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Technology Transfer and Public Policy:
Lessons from a Case Study

ABSTRACT

This paper uses recent events at the University of California as a case study to illustrate the consequences to the university of the collision between two powerful public policy agendas for the university: 1) that it maintain its traditional independence, carrying out its roles of teaching and research untainted by the lures and demands of the marketplace, and 2) that it become more active in economic development activities, including the development and sale of its intellectual property and the establishment of companies to exploit university research. The unsuccessful attempts over the last four years by the University of California to establish a separate nonprofit foundation to manage its considerable portfolio of intellectual property and to form a for-profit company to fund development and start-up efforts have been plagued with controversy. UC's story offers parallels with the experience of other universities illustrating an emerging pattern in the responses of higher education to the new pressures on them to be more economically relevant. The lessons from the UC case are valuable for other universities and for policymakers involved in technology transfer activities.

Technology Transfer and Public Policy:
Lessons from a Case Study

Like it or not, colleges and universities, particularly research universities, increasingly are being identified as important elements in the economic life of our nation. For some, the prospect of the academy's greater involvement in economic development activities, including the active development of intellectual property and the establishment of companies to exploit university research, seems salutary--part of the natural process by which the academy adapts to the needs of the society that supports it. They therefore desire to increase these activities. Others see such activity as diverting the academy from its appropriate roles and missions, blurring the definition of the institution and taking it into dangerous areas where it may not belong, and their agenda is to discourage this kind of behavior.

This paper uses recent events at the University of California as a case study to illustrate the consequences to the academy of a collision between these two powerful public policy agendas. The University's attempts to establish a separate nonprofit foundation to manage its considerable portfolio of intellectual property and to form a for-profit company to fund development and start-up efforts have met with both enthusiastic support and stiff opposition. As the debate continues, the issues become more sharply defined and lessons to be learned are clarified.

As we will see, California's experience is not uncommon. On the contrary, it illustrates an emerging pattern in the responses

of higher education institutions to the new pressures on them to be more economically relevant and to anticipate the consequences for the university, both internal and external, of economic development activities. Lessons drawn from UC's experience thus have general application.

Full-Service Technology Transfer: Lures and Pitfalls

While the battle between the two policy approaches just described is waged in and around universities, those same universities must deal with day-to-day concerns related to technology transfer activities, often in the absence of policy or clearly understood principles. From the university's point of view, the irreversible trend toward greater involvement between university and commercial interests is driven largely by the prospect of increased revenues. Corporate sponsorship of university research has increased from \$70 million in 1972 to over \$1.2 billion in 1991.¹ University management of intellectual property has become more aggressive and sophisticated in the last few years, and this has been reflected in an increase in financial returns. At the University of California, for instance, royalty income increased from \$11.1 million in fiscal 1989-90, to \$19.9 million in 1990-91, \$28.8 million in 1991-92,² and \$44.7 million in 1993.³ This kind of growth leads naturally to a desire, especially on the part of professional technology licensing officers, to expand university efforts into what has been called a full-service technology transfer program. Such a program includes accepting equity in licensing companies in addition to cash royalties, funding the development and expansion of nascent technologies ("funding the gap"), and--the last frontier of university technology transfer efforts--starting up companies to exploit technology developed by the university.

The path toward a full-service technology transfer program, however, has proven to be full of dangers and pitfalls. Several major research universities, including Harvard, Johns Hopkins, the University of Chicago, and Boston University, have taken steps toward implementing the "full service" concept and have found that these steps, especially investment in start-up companies, are often costly to the university in terms of both economy and public relations. For example, the president and several members of the board of trustees of Boston University have been under investigation for conflict of interest involving the university's investments in start-up companies such as Seragen, Inc., which was founded in 1987 to develop some intellectual property owned by BU and which received most of its funding from BU until it went public in 1992. John Silber, BU's president, is a director of the company and owns 105,000 shares. He also may have made \$386,700 when a Seragen spin-off company, Seradyn, was sold. Several of the members of the board of trustees were involved in Seragen and the Seradyn transaction and are members, along with the University, of Commonwealth Partners, a venture capital firm.⁴

Similar controversies have marked the efforts of other universities to form organizations to start up companies to develop university discoveries. The "cold fusion" controversy at the University of Utah, clearly caused by the university's desire to realize a large financial return, resulted in a great deal of embarrassment for the university and damage to its academic reputation and may have led to the resignation of the university's president when it was discovered that he had improperly transferred funds to support cold fusion development.⁵ Michigan Technological University's Venture Group, Inc., a profit-seeking investment company, has been controversial since it lost \$1.6 million in 1989 because of mismanagement and embezzlement by its officers.⁶ The University

of South Carolina's research and development foundation has been under intense public scrutiny since 1987, and this scrutiny led to indictments and convictions against the university's former president, James B. Holderman.⁷ These cases and many others offer warnings to universities preparing to step into the marketplace.⁸

Despite these painful examples, the lure of large financial returns and a desire to facilitate the commercialization of university-developed technology for the good of the public are pulling almost every research university into some new arrangement for technology development and investment. Based on a study conducted in 1984 by SRI International for the National Science Foundation, Gregory and Sheahan (1991)⁹ conclude that start-up investments are more successful in the commercialization of university-owned intellectual property than simple licensing. The financial returns are greater, and the range of inventions that achieve financial viability is wider. They point out that a technology licensing program based upon a patent licensing approach must be highly selective, which leads to the neglect of many middle-of-the-road inventions (that is, those promising a market under \$100 million in sales per year). They also conclude that an arms-length licensing agreement can often inhibit commercialization. Lacking the involvement of the university, licensees frequently lose interest in pursuing the commercialization of the technology.

Protective Mechanisms

Universities are beginning to learn from their mistakes and to recognize the importance of developing policies and practices to protect themselves from the dangers inherent in taking an active part in technology transfer. Several common patterns are beginning to emerge. To begin with, most universities are

seeking to buffer themselves by establishing separate for- or not-for-profit organizations to administer some or all aspects of the commercialization of intellectual property. A major exception to this trend is MIT which, perhaps because of the arrangements it has been able to make with the well-established venture capital community in the Boston area and the resistance it would have from that community if it were to set up a buffer organization, has publicly proclaimed that it would not separate itself from its intellectual property management functions.¹⁰

Universities have also become better at articulating technology transfer initiatives to their public and legislative constituencies. Such articulation often means emphasizing the public benefits of these initiatives and playing down the benefits to the university, including the increased resources made available to the university through these efforts. At the same time, gaining acceptance for technology transfer within the university often requires emphasizing the potential of such activities for resource generation. Striking a balance between the arguments required for internal and external acceptance can be very difficult.

Universities are experimenting with different approaches to the conflict-of-interest issues raised by aggressive technology commercialization programs. For instance, most universities do not allow university researchers to receive research funding from companies in which they own stock. The problem is that, once a university becomes involved in ownership of research-based companies, there are so many possible kinds of conflict of interest that policy formation is difficult. The trend therefore is toward "process policies," that is, policies that require full disclosure of the circumstances and then a review of those circumstances by a designated body. Johns Hopkins is a leader in this approach.¹¹

Unless these elements--buffer organizations, public policy rationales, and policies to deal with conflict of interest--are in place, universities are vulnerable to scandals associated with aggressive commercialization efforts. When a scandal does erupt, it colors the university's efforts to engage in technology transfer of any kind and often retards progress toward a stable balance between economic service and traditional university values.

With these general trends in mind let us now turn to the case of the University of California. Its recent efforts to form a separate organization to manage and market its intellectual property illustrate many of the dangers of, and obstacles to, an expanded university technology transfer program.

The Case of the University of California

In 1990-91 the University of California (UC) through its nine campuses and the three major research laboratories it manages for the federal government (Los Alamos, Lawrence Livermore, and Lawrence Berkeley), conducted \$1.36 billion in research, about 10 percent of the basic research funded by the federal government. UC's intellectual property is managed through a centralized Office of Technology Transfer (OTT) and several campus-based offices, including offices at Berkeley and UCLA. In fiscal year 1992 the OTT (not including the Berkeley and UCLA offices) received 352 invention disclosures, filed 197 patents, received 68 patents, issued 102 licenses, had 621 licenses in effect, and received \$28.8 million in royalty revenue.¹²

History.

The history of UC's management of its intellectual property through 1988 has been described elsewhere.¹³ To summarize, until about 1989, the University's intellectual property administration was oriented primarily toward protecting intellectual property through patents and copyrights rather than toward the active marketing of the property. To some extent this stance was dictated by the staffing level authorized for the office, then called the Patent, Trademark, and Copyright Office (PTCO). In 1980 PTCO had 10 employees; in 1987 it had 20 employees.

With this orientation and at these staffing levels, PTCO simply was not getting the job done. University researchers complained vigorously about the lack of attention given to invention disclosures, and the press made the public aware of the problem in a front-page article in the San Francisco Examiner.¹⁴

In response to these criticisms, the University hired a new director for PTCO, Carl Wootten. Wootten changed the emphasis of PTCO to marketing. He acted quickly to increase the staff and the licensing activity of the office, which was renamed the Office of Technology Transfer (OTT) to reflect its new charge. The number of staff increased from 20 in 1987 to 43 in 1989 and an authorized 57 today. These efforts apparently paid off: royalty and fee income increased from \$5.0 million in 1987 to \$44.7 million in 1993.

Despite this seeming success, a number of issues surfaced that caused concern among University administrators. First, a review of the University's inventory of undeveloped inventions revealed a large number that, with a relatively small investment, might be brought to commercial attractiveness, yet the University had no funding to dedicate to their development. This is known

as the "funding the gap" problem. Second, in a number of cases, licensees for what appeared to be very promising technology could not be found. In both these situations it seemed that the University, through an appropriate arrangement, could attract the necessary funding from outside sources. In still other cases, in the opinion of Wootten and others, the University was not getting the best result in terms of financial return or technology transfer effectiveness from deals restricted to the issuance of licenses.

It furthermore became clear that there were a number of difficulties in operating the OTT under the full force of the University's regulations, policies, and cumbersome bureaucracy. The OTT needed to be responsive and to be able to make decisions quickly, and its licensing officers needed to have the freedom to structure deals. High turnover in licensing professionals also indicated that the University's compensation structure was inappropriate. Salespeople should be compensated in part on an incentive basis, but the University was uncomfortable with such an arrangement.

For the administrators involved, including Wootten and the University's Vice President, Ron Brady (to whom he reported through an Associate Vice President), these concerns argued strongly for the separation of the OTT into some combination of for-profit and not-for-profit organizations. The remainder of this case study is a description of the-as-yet-unsuccessful efforts by these administrators to establish these entities. These attempts fall into four distinct phases, which might be called "white paper," "DU-1," "Pilot Project," and "state sponsored."

The White Paper Phase.

Shortly after his arrival at the University in May 1989, Carl Wootten wrote a "white paper" describing the need for an external structure to manage University intellectual property and recommending a particular configuration. This proposal has remained essentially the same during all the subsequent phases of the effort. Figure 1 shows the relationships of the various entities proposed in the paper as well as their relationship to the University and to outside stakeholders.

The white paper called for a not-for-profit Foundation to absorb all the functions performed by the (then) PTCO. In addition the paper recommended formation of a for-profit corporation to be called the California Technologies Ventures Corporation (CTVC), which would provide gap funding for undeveloped technologies and venture capital for start-up companies. CTVC would also help start-ups in other ways, for example by assembling management teams and providing subsequent rounds of venture capital. The University would own a majority of the shares in CTVC. The remainder of the shares would be held by corporate investors whose purchase of those shares would provide the initial capital to fund technology developments and prepare start-up efforts for first round financing. The Foundation would release technology to CTVC for development, and CTVC would then develop or sell that technology to the greatest advantage, returning licensing fees to the Foundation and profit from equity appreciation in start-ups to the University through distributions to its stockholders.

(INSERT FIGURE 1)

The Patents and Technology Transfer Executive Committee, composed of senior officials from the Office of the President and the nine campuses and three laboratories, met to consider

Wootten's proposal in early 1990. The committee decided that the proposal was too far reaching and complicated for the committee to pass on without a more complete review. Committee members felt they were unfamiliar with many of the issues, and they were ignorant of any alternatives to the plan. They also saw that achieving consensus across so many campuses and laboratories was going to be difficult. In the usual academic fashion, a subcommittee was formed to consider the proposal further and report to the full committee.

The DU-1 Phase.

Impatient with the pace of the discussions and feeling that the value of the proposal could be proven if given a chance, Wootten and his colleagues decided to just "do one"--that is, choose a very hot, promising technology and, on an exception basis and with the approval of the administration, secure venture funding and create a start-up company. They expected that in the process the policy and operational issues that would have to be addressed during a larger effort would become more clearly defined. Beginning approximately in early March 1990 and continuing through September 1990, a group of University officials, with help from experts outside the University, met to review the inventory of technologies in order to select one for intense development. The group finally chose a ceramic-metal composite with wide potential applications, from golf clubs to tanks.

The OTT prepared a proposal for the DU-1 effort and a business plan for the commercial development of the composite material. These were presented to the subcommittee on October 10, 1990. The subcommittee members questioned almost every aspect of the proposals. They wondered whether the selected technology really did have high chances for success. They questioned the wisdom of risking the entire program on only one technology. And

they echoed the criticisms of the previous phase--that the philosophical, policy, and informational framework for such a project had not been developed. In his report of the meeting, the chair of the subcommittee voiced the subcommittee's opposition to the DU-1 project and suggested that the next effort, whatever it might be, be preceded by an examination of the efforts of other universities in this area and an all-university conference of campus representatives to build the knowledge, background, and consensus needed for proper implementation.

The Pilot Project Phase.

The next chapter in the story began with a major reorganization in the advisory structure supporting the technology transfer efforts. Two major committees, the Intellectual Property Advisory Committee (IPAC) and the PTCO Executive Committee, were merged into a single Technology Transfer Council (TTC) in August 1991. This committee, like its predecessors, was composed of high-ranking campus and laboratory officials, often the number two official in each organization. The committee immediately formed a subcommittee called the CTVC Task Force to consider the next step in the CTVC project.

Wootten revised his white paper and presented it to the new committee in November 1991. Another plan was then developed, focusing on a pilot project to be based at a single campus. UC San Francisco (UCSF) had the most to gain from such a plan because of its large portfolio of undeveloped technologies. At a May 1992 meeting, therefore, the TTC approved a study of the feasibility of developing a CTVC pilot program at UCSF.

During the summer of 1992 the feasibility study was made. Faculty members were interviewed, the experience of other universities was examined, alternatives were proposed and

evaluated. The study supported the feasibility of a CTVC pilot program at UCSF, and the proposal for such a program was endorsed by the UCSF faculty and administration.

A meeting of the CTVC Task Force was held on October 12, 1992 to consider the study. The Task Force expected to recommend that the TTC approve the pilot project at its scheduled meeting on November 6. The day before the Task Force meeting, however, the chair of the Task Force, a vice chancellor at UCSF, met with Vice President Brady to review the study and the project proposal. The report of this meeting astounded the members of the Task Force. Brady raised serious questions about the study, despite his ongoing knowledge of its development, and basically vetoed the project. The TTC meeting scheduled for November 6 was canceled.

The State-sponsored Phase.

This sudden reversal had come about because events had overtaken the proposal, calling for more aggressive and visible efforts by the University. The new president of the University, Jack Peltason, who had just assumed office on October 1 under intense budget pressure and strong demands that the University demonstrate its economic value to the state, had quickly developed what were called his economic initiatives, a prominent feature of which was a full blown Foundation and CTVC proposal as opposed to the relatively small scale and seemingly tentative pilot project. The University made a deal with the state whereby the state's share of royalty revenue (about 25 percent after administrative costs) which was based upon the premise that the state had provided some of the means by which the inventions had been made, was capped at 1992 levels. Any additional amounts would go to fund Foundation and CTVC efforts.

This plan gained immediate and enthusiastic support from the state government, which was desperate to improve the California's economy. The response has been less enthusiastic among members of the business community, particularly among biotechnology and venture capital firms, who view it as a potential competitor. They are concerned about what is called "pipelining," the practice whereby the most promising technologies are chosen for in-house development rather than offered openly to the business community. This is a particularly touchy issue for a public university, which is generally held to have a duty to make sure that the public is served before its own treasury.

The UC faculty also has expressed reservations. In a letter to President Peltason dated March 8, 1993 and endorsed by 43 of his colleagues from five campuses of the University, UCLA Professor Emeritus Paul Boyer objected to the Foundation (now called UCTDF) and the CTVC (now UCTDC) in the following terms:

Pursuit of basic knowledge in biological, biomedical and agricultural research has achieved remarkable success in enriching our culture, promoting our health, and launching the biotechnology industry. The accomplishments document the rewards to society from University support and illustrate the success of interactions with private enterprise under present policies and procedures.

Based on this experience and other considerations, we believe that the proposed UCTDF/UCTDC would be a mistake. Such action is unnecessary and could seriously detract from the teaching, research, and public service functions of the University. Any changes aimed at improving technology transfer should not undermine the primary mission of the University.¹⁵

This letter received wide circulation and was featured in stories in the state and national press.

Complicating Factors.

Much has been left out of this story. One complicating feature is the tension between the OTT and the individual campuses regarding the administration of intellectual property. In May 1989 the chancellors of the campuses voted to permit the campuses to open their own technology licensing offices and control their own intellectual property. Berkeley and UCLA have done so, and several other campuses are considering this alternative. The president's latest proposal appears to threaten this recently won campus autonomy, so there is cause for campus opposition to the plan. Underlying this opposition is the understandable tension between two practical concerns. On the one hand, technology licensing officers need to be close to faculty researchers and develop personal relationships with them in order to elicit invention disclosures and help in marketing technology. On the other hand, there is also a need in a multiple campus organization for intellectual property matters, including policy formation and administration and marketing, to be administered and coordinated on a systemwide basis.

Then there is the series of controversies and scandals that have shaken public confidence in the University's ability to manage its affairs in the public interest. In March 1992 a controversy erupted over the retirement package granted to President Gardner, which was reported to be over \$1 million. This package came to light at a time when the University was raising

student fees significantly (over 40 percent), laying off employees, and freezing salaries in order to meet a budget shortage caused by a reduction in support from the state. Other aspects of University fiscal policy and practice came under intense and often hostile public scrutiny at the same time, including (unfortunately for the proposal being described) elements of the University's technology transfer efforts.

In 1989 the then PTCO moved into new administrative space in Harbor Bay Isle, a large real estate development in the city of Alameda. Ron Cowan, the developer-owner of Harbor Bay Isle, offered PTCO ten years' free rent in the hope of attracting not only it but other University units and spin-off companies based on University technology. Cowan and Vice President Ron Brady apparently formed a close friendship. Cowan also retained the services of Willie Brown, a lawyer, but also the powerful speaker of the State Assembly and a UC Regent by virtue of that post. Furthermore, when UCSF, frustrated by local opposition to its efforts to locate a "second campus" within the city and county of San Francisco, began looking for space in nearby cities, Cowan presented the University with a proposal for using Harbor Bay Isle for that campus as well.

Fearful of the loss of jobs and economic benefits that the removal of part of UCSF would cause, the city of San Francisco, as well as the San Francisco press, began looking for

improprieties in the relationship between the University and Cowan. It came to light that a number of meetings held in 1990 about technology development projects were held in the offices of Cowan's development company, a practice that continued until one of the committee members questioned the propriety of holding meetings about University business in such a setting. Willie Brown was rumored to have attended some of the meetings (although this was never verified). To make matters worse, several high-ranking University officials, including Brady and the Chancellor of UCSF, appeared in a promotional videotape for Harbor Bay Isle, extolling its virtues and mentioning the fact that the OTT was located in the development. A subsequent independent investigation by the University cleared UC officials of substantive violations in these matters although there were some "technical violations" and "the strong appearance of impropriety."¹⁶

The Present Situation.

All this publicity cast the current proposal for the state sponsored foundation and for-profit company in a very questionable light. In mid-May, 1993, Theodore Hullar, Chancellor at UC Davis on special assignment to direct President Peltason's economic initiatives, announced that the plans for the for-profit CTVC were "off the table." In late June 1993 under the headline "UC's Secret Stock Deals," the San Francisco Examiner reported that the University had "taken ownership in at

least 10 start-up high-tech firms" in return for the licensing of university-owned technology in spite of a University policy prohibiting such ownership. The newspaper protested the secrecy and the University's refusal to provide information about the deals.¹⁷ The same issue incorrectly reported the failure of one of the companies and suggested that Carl Wootten had a conflict of interest in dealings with the man who had been named CEO of the failed company,¹⁸ a suggestion that Wootten has exhaustively disputed.¹⁹

In spite of all this the Foundation initiative is apparently still alive. However, with faculty opposition openly expressed, individual campus opposition likely to grow, a business community offering dubious support, and a hostile press examining every move, the proposal will have a difficult time at best if it is ever considered by the University Board of Regents.

Some factors suggest a more positive outcome, however. To begin with, a new cast of characters is in charge of the University. Vice President Brady has retired, and his replacement is knowledgeable about the underlying issues involved in the proposal. Walter Massey, who, as Director of the National Science Foundation, encouraged that agency's efforts in promoting technology transfer, is the new Vice President for Academic Affairs. The Cowan-UCSF controversy seems to have blown over; UCSF has decided, at least for now, not to consider the Harbor

Bay Isle site. The underlying aims of the plan--increased resources and more effective technology transfer--especially against the backdrop of salary cuts for University employees and the elimination of schools and departments, are more important than ever. The plan is also supported by the current president of the University.

In short, this is very much a story to be continued. Its outcome is anything but clear.

Lessons from the UC Case

Much may seem idiosyncratic in the evolving case of UC's attempts to create a "full-service" technology transfer program. Few universities compare to UC in sheer size and in complexity as a multicampus, multilaboratory organization, for example. Clearly, however, UC's story offers parallels with the experience of other universities. Some lessons from the UC case thus may be valuable for other universities and for policymakers involved in technology transfer initiatives.

Avoid Real or Apparent Conflict of Interest.

As universities step aggressively into the marketplace, they become enmeshed in the threads that form the fabric of commercial relationships. The problems UC officials faced because of their associations with real estate developers and outside commercial

interests are not unique as the experiences of Boston University, Utah, South Carolina, and several others attest.

University trustees are often selected precisely because they are well connected with the commercial world, and university presidents must deal with people in that world every day. As the university starts trying to make money through aggressive commercialization of its intellectual property, conflict of interest problems are likely to arise. It is natural and valuable for trustees and presidents to be directly involved in establishing the basis and mechanisms for university commercial involvement, but it is also important that, from the beginning, appropriate mechanisms be put in place to avoid conflict of interest or the perception of conflict of interest. Review committees, scientific panels, strict guidelines, and appropriate buffering mechanisms, all supported by a careful public relations effort, are important early components of any effort to commercialize university research.

Articulate a Clear and Timely Public Policy Agenda.

Only in late 1992, about three years after the first efforts to establish separate organizations for the purpose, did the president publicly endorse an expanded technology transfer effort. His statement came in response to a crisis and, at least in regard to the elements described in this case study, was done without the full advice and consent of the faculty or even the

committees established to oversee the efforts. His statement also included a specific and controversial proposal (for the establishment of the Foundation and CTVC). A university administration's support for technology transfer efforts is crucial, but in UC's case that support was not fully effective. It came late, it appeared to be reactive to a crisis, it was hurriedly put together without a broadly based consultative effort, and it mixed policy elements with policy implementation steps, some of which were controversial. Such errors can be avoided.

General policies, expressing the university's support of technology transfer and explaining how this support fits with the institutional mission, should be formulated and formally adopted by the board of trustees after a process involving extensive consultation with faculty. Such consultation is also necessary for the next step, the setting of appropriate implementation plans, which should involve expanding the consultative process to members of the university's external constituencies, including, where appropriate, governmental bodies.

Provide a Forum and Process for Internal Debate.

Most universities, certainly including the UC system, lack a structure or forum and a process by which the members of the university community can reach consensus on broad policy issues such as the nature of the university's role in economic

development or technology transfer. A new forum and process thus must be invented each time the university faces such issues. Such invention takes time and effort and may mean that the discussion never happens. This was the case with UC. After the failure of the DU-1 initiative, the chair of the CTVC Task Force proposed a University-wide conference to consider alternatives, but nothing was ever done to organize such a conference.

The process of consideration was also flawed. Although the experiences of several other universities were examined, no serious consideration was given to models for organizing technology transfer efforts other than the one laid out in Wootten's original white paper. Each effort, then, took on the appearance of a selling job for the original proposal rather than an objective examination of what was best for the University. University faculty are unlikely to respond positively to such an approach. Many large universities have had to face technology transfer issues, so there are many models and much data for university administrators to consider and evaluate. No process of examination can be considered legitimate unless it includes an objective study of available alternatives.

Avoid the Appearance of Unfair Advantage.

Traditionally universities, particularly public and land-grant universities, are not supposed to make money from the knowledge they produce. Although this principle is being

steadily modified, many members of the general public (including university alumni), government officials, and faculty members still believe in it. The public policy justification for university technology transfer activity therefore must emphasize the good to society that such efforts are likely to bring and place the benefits to the university treasury in a secondary position of importance. The guiding principle for a full-service technology transfer program is the increased commercialization of university-developed technology, which means, among other things, that the best mechanism for economic development for each technology should be sought and found, even when that mechanism does not maximize financial return to the university.

In the UC case it was not always clear exactly what privileges the Foundation and CTVC would have with regard to University-owned intellectual property. Would CTVC, for instance, have the right of first refusal over University technology, or would it have some kind of facilitated access to information about the technology? Either way, the University would be vulnerable to the charge of pipelining. Another problem with the UC proposal was the combination of functions proposed for CTVC. The public policy argument in favor of "funding the gap" is much easier to make than is the argument in favor of the university's investing in start-up companies. Thus the controversy over University involvement in start-ups may have prevented progress on the funding-the-gap issue. Universities

can avoid these problems to some extent by establishing procedures designed to find interest in university technology from a wide pool of potential commercial developers. University-sponsored commercialization should be undertaken only after the technology has been marketed and then only according to established criteria.

Choose Appropriate Partners.

So many universities have run into difficulties because of a poor choice of partners in technology development that this problem begins to seem unavoidable. UC's association with real estate developer Ron Cowan, while not directly related to a technology commercialization proposal, illustrates this point. Universities can protect themselves to some extent, however, by establishing standard procedures and criteria to evaluate the background, reputation, and capabilities of potential partners (both individuals and organizations).

Seek External Support.

Wilson and Szygenda claim that the keys to successful technology transfer are a wide range of tools, clear university policies, and a supportive capital community. They also stress the importance of supportive governmental policies.²⁰ For most of its life, however, the current UC initiative has been primarily an internal matter, with little involvement from outside the University. Only in its latest stage has it received

the endorsement of the state government. Members of the capital community remain skeptical of its value, and some view it as potentially competitive to their own interests. Without strong external support, the UC initiative will have trouble passing internal reviews. In developing technology transfer initiatives, universities should seek the early involvement of external groups to assure that university programs mesh with and support related efforts rather than compete with them.

Establish Appropriate Oversight.

Universities face a dilemma when they decide to become more aggressive in developing commercial technology. On the one hand, they must engage professionals who are experienced in selling intellectual property, which means making deals with sophisticated commercial interests. On the other hand, they must constrain those professionals with policies designed to protect the university from the problems described in this paper. Licensing professionals are bound to be frustrated by restrictive policies and will desire independence and autonomy. An appropriate balance between autonomy and restriction is difficult to strike, both for in-house efforts such as those (up to now) at UC and for buffer organizations, where the issue is defined primarily in terms of ownership and control relationships between the university and the organization. However, the balance must be established and defined in order to avoid continued

frustration, both in the professionals who carry out the technology transfer activities and in those with whom they must deal.

Integrate Technology Transfer Activities on a Broad Scale.

Technology transfer is part of such a sweeping trend in higher education that no single initiative, even one as significant as that proposed by UC, can be taken without serious implications for other parts of the institution. Related university policies, particularly those concerned with conflict of interest, consulting, use of university property, graduate student employment, and leaves of absence must be examined and revised if such initiatives are adopted.

New forms of organization, such as the Foundation and CTVC, must be devised, evaluated, and created. The activities of previously unrelated existing organizational units must be coordinated, as one major university discovered: it found that its patent office was suing a corporation for patent infringement at the same time its development office was making a major pitch for research support to the same corporation! In addition, efforts to alter the culture of the university in favor of the desired changes must be undertaken--campaigns to educate faculty about the value of technology transfer, public relations efforts describing successful initiatives, and so on. Even with such

efforts, there is no assurance humanities faculty, for instance, will support technology transfer efforts.

In any event, in the UC case there is clear evidence that no such broad-scale effort was ever seriously contemplated, let alone carried out. On the contrary, the DU-1 and the pilot project phases can be seen as attempts to take a shortcut around this difficult and time-consuming task. Their failure illustrates what is perhaps the most important lesson of all: there are no shortcuts.

Conclusion

As the university is called upon to assume new roles in society, in this case as an important contributor to national and regional economies, some of its traditions are inevitably challenged and even overturned. The process by which traditional and new demands are balanced is and always has been vital to the university, allowing it to adapt to changing social conditions and at the same time maintain its legitimacy and integrity. However, this process is carried on in a fragile shell. There is always the danger of a rupture, a catastrophic loss of public confidence or a fracture of the internal cohesiveness of collegiality. If change occurs without the self-awareness and free debate necessary to define the issues and come to some

consensus, the whole structure and basis of the university is threatened. Such a danger is present now.

The trend toward increased university and faculty involvement in commercial activity is irreversible: the commitment to economic development and commercialization of intellectual property is too strong and too advanced to be undone or even slowed down very much. Having stepped into the marketplace, the university will find itself governed by new rules. It will have to take legal action against others, as in the defence of patent rights, and it will be sued in its turn. Errors of judgment or association that bring negative attention to the university inevitably will occur. Danger to the university arises not so much from these individual occurrences (although some of the cases cited have been very serious indeed) as from the fact that universities are unlikely to be ready for them.

Most American universities have a poor understanding of the scope of the changes related to their increasing commercial activity. They see problems that arise as isolated instances of bad judgment or bad luck, calling for ad hoc solutions, rather than as symptoms of an underlying trend. Most universities also lack provision for the kind of debate and interchange of ideas that is necessary for informed decision making on such issues. University faculty and administrators thus are poorly equipped to

handle the crises, large and small, that are sure to come as commercial involvement increases.

Because universities have not yet marshaled sufficient administrative and faculty support for their new role, scandal or financial failure related to commercialization or economic development might well crystallize traditionalist opposition and allow it to carry the day. The result could be a temporary retreat from the new course. The consequences of such a retreat are likely to be as little foreseen or understood as the consequences of the advance that preceded it. The university's resultant unsteady course will condemn the institution to further loss of public confidence.

University leaders must strike a careful balance between the traditions of their institution and the new demands placed on it by constituencies both inside and outside the university. This balancing act starts with increased awareness of underlying issues and activation of debate between groups or individuals within the university. The balancing will never end, but if it is successful long enough, it should become more like riding a bicycle than like walking a high wire.

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