Reavis, and Louis P. Berneman, "Induced Investments and Jobs Produced by Exclusive Patent Licenses—a Confirmatory Study," *Journal of the Association of University Technology Managers* 9 (1997): 79–100.

[9]Riverside Webster's II Dictionary (New York: Houghton Mifflin), 149.

[10]National Institutes of Health, "Conflict of Interest Information and Resources," available at www.nih.gov/about/ethics_COI.htm.

[11]Rai and Eisenberg, "Bayh-Dole Reform and the Progress of Biomedicine," 52–59.

[12]Donald Kennedy, "A Second Postwar Revolution for Biomedicine: Enclosing the Knowledge Commons" (invited Shannon lecture, Stanford University, April 1982).

[13]Bok, *Universities in the Marketplace*, 77.

[14]Krimsky, *Science in the Private Interest,* 52.

[15]Washburn, *University Inc.,* 103–136.

[16]*Fenn v. Yale University*, WL 22160423 (D Conn. 2003).

[17]The URL for the Stanford Web site is www.stanford.edu/dept/DoR/ad_hoc.html.

[18]Thomas R. Cech and Joan S. Leonard, "Conflicts of Interest—Moving Beyond Disclosure," *Science* 291 (2001): 989.

[19]Raja Mishra, "Harvard Medical Amends Policies: Rules for Faculty on Conflicts May Become a Model," *Boston Globe*, May 29, 2004.

[20]National Institutes of Health, "NIH Announces Final Ethics Rules," press release, August 25, 2005, available at www.nih.gov/icd/od/.

[21]Lee Randolph Bean, "Entrepreneurial Science and the University," *The Hastings Center Report*, October 1982, 5–6.

[22]Robert Merton, "The Normative Structure of Science," in *The Sociology of Science* (University of Chicago Press, 1973).

[23]The Stanford Web site can be found at www.stanford.edu/dept/DoR/ad_hoc.html.

[24]AUTM lists some sample policies and agreements on its Web site at www.autm.net/AM/Template.cfm?Section=Technology_Transfer_Resources&Template=/CM/ContentDisplay.cfm&ContentID=2339. The *AUTM TTP Manual™* can be found at http://www.autm.net/AM/Template.cfm?Section=Volume_2_TOC.

[25]See Association of American Universities, *Report on Individual and Institutional Financial Conflict of Interest,* October 2001, available at www.aau.edu/research/COI.01.pdf. See also Council on Governmental Relations, *Approaches to Developing an Institutional Conflict of Interest Policy,* 2004, available at www.cogr.edu and Organization for Economic Co-operation and Development, *Recommendation of the Council on Guidelines for Managing Conflict of Interest in the Public Service*, June 2003.

[26]See Council on Governmental Relations, *A Tutorial on Technology Transfer in U.S. Colleges and Universities,* September 2000, available at www.cogr.edu; Jon Sandelin, "Successful Licensing of Research Results," *les Nouvelles* 28 (1993): 127–129; and Jon Sandelin, *An Operations Manual for a Technology Transfer Organization* (Technology Innovation Group), available at www.techingroup.com.