Ten Things Heads of Institutions Should Know about Setting Up a Technology Transfer Office

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ABSTRACT

Technology transfer is a rewarding process for the university, researchers, students, the business community, the public, and the professionals who make it all happen. Technology transfer brings new products, services, and jobs. But it is a complex process, one that requires sustained dedication at every level. This chapter offers advice about some of the most important policy and strategy issues: five are economic issues and five relate to implementation. The chapter concludes with a discussion of technology transfer pitfalls caused by unrealistic expectations. The chapter emphasizes the role of senior management in changing the IP (intellectual property) culture, the need for transparent conflict-of-interest policies, and the importance of sufficient autonomy and infrastructure support for technology transfer officers.

1. INTRODUCTION

The widely touted success of technology transfer from U.S. universities has attracted interest from universities and research institutes around the world. Such diverse countries as Germany, the Republic of China, South Africa, the United Kingdom, and many others have changed their laws and policies, modeling them after U.S. practices, to allow universities and faculty members to manage and transfer intellectual property (IP). In the United States, smaller universities and research institutes are looking to imitate the successes of their larger counterparts. Such changes are motivated primarily by two economic interests:

1. enhancing economic development by transferring new technologies to local industries
2. obtaining financial support from industry to support university programs

The advice offered in this chapter aims to provide to heads of a research institutes and universities perspective on what challenges to expect when setting up a technology transfer office. These "Ten Things" are based on almost 20 years of experience in the Technology Licensing Office of the Massachusetts Institute of Technology. The ideas expressed in this chapter reflect also my long-time experiences with the Association of University Technology Managers (AUTM), including a stint as president, during which I watched many North American technology transfer programs grow. The ideas expressed here have been influenced by my experiences visiting with universities in almost 20 different countries and learning about their technology transfer activities.

2. THE LIST OF TEN

Many items in the list of ten may surprise you (Box 1). The economic five may sound discouraging even, but that is not the intention. It is to encourage a realistic time frame and the sustained investments in time and money are needed to reap the substantial societal and

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Box 1: Ten Things to Know about Setting up a Technology transfer Office

The economic five

1. **Technology transfer will not make your university rich.** A successful program will make a small profit but will not support the university. It will, however, provide many other benefits to the institution and the community.

2. **Building a robust technology transfer program takes sustained financial investment**. Investments are required to develop a patent portfolio, attract expert talent, and train office professionals.

3. **It will likely take eight to ten years before your program stops losing money—and it may never make your institution any substantial amount.** It takes time to build an IP portfolio, establish contacts, and develop skills in technology transfer. Following the set up, the TTO *may* begin to make money.

4. **It may take two decades or more before a university technology transfer program (including entrepreneurial spinouts) substantially affects the local economy**. Impact in regional economic development takes 20 to 30 years. Expecting substantial returns in a few years leads to underinvestment and disappointment.

5. **The ultimate impact may be very large—both economically and culturally—for the university, its graduates, and the community.**

The implementation five

6. **Sustained effort requires visible support—fiscal and otherwise—from senior administration**. Senior management must not only lead the way, but also sustain the effort to change the culture of research and investment.

7. **Only senior administration can set the mission, policies, and priorities for the program**. Clear mandates will help technology transfer professionals choose among competing priorities and the ever-present trade-offs between business and academic values. These policies will ultimately help to define the university. They need to be clearly stated, and supported from the top, so that technology transfer professionals can make the best decisions and withstand pressure from competing interests.

8. **Clear policies on IP ownership, the roles of researchers in interactions with industry, and other ground rules should be set up before the program begins.** Working out such policies in the middle of making deals leads to confusion and bureaucratic lethargy, slows down the learning process, and hurts a university's reputation for being able to consummate deals.

9. **Conflicts of interest, both real and perceived, are inevitable.** Clear policies and a well-understood review and appeal process need to be put in place early. Much can be learned from the experience of others in the technology transfer field. Again, support from senior administration is critical.

10. **Technology transfer is a talent-based business.** It is difficult to find people who can speak the two languages of academia and industry and who also have the creativity to craft agreements that meet the needs of both sides. One should not underestimate the combination and level of skills required. These skills and experiences are very different from those needed to conduct research.

economic benefits of a successful technology transfer program. A few TTOs have performed atypically and these provide exceptions to the principles described, especially with respect to the economic five. But these exceptions depend mostly on luck and planning—they cannot be counted on. The issues are discussed in more detail following the list.

The sections that follow discuss more fully the promise of technology transfer, the economic issues and expectations involved with technology transfer, and implementation matters.

2.1 *The promise of technology transfer*

There is little doubt about the ultimate potential of university technology transfer programs when it comes to accelerating the adoption of new technologies, enhancing entrepreneurship, creating new medicines and other products, creating jobs, and adding prosperity through economic development. The clustering of high technology and biotechnology companies around major universities has been well described, and AUTM and others have documented the creation of hundreds of thousands of jobs directly related to university licenses and startups.

Within universities, robust technology transfer programs also have many important benefits that are quite separate from royalty income (*royalty income* as used here includes royalties from licenses to university intellectual property and monetary return from equity holdings in spinout companies formed around university intellectual property). Among others, these include:

- productive interaction with the industrial community: ideas shuttling back and forth between the academy and the private sector, which often increases the quality of research
- increased industrial support of university research
- more willingness from central and local governments to support university research for economic development
- student exposure to the world of industry and to the commercial opportunities of research (including training in entrepreneurship), thus influencing their future career aspirations and ultimately impacting the country's economy
- financial support from grateful alumni and other entrepreneurs who have grown wealthy from companies started from university research

Such programs can have a major impact on the economy of the surrounding regions—and not only directly from entrepreneurial spinout companies from the university. The entrepreneurial ferment and capability resulting from university spinouts leads in turn to the formation of many other new companies. Larger companies also often move to the region to take advantage of relationships with entrepreneurial companies and the skilled employee base.

2.2 *Expectations in setting up a program*

Despite the promises of successful technology transfer programs, when communities and their universities try to start new technology transfer programs or to accelerate existing ones, the road is rocky. Unrealistic expectations are a major cause of failure and frustration. Universities often expect their programs not only to bring in industrial sponsorship for research but to provide royalty income and entrepreneurial spinouts that will support the entire university.

Unfortunately, government expectations are often equally unrealistic. Some governments, for example, have expected royalty income from technology transfer to replace government support of their universities. Too often, local and national governments believe that just a few years of financial support for technology transfer—coupled with pressures on universities to produce measurable impacts—will almost instantly create thriving clusters of biotechnology,[1] software, or telecom companies akin to those in Boston, Silicon Valley, or San Diego.

A more realistic picture, however, is provided by almost a quarter century of technology transfer experience in the United States under the Bayh-Dole Act of 1979, which allowed universities to own patents from federally funded research.

2.2.1 *Licensing income*

Income from royalties and equity in spinouts is measured most easily. Data from the AUTM survey of U.S. universities (not including hospitals and research institutions for fiscal year 2002 shows that total gross royalties (including income from equity) for 158 universities was US$959 million. This from a research expenditure base of over US $32 billion during that year!

Thus, even before subtracting expenses for patenting and staff costs, technology licensing and spinout equity income averages **less than 3%** of the amount universities spend on research. And the income distribution is skewed: ten universities in the United States (6.3% of the total) account for almost 60% of the total royalty income for all U.S. universities.

The income distribution is skewed because a good fraction of the total U.S. university income from technology licensing is from a few blockbusters: single inventions that yield very high royalties (millions or tens of millions of dollars per year, often for over ten years, until the patent expires). These blockbusters are few and far between—there are no more than two or three ones each year in the United States.

It is therefore unwise to look to technology licensing and income from spinouts (royalties or equity) to support the university.

2.2.2. *Program profitability*

Building a program to break-even profitability takes time and money. Again, the North American experience is instructive. Studies have shown that it can take a technology transfer program eight to ten years or more to reach profitability, although most programs become profitable if the effort to build them is sustained.[2]

If measured only by royalty income, universities with smaller research bases have a more difficult time breaking-even. Less research means fewer inventions, lowering the statistical probability of a blockbuster invention. Fewer opportunities for licensing also mean that the technology transfer staff gains less experience and learns the craft more slowly. Small technology transfer programs, therefore, may have to be sustained financially for a long period of time, with the revenue shortfall justified by their nonroyalty contributions to the university and community.

Finally, it should be noted that new technology transfer programs are too often starved—both for money to file patents and for staff. A university frequently expects its program to somehow bootstrap itself into profitability and expansion. An "anorexic" program, however, climbs the learning curve—and reaches profitability—much more slowly and has a much lower impact on the university and the community along the way.

Thus, the university must have a well-thought-out, long-term financial plan for building its technology transfer office. The plan should be based on expected benefits—both financial and especially, nonfinancial—and on what the university can afford during the decade or so it takes to build a mature program.

2.2.3 *Regional economic development*

Governments most frequently support technology transfer in universities directly because they hope that entrepreneurial spinout companies will revivify the regional economy surrounding the university. This is not an unfounded hope—a number of regions have demonstrated the success of such programs over time. But it takes time: more than ten years for more than a few spinouts to be formed, and as long as 20 to 30 years before a substantial cluster of technologically-based companies forms—and this only when such development has been purposefully planned and robustly supported financially. (The Research Triangle region in North Carolina, U.S.A., is one such success—after about a quarter century!)

Thus, government programs that support technology transfer for four to five years and then expect the programs to be self-supporting and surrounded by a flourishing cluster of companies are unrealistic. It will not happen that fast. Building a regional economy based on entrepreneurialism is a slow, gradual process.

3. IMPLEMENTATION

3.1 *The role of the upper administration: culture change*

Founding a successful technology transfer program means changing a culture. Researchers must become aware of how useful and rewarding it is to identify potentially commercializable inventions from their research. They also need to see the benefits of cooperating with industry to transfer such technology. For most researchers this will be a new way of thinking, and some will feel that it threatens the very purpose of the university.

This change in culture must start from above. The upper administration needs to clearly delineate the purpose and potential benefits of a technology transfer program—not only to the individual and the university but to the community at large. The administration of the university can thus allay mistrust by making it clear that technology transfer will not be allowed to distort traditional academic principles: investigator-initiated fundamental research, uncensored publication, and open exchange of information within the university.

3.2 *Defining the mission*

The upper administration and the faculty must define the mission and priorities of the technology transfer office: Is it primarily to produce licensing income? Or industrial support of research? Is the mission primarily to get technology developed for the public? Or is it primarily to generate startups and regional economic development?

There are inevitably trade-offs among these potential primary missions. Unless priorities are explicitly set, the practices of the technology transfer office may well diverge in time from the best interests of the university. Surprisingly, even in the United States, with a quarter century of experience in university technology transfer, discussions about mission and priorities rarely are held between university management and the technology transfer office.

3.3 *Setting the ground rules: policies and practices*

The technology transfer office—and the researchers, companies, and investors that it deals with on a daily basis—must all know the ground rules before work can begin. The growth and learning process of the office will by stymied if each new invention or license-in-negotiation must be run through a committee. Accordingly, policy guidelines concerning such issues as IP ownership; the rights, duties, and obligations of the faculty in regard to technology transfer; sharing of revenue and equity with inventors; use of university facilities by companies; and related issues should be clearly defined as early as possible.

New offices will find that there are many guides available from experienced universities to help them write their ground rules—but only the administration and faculty of the university can decide which rules make the most sense for their particular institution.

3.4 *Conflicts of interest*

Technology transfer inevitably brings conflicts of interest.[3] The challenge is to manage them.

For the university itself, conflicts may exist between the goals of maximizing royalty income and promoting publication, between commitments to fostering spinout companies (for example, by allowing the use of university facilities, staff, or even students) and preserving university resources or between strong IP ownership policies or indirect cost rates and attempts to bring in more research support from industry. One big conflict of interest arises when university administrations are called upon to make exceptions to long-standing policies in order to bring in a big program; the exception itself may be only marginally harmful to the university, but the willingness to make an exception for enough money or for a very senior person can be a dangerous precedent.

For faculty members, conflicts of interest may involve time commitments (often called *conflict of commitment*). For example, conflicts may arise between time spent in university teaching and research and time spent with the spinout company. Faculty may also be tempted to withhold research data from university research efforts because of potential usefulness to the company for the data to remain secret—or because of harm to the company publishing might cause. Using students on

company projects presents another potential conflict of interest, as does company use of university equipment. A conflict of interest also arises when a researcher has to decide whether his or her new patent belongs to the university, to him- or herself, or to the spinout company.

Even a national government can find itself with a conflict of interest: Does it want to support *basic* research in its university, keeping its scientific community at a world-class level in the pursuit of new frontier technology for the coming decades, or should it shift its support to practical research that is more likely to quickly usher in new transfer technologies, new spinout companies, and regional economic development?

For universities and their faculty members, written policies that are well thought out and consistently applied can avoid many conflicts of interest. There are, inevitably, gray areas or appeals for exceptions that will intensify with time as the technology transfer program matures. The university needs to define a clear chain of command for ruling on most of these issues. Only rare exceptions should find their way to oversight committees; otherwise the process bogs down in the interminable wait for committees to be assembled and convened. Twenty years of experience suggests that exceptions to policy should be granted very, very rarely. It is difficult in a university to make an exception for one researcher without soon being called upon to make a similar exception for the next one—and policies soon erode and become meaningless.

3.5 *Talent*

Technology transfer officers need an unusual combination of qualifications:

- an understanding of state-of-the-art research (though not necessarily as a practitioner), often over a fairly broad range of technologies in a multidisciplinary university. (This usually requires a solid background in science or engineering.)
- an understanding of the language of industry (Officers must be familiar with markets, how technology is developed into products, accounting and finance principles, and decision-making processes.)
- at least a minimal understanding of venture capital, spinout formation, and smallcompany operation
- more than a passing familiarity with patent law
- an understanding and sympathy with how academia operates, academic principles, and the career development paths and aspirations of students and professors
- outstanding written and verbal communications skills in both formal and informal situations
- good negotiation skills—or the innate talent, intelligence, emotional control, and "people skills" needed to learn them
- ability to deal with multiple constituencies with conflicting objectives, most of whom one has no authority over
- ability to deal with highly ambiguous, confusing situations
- both the drive and creativity to solve complex multidimensional problems and arrive at win-win solutions
- drive to get the job done, or follow through
- very high personal integrity and the wisdom to avoid situations that get *close to the line* on ethics—no matter how profitable the situation may be to the university, a faculty member, or the licensor. A university's reputation is priceless. It must not be endangered by unethical behavior—or naiveté.

And finally:

- the willingness to work at a university salary because of the inherent satisfactions of the technology transfer job: great technology, complex and always-interesting issues, the satisfaction of seeing new companies form and new technologies reach the market, and, above all, the opportunity to contribute to the university, its students, and the community

People who embody all of these qualifications are indeed difficult to find, but one should not underestimate the need for a very high level

of talent. My experience in hiring and supervising technology transfer professionals have taught me that it is a talent-based business—some can do it and some cannot. Those who can will perform many times better than those who cannot. They will also build much better relationships with researchers and the business community over time, thereby enhancing the office's effectiveness.

In choosing staff, some formal qualifications in technology and business are a sine qua non. These qualifications, unlike personal characteristics, can be easily be checked on a résumé. Whether the technical background is at a bachelor's or Ph.D. level is relatively unimportant, provided that the person is very bright and can understand how research is done and how universities operate. Unfortunately, until the candidate has taken the job, it is difficult to determine whether an individual has the creativity, interpersonal skills, ability to deal with ambiguity, and drive to completion that the job requires.

Staff should be given sufficient clerical and infrastructure support and sufficient autonomy so that they can do their jobs well. Clearly written policies help define the limits of that autonomy. Good training coupled with oversight supervision—but not micromanagement—allows the talented professional to learn and grow on the job while bringing his or her talents to bear on the tasks at hand. Plus, he or she can make decisions and get deals done quickly, without waiting for multiple levels of approval at each point along the way.

They must also be given *adequate clerical support*. Clerical support seems trivial: it is not. Regrettably, technology transfer is not only a *talent-based business* but also a *paperwork-intensive business*. If good computer systems and clerical help are not available, your very talented technology transfer professionals will spend far too much of their time on clerical work—which is both wasteful and demoralizing. ■

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1 See, also in this *Handbook*, chapter 3.11 by PWB Phillips and CD Ryan, and chapter 3.12 by K Viljamaa.

2 Brandt KD, EJ Stevenson, JB Anderson, CL Ives, MJ Pratt and AJ Stevens. 2005. Do Most Academic Institutions Lose Money on Technology Transfer? Boston University. Poster Session, AUTM Annual Meeting, 2005.

3 See, also in this *Handbook*, the chapter 5.7 by A Bennett.