Guidelines for Industry-Sponsored Research at Universities

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Summary. As the number of cooperative research programs between universities and industries grows, the potential for problems that stem from the inherent differences between the two types of organizations increases as well. The key to success in such relationships lies in anticipating problems and developing guidelines for averting them or dealing effectively with them. Ten guidelines for successful university ties with industry are discussed. The topics covered include publication rights, patent ownership, copyrights, confidentiality agreements, research units, faculty consultants, faculty entrepreneurs, international agreements, the sharing of personnel and equipment, and model research agreements.

Any discussion of cooperative endeavors between universities and industries inevitably focuses on the disparities between the two. Universities operate under several basic principles: that their primary functions are to preserve existing knowledge and to seek and disseminate new knowledge, that freedom is essential to inquiry, and that research and teaching are inseparable. For industries, making a profit and providing useful products and services are the primary functions, financial rewards are essential for assuming risks, and the freedom to carry out or support all types of research is critical. Focusing on these differences has engendered mistrust and fostered misunderstandings between the two sectors (*1*).

Many of society's needs could be met most effectively if universities and industries joined their broad range of capabilities and facilities (*2*). Not only would society benefit from the fruits of cooperative research, but the private and academic sectors themselves would stand to gain much if they capitalized on their differences and developed ways to reinforce their strengths. Universities need the financial support and the technical know-how that industry can provide, whereas industry looks to the nation's universities for new talent, new ideas, and basic research facilities (*3*). The increasing complexity of product and process development has made it difficult for industrial laboratories to have the expertise needed to keep up with technological and scientific advances (*4*).

However, cooperative research relationships require careful management (*3*). The key to their success lies in anticipating potential problems and developing guidelines for averting them or dealing with them effectively if they occur. The following are among the most critical guidelines for universities establishing research relationships with industry. Although following them will not guarantee perfect interaction between the two types of organizations, it will promote the benefits of such interaction while limiting conflicts.

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Ten Management Guidelines

Retain publication rights. This policy is based on the fundamental purpose of a university—to preserve and transmit existing knowledge and to generate new knowledge. As the primary trustee of the world's knowledge, the university has an obligation to society; the ability to fulfill that obligation is dependent upon the university's freedom to publish. The freedom to publish is critical not only to faculty but also to students, for industries often use publication as a criterion of research competence when evaluating students for employment (*5*).

Industrial sponsors frequently have proprietary interests to protect, and they will ask to review proposed publications in order to ensure that proprietary information is not revealed to the public. This request creates a potential conflict with the university's need to publish research results. However, the conflict is easily resolved if the university agrees to keep confidential any proprietary information it acquires to conduct the research, and the industry agrees to publication of new research findings.

The industrial sponsor has the right to review publications as well as the right to request that any proprietary information be removed if it has been included in a publication. This right should in no way be regarded as veto power, however. The contract should stipulate that the sponsor's approval shall not be unreasonably withheld. If opinions differ as to whether or not the company's rights have been violated, the two parties must attempt to reconcile these differences, with the ultimate decision being left to the university.

Publication may pose a problem in research interactions that generate inventions. The property rights to inventions are best protected by patents, but preparing patent applications is complicated and time consuming. Problems arise because publication of an invention prior to filing a U.S. patent application bars foreign filings, and U.S. applications must be filed within a year of publication. This issue can be resolved if the university agrees to delay publication for up to 6 months in order to give the sponsor time to file a patent application (*6*).

A graduate thesis becomes a publication as soon as it is placed on the shelf of a university library. If a thesis discloses patentable material, the publication dilemma can be resolved by sequestering the document for no more than 1 year. This policy should require that the student, the faculty advisor, the department chair, the dean of the college, and the dean of the graduate school agree on the need to sequester; the company must supply satisfactory arguments to convince them of this need.

Sequestering a thesis usually benefits the student, because at most universities inventors share the income derived from inventions. As industrial sponsors usually have some rights to the research through licenses, most will be amenable to this solution. Under no circumstances, however, should this policy result in a degree being delayed; the thesis should merely be held out of circulation.

Retain ownership of all patents. Universities have an obligation not only to disseminate knowledge through publica-

tions but also to make a best effort to bring inventions to the marketplace. Although it is usually advantageous for companies to market their inventions, they may decide as part of a profit-motivated strategy that certain inventions should be withheld. The principal way for a university to prevent a company from withholding the products of a joint research program is to retain ownership of all patents issued for faculty, staff, and student inventions. Property rights may be transferred from a university to an industrial sponsor by a license agreement, but that same agreement should provide the university with march-in rights if, after some clearly defined period, the invention is not exploited by the licensee.

The details of a license, except for the above stipulation, should be left negotiable; a license can be exclusive or nonexclusive, royalty-bearing or royalty-free, depending on the circumstances. Most universities prefer to grant nonexclusive licenses, but exclusive licenses are frequently granted at the request of the industrial sponsor (*7*). For a royalty-bearing license, guaranteeing minimum royalties 2 or 3 years after licensing provides an incentive for commercialization. This protects the inventor's rights as well as those of the institution, for most universities share a significant portion of the royalties with the researcher (*5*).

The university's obligation to protect the inventor's rights means that royalty-free licenses should be granted only under exceptional circumstances, but industries may feel that a royalty-free license is justified because they supported the work. How, then, does a university deal with a sponsor whose policy demands ownership of the patents from a sponsored research agreement? One possibility is for the university to request that a portion (at least 15 percent) of the research support be designated an unrestricted research grant that can be used to reward the inventor. In all cases, patent ownership and distribution of royalty income should be stipulated prior to initiation of the research.

Establish copyright policies for software. As computers have assumed an increasingly important role, academic institutions have devoted substantial funds to purchase computer hardware and software, to hire new faculty and staff, and to house this equipment and personnel. These investments have generated a large amount of computer software ranging from personal programs of little value to anyone other than their authors to general-interest programs of substantial academic and commercial value. As software technology continues to grow, copyrights will assume greater economic importance at universities (*8*).

Software is usually developed under policies based on the traditional scholarly activities of faculty, particularly book authorship. Most universities offer faculty members complete ownership of all scholarly works protected by copyright (*9*). The university's contribution to such work typically comprises release time, secretarial support, supplies, and office facilities—all at little incremental cost to the institution.

Nevertheless, because the creation of software entails significant use of university personnel, equipment, and funds, the university should claim some share in the benefits from its commercialization. Universities therefore need policies to protect their rights in this area, but because the issue is relatively new, such policies now vary widely from one university to another. Some hold that the software belongs wholly to the institution because it is a piece of technology produced with university equipment; others treat programs as literature and assign all rights to the author (*9*).

One way to deal with this issue is for the university to set a threshold below which it has no interest; that threshold is usually the point at which computer software becomes marketable. This eliminates most of the problem. For cases where the software is commercialized, the university should not expect to recover all developmental costs; however, marketing expenses and legal fees should be recouped before any income is shared with the author. The university's patent policy can serve as a guide to the equitable apportionment of income; this policy usually allocates the greater portion of the income to the institution—a two-to-one ratio is typical.

Minimize the use of proprietary information in research and do not require graduate students to sign confidentiality agreements. Most universities will not undertake confidential research for the federal government or for industry. The reason for this policy relates, again, to the fundamental purpose of a university. If research results cannot be published, the university has failed to fulfill part of its obligation to society.

However, a university can accept proprietary information from an industrial sponsor if it is used to generate new knowledge that, in turn, is publishable. Although receipt of this information is not a problem in itself, the institution should minimize the amount of proprietary information it accepts in order to avoid conflict when the new research results are published.

The university should stipulate that it will accept proprietary information only when it is in writing and designated as proprietary. The only individuals with authorized access to this information should be full-time faculty or staff; students should be insulated from this type of data. Industrial sponsors may require investigators to sign a confidentiality agreement prohibiting them from divulging the information for a given period, often up to 5 years (*5*). Such an agreement is an unrealistic burden to place on a student who may soon be seeking employment in the same industrial sector as the sponsor. The education of students is a primary function of the university, and students should be free to bring to their future employers all of the knowledge they have gained.

If the student must be exposed to proprietary information, the confidentiality agreement should be between the sponsor and the student. The university cannot be responsible for the enforcement of such an agreement, and this position should be clearly stated.

Create research units with faculty and students, and hire full-time researchers to staff such units if necessary. Many of the most successful research relationships between universities and industries have resulted from universities creating research units devoted to specific problems or areas. Often those research units are a response to an industry identifying a research need and recognizing that a given university has the expertise to do the work (*10*). These centers or institutes are staffed with faculty and students as well as a contingent of full-time, nonfaculty researchers, many with industrial backgrounds. The combination of faculty, students, and professional researchers enables these centers to respond to industrial needs in a more timely fashion than is possible with the more traditional approach to research found at most universities.

These units do not operate as private consulting firms. They work in academic-year cycles (that is, a minimum 1-year project duration), and—even more important—they have a strong educational focus. Students associated with these centers as part of their academic training gain a great deal from such work: financial stability for their research, communication skills, job opportunities, and close interaction with industry, including contact with management, exposure to technical knowledge, and use of equipment and materials (*11*).

The primary difference between a re-

search center and a more conventional academic department is that productivity is enhanced by the full-time professional researchers. (An old adage seems particularly appropriate here: ten professors at one-tenth time do not a person-year make.) Moreover, a full-time researcher with industrial experience tends to produce more inventions than the typical faculty member. This is not to suggest a qualitative difference between the work done by the professional researcher and that of the faculty member, but the industrially trained individual can more readily recognize an invention. In fact, working with professional researchers frequently helps faculty identify inventions arising from their research results. These research units are not only productive but also likely to attract industrial support because the availability of researchers with industrial experience enhances communication between the two sectors.

Faculty should not be permitted to consult with sponsors in the sponsored research area. One of the perquisites of faculty at most research universities is the right to consult privately on a limited basis. Consulting enhances both the professional competence of the individual and the reputation of the institution (*7*), but faculty members must balance their outside consulting activities with their institutional responsibilities for teaching and research (*12*). A potential conflict may arise, for example, if faculty members are invited by the sponsors of their university research to consult in the same specific research areas. Any know-how or patents arising from this work could accrue to the sponsor through the consulting agreement, whereas the work done on the sponsored research project through the institution was probably designated university property in the institutional agreement or contract.

The key factor in implementing this rule is to define clearly the scope of the research being supported by the industry and allow the rule to apply only to that narrow area. This approach frees researchers to consult with industrial sponsors in their general fields of expertise. Unfortunately, enforcement of this rule is virtually impossible; its success depends on the integrity of the researcher.

A faculty entrepreneur's company should not be permitted to sponsor his or her research on campus. This guideline arises from another recent development. In the past, faculty members consulted with outside firms, but few started their own companies. However, much academic research is now easily and rapidly translated into products and processes with commercial value. In the area of biotechnology alone, for example, more than 200 companies have been established within the last 4 years (*9*).

Obviously new rules are needed to deal with this situation. Implementing them requires first that entrepreneur be defined. If a company is wholly owned by a faculty member, then that individual is clearly an entrepreneur. However, when the faculty member owns a percentage of an outside company, some gauge is needed to determine when that percentage is high enough to present a conflict of interest. While it is difficult to establish a firm rule for this situation, a general guideline is that more than 10 percent ownership in a company constitutes an equity interest.

Once faculty entrepreneurship has been established, the faculty member's on-campus responsibilities and off-campus venture must remain completely separate (*13*). Objectivity is difficult to achieve when a researcher has responsibilities both to the institution and to a venture in which he or she has a vested interest, yet objectivity is essential to the judgments needed for education and scientific research (*14*).

The key issue is accountability: when the institution accepts a research grant, it accepts the responsibility for accomplishing the work, and the sponsor expects the project to be completed correctly and on time. A researcher who is also a sponsor, however, becomes both judge and jury. He or she is hardly in an appropriate position to decide, for example, whether or not a late completion report is acceptable. The institution must deal with the sponsor in one way and the faculty member in another; when they are one and the same, this becomes impossible. The faculty entrepreneur's company should, however, be allowed to sponsor other research on campus, even within his or her own department, because this situation allows a clear separation of roles.

The extension of this prohibition against faculty sponsoring their own work is that a researcher's graduate students should not be employed by the researcher's company either. The reason is simple. Ideally, the choice of a graduate student's research topic is a free one; in reality, however, the choice is often made after the faculty adviser has been consulted and the availability of funds considered. Even given these limitations, the student should still have some choice. However, that choice may be undermined if the faculty entrepreneur's company is supporting the student's work; the research may be directed toward the specific goals and needs of the company. Moreover, the work may be accelerated to meet the company's schedule rather than the student's needs. These abuses may be rare, but guidelines are needed to prevent them from occurring.

A corollary to this guideline is that faculty entrepreneurs should never be allowed to lease or use space in their university departments for private business. The resulting mixture of personnel and facilities can confuse colleagues, students, support staff, and outsiders in determining whether a given project is part of an institutional responsibility or a private business activity (*7*).

Beware of international agreements. A common mistake universities make in drawing up international agreements lies in assuming that the elements of a successful domestic agreement can be applied. A second error lies in assuming that experience with one foreign sponsor is applicable to another. Cultures vary so widely that experience with one country may help very little in making arrangements with another. Any guidelines or policies established by a university regarding international agreements must therefore be sufficiently flexible to allow for case-by-case modifications.

A major difference between domestic and international contracts is that the negotiation phase of the latter can often generate expenses that are substantial in proportion to the actual research support. Aside from the staff commitment to these negotiations, legal fees both at home and abroad can mount up quickly. Unfortunately, recovering these negotiating and legal expenses is difficult. To be realistic, the university should double its estimate of the expenses that will be incurred during the preproposal stage.

Another problem is that tax-exempt U.S. institutions seldom have the same status overseas. Income derived from licenses on patents can be taxed by the foreign licensee's government; as a result, the net income from the licensed product or process can be considerably below the negotiated amount.

Translation can present yet another problem with such arrangements. Most contractual documents and deliverables (completion reports, for example) are written in English, and the details as well as the overall spirit of these documents must be preserved when they are translated into the sponsor's language. An attorney well versed in the sponsor's language is almost essential.

If, after considering all the risks of such an association, a university decides to enter into an international agreement,

several suggestions can guide those involved in drawing up the contract. The most important is to clarify the nature of the project immediately so that team and technical requirements, cost estimates, logistic support, and other relevant factors can be specified.

While the guidelines for an international agreement must be general enough to allow for variations in details from one case to another, the contract itself should be as specific as possible. Provision should be made for scope of the work, financing, salaries, medical benefits, language training, reports, publications, patents, subcontracts, taxes, travel, transportation and storage of materials, equipment, training, termination, and disputes. A complete and explicit contract is the university's best antidote to disaster (*15*).

Share personnel and equipment with industry. Although there is renewed interest in cooperation between universities and industries, in fact, the two parties have always interchanged ideas and people. Many industrial employees have held adjunct appointments at universities just as faculty have often had formal consulting agreements with industries. More recently, however, arrangements have been made whereby a researcher's time is shared; the sharing need not be on a 50:50 basis, but a split less proportionate than 25:75 is probably unwise.

Such arrangements have potential pitfalls. Industrial research usually produces proprietary information, whereas university work is expected to lead to publications. The question of patent or copyright ownership must be considered also, especially since many companies do not share income with authors and inventors as universities do. Another problem may arise from the industrial prohibition against consulting with another firm, contrasted with the rather liberal policies of most universities regarding faculty consulting. A researcher working for both a university and an industry would probably be restricted to the combined salaries of the two positions and not have the opportunity for extra compensation through consulting.

However, the advantages of sharing outweigh the problems in most cases. Researchers in industry have access to excellent facilities and support staff, and they usually work with a group of researchers in a given area. The advantages of a university association are the stimulation derived from working with students and interacting with a more diverse group of colleagues (*16*).

Universities and industries can share not only personnel but also equipment. Sharing is particularly beneficial with sophisticated research equipment that would be used infrequently by industry. In such a case, several companies can contribute to the purchase of the equipment, house it at a university, and schedule its use. The major advantage to the university lies in having state-of-the-art equipment for faculty, students, and staff to use when the sponsor is not using it. The university should offer industrial personnel access to the equipment and make appropriate arrangements for liability protection. Cooperative arrangements can help universities fill the needs created by declining federal support of equipment and facilities (*17*).

Prepare a model research agreement for potential industrial sponsors. As industry increases its support for research, the need for universities to develop model agreements for potential industrial sponsors becomes more compelling. A university's negotiating position is strengthened when it presents standard provisions to prospective clients early on (*5*). All of the above guidelines should be incorporated into the model agreement.

The university should also have a standard international agreement. Although the needs, philosophies, and expectations of foreign sponsors vary, a model agreement can still serve as a sound basis to begin negotiations for overseas work.

The university's first contact with a potential industrial sponsor is often through the faculty researcher (*18*). Faculty should therefore be familiar with these model agreements and present them early in discussions with potential sponsors. And, again, as many details as possible should be stipulated in the agreement, whether it be with a domestic or a foreign sponsor, to circumvent problems as the research association develops. Although many clauses in such an agreement will be open to negotiation, having the framework of the agreement available from the beginning can avert misunderstandings. Another advantage is that a model agreement, although subject to variation through negotiations, demonstrates to potential sponsors that the university approaches all sponsors with the same set of rules.

Conclusion

There is much to be gained from increased interaction between universities and industries, both for the institutions themselves and for society as a whole. Innovation cannot occur without basic research as input, and basic research that does not lead to technological innovation in the form of marketable products and processes does little to better our quality of life. Too much emphasis has been placed on the dichotomy between the "pure," basic research done at universities and the applied research considered the province of industry. Rapid growth in scientific advancement has blurred the line separating the two (*16*). Increased interaction between universities and industry is inevitable as the federal government contributes an ever smaller portion of the research dollar; such relationships may prove to be the best way to serve the needs of all involved, including the public (*3*).

Many have expressed concern that universities are selling out by becoming so closely allied with industry (*19*). But cooperative research can threaten academic freedom only if universities allow it to do so. If, instead, they monitor themselves closely, they can reap the rewards of interaction with industry without sacrificing the principles that constitute their very foundation. But university research administrators should not view our guidelines as an exhaustive set. Many more will be added as faculty researchers, corporate sponsors, and university administrators gain new insights from their experiences.

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