Campus Attitudes Change

Universities have intrastructure necessary to make technology transfer program work; students, school, faculty to benefit

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This article is based upon the authors' observations of technology transfer efforts of North American universities. While the article is written from this perspective, the authors' conclusions about the role of business faculty and students in the transfer of university technology may be appropriate for other countries as well.

Historically, many universities in the United States and Canada have ignored faculty inventions or have considered them to be an occasional byproduct of faculty technological research efforts.

However, in recent years members of the campus scientific community, and in some cases, university administrators, have begun to display an increasing interest in university technology.

This new interest represents a substantial opportunity for business schools. On many university campuses the scientific (technological) and business faculties live in different worlds with little communication between the two groups. Technology transfer, however, requires the application of the business sciences to the problem of commercializing the inventions of the scientific community. In addition to offering new opportunities for interdisciplinary learning experiences for both technical and business students, business schools have an opportunity, through participation in technology transfer, to perform an important service function as well as broaden their visibility among members of the university scientific community.

CORPORATE INTEREST IN UNIVERSITY TECHNOLOGY

In recent years, a number of factors have led to an erosion of the NIH (not invented here) mentality in the corporate sector. Perhaps chief-ranking among these factors has been skyrocketing development costs. Industry R&D expenditures for 1974 are estimated to be \$11.9-\$15.5 billion.[1] Assuming that R&D costs represent about 30 percent of the total cost of developing a new product,[2] the total 1974 industrial investment in new products was in the range of \$37.7-\$51.7 billion.

These and other factors have led to the development of a \$1 billion technology transfer industry. Many firms, anxious to recoup R&D costs, now are eager to license out unwanted technology and new products. Conversely, many firms, wishing to reduce new product development costs, have become more receptive to outside technology.

However, the demand for new technological innovations has, for the most part, outstripped the supply. As a result, industry interest in universities as a source of new technology has increased substantially.

UNIVERSITY ADMINISTRATION INTEREST IN TECHNOLOGICAL INNOVATION

This off-campus interest in University technology has coincided with an increased interest on-campus. As the glow of the golden age of academia in the sixties dims, the stark realities of the seventies have become more apparent. University administrators are now viewing university inventors as a potential source of revenues.

Universities employ approximately 15 percent of the scientists and engineers engaged in R&D activities in the United States[3] and account for about 16 percent of R&D expenditures.[4] They hold, however, only 2 percent of the patents.[5] This picture is likely to change somewhat. Declining student enrollments and increased competition for available grant monies, among other factors, have caused some administrators to be more open to nontraditional sources of funds.

In addition, a recent trend toward relevancy seems to have invaded academia. Some administrators now seriously question a system under which few universities have ever produced anything of commercial value even while maintaining multimillion-dollar technological research activities. There is a dearth of information on the subject of university technology transfer. There are, however, only a few universities (Wisconsin, Stanford and MIT, among others) that have received substantial revenues from licensing technology.[6] Some have had modest success while others have had occasional (and accidental) transfers of technology. However, for the most part, the inability of the academic community to transfer the output of its technological research has been (or ought to be) an embarrassment to university administrators.

Perhaps one of the most debilitating factors affecting the commercialization of university technology is the attitude of faculty toward inventions, patents and technology transfer. After conducting a study of

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faculty patent awareness, Research Corporation identified four main areas of confusion.[7]

- The kinds of academic inventions that can be protected by patents. "I can't see anything in my research area that might be patented," or "I do only basic research; nothing patentable will ever come of it."
- Effect of government sponsorship of research. "I'm working with federal funds, so anything I discover belongs to the government."
- Effect of publication on patenting. "It doesn't concern me; my only responsibility is to publish my research results, and if I publish, I can't patent."
- The patent policy of the institution. "If there should be any income, do I share in it? Does my department?"

In addition to these areas of confusion, many faculty have negative attitudes toward patents and technology transfer, viewing both as being nonacademic activities and therefore, beneath a scholarly-oriented university.

This is a misconception. First, a patent constitutes a public disclosure — a publication. In this sense, a patent ought to carry the same prestige as a refereed publication. Patent applications are refereed in the sense that patentable inventions must be new, non-obvious and useful. In addition, patents, like publications, are intended to act as a stimulus for further advancement of the art.

Second, technology transfer may be likened to the teaching function. We teach in order that our students might learn and in the hope that they will use that knowledge to the betterment of society. Similary, technology must be transferred before it can be utilized. Sometimes, publication is sufficient to transfer the results of research. However, this is not always the case. Where R&D and market development costs are high, most firms will not undertake commercialization of new technology without some form of protection. It makes little sense for a firm to incur the costs of introducing such products into the marketplace, only to share the market with competitors who have not had to bear the burden of developing the new technology. Thus, in certain areas, publication before patent application could actually work against one of the major objects of a university — the utilization of new knowledge.

The fact that technology transfer involves some sort of royalty to the university seems to offend some faculty. Such business activity, they claim, is not academic. Perhaps this confusion could be cleared up by charging "tuition fees" rather than "royalties" in licensing technology.

Perhaps the most significant factor impairing commercialization is the attitude of the academic scientific community toward university patent policies. On many campuses, affected faculty find these policies to be especially onerous and without merit. Some engineering and scientific faculty even refuse to sign required invention disclosure agreements. Faculty frequently view these documents as one-sided, unfair and discriminatory against the technological inventor (as opposed to the artist or textbook writer). While there may be some validity to their claims, they are, for the most part, venting their anger upon a symptom rather than the cause of their frustration. Far too often, faculty disclose inventions and postpone publication only to experience long delays, negative response and minimum feedback. In fact, the academic inventor's basic problem is that few universities have developed the capability to market faculty inventions.

THE CURRENT STATE OF THE ART OF UNIVERSITY TECHNOLOGY TRANSFER

The current state of the art is not due to anything inherent in the nature of academic technological research. While much of the technological research done at universities is basic rather than applied, this does not preclude the possibilities of marketable inventions resulting from such research. Furthermore, to pose the "basic research" theme as an explanation for the lack of practical output only lends credence to the claims of the critics that academia produces nothing of practical value.

The relative unproductivity of academic technological research appears to have two principal causes. First, most universities do not have the proper organizational structure for technology transfer. Secondly, the information output of those responsible for technology transfer is often incomplete.

While some universities with advanced programs have special technology transfer agents or patent administrators, the responsibility for the technology transfer function is frequently all but ignored. On many, if not most campuses, the responsibility is assigned to an administrator or an ad hoc faculty patent policy committee. While faculty committees are an essential part of the system for policy purposes, they are not a viable vehicle through which technology may be transferred. The transfer of technology is a difficult marketing job requiring expertise and diligent effort. The effect of shared responsibility in a committee system, coupled with the nature of the faculty decision-making process can be disastrous to technology transfer. The natural outcome of this particular system frequently is unhappy and frustrated faculty inventors.

If the nation's universities are to become a viable source of new technological innovations and if university technology is to become a source of revenue, universities will have to organize the technology transfer function in a more efficient form. Obviously not all universities have sufficient revenues to maintain full-time technology transfer agents. However, it is feasible for many universities to assign the responsibility in this area to an individual on a part-time basis, or to fund a viable technology transfer program through joint efforts with other universities.

THE IMPORTANCE OF COMMERCIAL FEASIBILITY RESEARCH

The second factor contributing to unsuccessful technology transfer by universities involves the output of those responsible for the transfer process. While some universities have alleviated the organizational problem by assigning technology transfer responsibility to an individual, the effectiveness of those agents has frequently been less than dramatic. The approach taken by some of these technology transfer agents is incomplete. Information on technical feasibility frequently is the only information transmitted to the market. In fairness to the transfer agent, this shortcoming often occurs because the agent lacks the resources and/or skills necessary to provide the other essential information input, that is, information on the commercial feasibility of the development. In order to improve the chances of commercialization of university technology, information on both the technical and commercial feasibility of the development is essential. Unless the transfer agent is clairvoyant, he will be unable to place a value on the development. It is difficult to estimate accurately the worth of the development unless estimations of several key parameters are made.

A complete and detailed analysis of the design of a comprehensive business plan or commercial feasibility study is well beyond the scope of this paper. However, the key factors in such a plan are:

—Estimates of potential uses and market potential.

—Sources of existing competition.

—Information on the protective features of the patent.

—Estimates of production costs and set-up costs.

—Estimates of sales potential and expected sales.

—Assessment of the variability of estimates.

Once the value of the developed technology has been derived from estimates of the sales, costs and the timing of these flows, those responsible for commercialization can pursue those developments with a greater likelihood of success. Other factors being equal, the higher the value, the greater the probability for the successful commercialization of the development.

In addition, the information gained in a commercial feasibility study should reduce the probability of the agent's pricing the development too low. If a firm does review a technological development and makes an offer for outright purchase or royalty arrangement, how can the university assess the offer unless it has gathered some commercial intelligence? Delegation of the responsibility for price setting to the buyer increases the likelihood of the innovation's being underpriced. If the university makes its own pricing decisions without adequate information, it may establish a value that is either too low or too high. The latter risk is probably more serious in that the most frequent outcome of such an event is that the technological development is likely to stay where it is — within the university.

INCREASING THE EXPECTED VALUE OF UNIVERSITY TECHNOLOGY

The information obtained in a commercial feasibility study should increase the expected value of the particular development. The basic reason for the increased expected value is that such information will increase the probability of commercialization since it reduces the costs to the firm that reviews the development. This is demonstrated by:

EV = V x P where

EV = Expected Value to the university.

V = Value of developed technology if commercialization is realized.

P = Probability that the development will be commercialized.

The process of gathering information is costly and time-consuming. Firms frequently are not willing to bear the costs to see if a particular development has profit potential. However, the generation of such information is a part of the development process and as such, has value to the firm. Similarly, commercial (in addition to technical) data raises the probability of commercialization in two ways.

First, the generation of commercial feasibility information expands the number of "channels" open to the university. Generally speaking, purely technical information must be presented to technical people. They are, in a sense, the "channel" through which the university must move. However, under normal conditions, it is the marketing manager who feels the greatest pressure and need for new products. Unless that person has a technical background, the university — with only technical data in hand — must rely upon the technician to interface with the nontechnical manager. Given the possibility of communication problems, lack of incentives and the virtually ever-present NIH factor (not invented here), the approach may be unproductive. Armed with a commercial feasibility analysis the transfer agent has new channels — a new set of customers — open to him. In other words, a technical approach presupposes that innovation (new product) decisions are made by technical managers. In many firms, these decisions are made by, or shared with legal and nontechnical personnel as well.

Second, in those instances in which the technical department may be an unwilling bridegroom, the transfer agent may be able to pursue a "pull" strategy as opposed to the technically oriented "push" strategy. For example, the Innovation Center at the University of Oregon was, in one instance, unsuccessful in interesting the vice-president of engineering in a technological development. However, contact with the president of the firm resulted in a projected $250,000 royalty agreement with the firm. In this case, it was not the technical information that transferred the technology, but the projected application of that technology.

NEW OPPORTUNITY FOR BUSINESS SCHOOLS

Having established the need for organizational changes and the need for increased information on commercial feasibility of developed technology, the questions that remain to be answered are how the business school can fill this void and why this represents an opportunity for business schools.

In terms of "how", most of the nation's better business schools have the resources and intrastructure necessary to supply the missing link in university technology — commercial information. Within the business school, the bureau of business research probably represents the best vehicle for coordinating such research efforts. Faculty can furnish the expertise needed, and graduate students are a readily available labor pool.

In terms of "why", commercial feasibility studies involving student and faculty interaction can provide some significant benefits. First, such activity is likely to increase the probability that university-developed technology gets transferred to the market. This will re-

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