Higher Education, Commercialization, and University-Business Relationships in Comparative Context
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Chapter 1
Wither the (Entrepreneurial) University?

Henry Etzkowitz

The entrepreneurial university is the latest phase of an “inner logic” of academic development, moving from teaching and research to economic and social development. Originating as a medieval institution for the conservation and transmission of knowledge, the university has evolved over the centuries into an institution in which knowledge is also created and put into use. Teaching expanded from dissemination of available knowledge to include methodologies that retrieve lost knowledge in order to better achieve educational purposes. What was found has been reinterpreted as an extension of the methodology of retrieving forgotten texts. Research as an inextricable part of the teaching process was expanded to an increasing number of disciplines as reliable methods were formulated for students to participate in the creation of new knowledge, as with organic chemistry in the mid-19th century (Rossiter, 1975). Moreover, practical implications were discerned in some of these research results and steps were taken to put them to use. Anomalous 18th-century pharmaceutical and 19th-century chemical
instances have given way to paradigmatic formats in the late 20th and early 21st centuries, as universities enhance their interface and technology transfer capabilities (Matkin, 1990).

A “third mission” is emerging in various academic systems in which universities are expected to contribute directly to economic and social development. Changes in the larger society, such as the decline of industrial mass production, have led to universities being called upon by national and regional governments to play a greater role in the economy, through creation of knowledge-based firms from academic research and entrepreneurship training programs (Jones-Evans & Klofsten, 1997). Internal developments within the university are paralleled and reinforced by external changes in triple helix interactions, creating a bidirectional flow of influence between academia and its stakeholders. Endogenous and exogenous trends reinforce each other and move the university into a more prominent role in society in an institutional triad of university–industry–government: the triple helix (Etzkowitz, 2008). Thus, the opposing academic models of “ivory tower” isolation and polytechnic support structure to a local industry have been superseded by a more proactive academic role in which the university participates, or even takes leadership, in advancing economic and social innovation. In this transition, academic autonomy, traditionally protected by isolation, takes on a new dimension. Autonomy is important for universities to fulfill their mission in economic as well as academic development, through creation of new industries in competition with existing ones. Too close a connection with existing firms may inhibit the university’s potential as a source of new knowledge-based clusters.

The transition to an entrepreneurial university and a knowledge-based society seldom, if ever, follows a smooth path. The great recession, beginning in 2008, opened up by a financial bubble, does not close easily as lost jobs in the industrial sector are not replaced in the knowledge sector without significant stimulus to spur the transition. Uneven development also occurs within the academic sphere. The development of an entrepreneurial university format is typically marked by controversies over conflict of interest and commitment as the university incorporates a new role typically seen to be at odds with its previous missions. When the university leads this transition, the emerging academic model may be out of phase with traditional academic expectations and those of other institutional spheres as well (Tuunainen & Knuuttila, 2009). In the following, we discuss the impetuses, and resistances, to the transformation of the university into the key generative institution of knowledge-based society.
Defining Academic Entrepreneurship

Entrepreneurial universities pursue an interactive model of innovation that incorporates linear and reverse linear modes. Even the linear model characteristic of the Research University is enhanced as knowledge and technology transfer increasingly takes place according to an assisted linear model, providing an organizational and legitimating framework for moving knowledge from the research site to the place of utilization (Etzkowitz, 2006). Faculty members and students, to varying extents but in increasing proportions, take an active interest in the utilization of knowledge in the entrepreneurial university. They may play a direct role in commercialization activities in addition to assisting existing users in accessing the useful properties of academic knowledge, both new and old. The transition to an entrepreneurial academic format may take place from a research or teaching university format as well as an independent foundation. It may occur through the creation of entrepreneurial training programs to enable junior researchers to follow an alternative career path in assisting their faculty mentors to commercialize their research or to sensitize undergraduate students to the potential of an entrepreneurial career in addition to the beaten track of an employee.

University administrators may play an active leadership role in the entrepreneurial academic transition by positing activities, from patenting to firm formation, as legitimate academic tasks. They may include these tasks as part of internal criteria for hiring and promotion and may reposition the university externally as well; for example, by playing an active role in regional development initiatives. Interface capabilities are created, both as an internal faculty and academic administrative development and in response to external encouragement and subsidies in different academic systems (Kneller, 2010). Liaison and Transfer Offices and incubator facilities manage and market knowledge produced in the university at several levels, from specific pieces of protected intellectual property to technology embodied in a firm and propelled by an entrepreneur. Such units also play a reverse linear role in connecting the university to external problems, sources of knowledge and firms seeking academic resources.

The concept of the entrepreneurial university is often misinterpreted to imply the subordination of the university to business on the assumption that industry is inevitably the stronger partner (Washburn, 2006). Derek Bok, former President of Harvard University, has suggested that
the role of athletics in U.S. universities provides a cautionary model for
the commercialization of research (Bok, 2003). Nevertheless, despite
occasional scandals of faculty succumbing to pressures to grade athletes
leniently or even change grades, the sports entertainment role of the
American University has typically been subordinated to academic goals
or at least encapsulated in a separate unit. Moreover, the positive side
of the university’s sports engagement must also be acknowledged: It binds
alumni and local publics to the university, creating the base for increased
legislative and individual donor support. In addition, a new subdiscipline
of sports analytics has recently been created, giving academia a research
role in athletic management.

A similar emergent model may be discerned in university technology
transfer. Indeed, as president in 1980, Bok played a leading role in
advocating that the university take a direct role in formation of a firm
based on molecular biology research at Harvard, drawing back only in the
face of strong faculty opposition. Even as he announced cancellation of
the initiative, Bok said that another way would be found to accomplish the
objective of university participation in the commercialization of research.
In 1986, the Harvard Corporation, the nominally separate governance and
financial arm of the university, announced it would participate in firm-
formation initiatives from the university’s research, providing a firewall
between the business and academic sides of the university.

A frequent assumption made by critics is that there is a conflict between
internal (university) values and external (economic) values. It is held
that academic activity must occur in a setting that is decoupled from the
economic sphere of efficiency and profit making. Once that barrier is
crossed, they fear, it becomes extremely difficult to stop the corruption
of values that they believe is entailed by the intersection of universities
and the market. There is a strong analogy between some of the initial fears
of critics of recombinant DNA research and the fears of these critics of
entrepreneurial scientists and universities. In both cases, the fear is that the
breaching of a barrier, whether natural or moral, will lead to catastrophic
results: The risk of catastrophe is too great to take a chance on breaching
this barrier.

The relationship of the university to other institutional spheres has varied
tremendously over time and place, with academia a subset of other institutions
such as the church and the state, as well as a relatively independent sphere.
Indeed, it has been suggested that a closer examination of the origin of the
modern research university with its principles of freedom of teaching and
learning and the unity of teaching and research would show that the principles
of the founder of the University of Berlin, Wilhelm von Humboldt, were
accepted in the reform of the Prussian universities in the early 19th century in
part because of their contribution to economic as well as national development:
“The Prussian government perceived the linkage between scientific training in
the universities and the application of science to and in industry, and so they
sponsored the emergence of the research university” (Mueller, 1984, p. 10).
The university’s nation-state development role was largely played out through
the creation and expansion of humanistic disciplines to formalize national
literatures and recuperate folkloric traditions as part of a new synthesis of
national heritage. Thus, the humanities as well as the sciences have played
significant societal roles, well beyond the walls of the academy.

The ethics of university roles are tied to both universal ethical principles
and historical conceptions of the role of the university. Disentangling and
associating normative expectations with contingent and necessary factors
is a sociological and philosophical task as well as an arena for regulators,
both within and outside of academia. The Office of Research Integrity
(ORI) was created within the U.S. National Institutes of Health to examine
disputed conduct of researchers receiving grants from the agency. Most
such disputes have been over research misconduct (e.g. falsifying or
inventing data), but conflicts of interest are within the purview of the office.

The appearance of controversies over conflicts of interest and commitment may be an indicator of the transition from teaching and research to the entrepreneurial university associated with an early period

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before rules and accepted patterns of conduct in commercialization of research were delineated (Table 1.1; Etzkowitz, 1993). The ethical requirement is not necessarily to prohibit all conflicts of interest but to regulate and adjudicate legitimate conflicting interests. A major part of the problem in determining whether there is a conflict of interest has to do with determining whether a particular interest is legitimate or not. There are instances of conflict of interest in which not all the interests are legitimate and cases of conflicting interests in which each interest is independently legitimate. For example, do the faculty members’ or the university’s attempt to make money on a scientific discovery or to aid off-campus groups in making money from the commercialization of the discovery count as legitimate interests? Here, the dispute turns on the legitimacy of the role of the university in economic development. In addition, the values (or many of them) of entrepreneurial science may already be implicit in the university, and people may already be acting upon them as leaders of research groups that are quasi-firms. These entrepreneurial values are now being made explicit. Thus, the conflict, instead of being one between internal and external values, may actually be between two different sets of internal university values.

The Rise of the Entrepreneurial University

The academic enterprise is transformed in parallel, sometimes leading, other times lagging, to the transition to a knowledge-based economy. The university is a flexible and capacious organization. Like the church, its medieval counterpart, it is capable of reconciling apparent contradictions while pursuing multiple goals in tandem. As the university takes up a new role in promoting innovation, its educational and research missions are transformed. As the university expands its role in the economy, from a provider of human resources to a generator of economic activity, its relationship to industry and government is enhanced. Paradoxically, as the university becomes more influential in society, it is also more subject to influence, with academic autonomy increased in some instances and reduced in others.

The basic research model of science was ascendant from the mid-
19th to the mid-20th century. Before this era, discovery and utilization were more tightly integrated, with the same persons often involved in both activities. For example, the Sillimans, father and son professors of chemistry at Yale in the early and mid-19th century, exemplified this taken-for-granted practice of combining research, consultation and teaching (Brown, 1989). In recent decades, these processes have collapsed into each other again, opening up opportunities for scientific entrepreneurship. For example, the first successful insertion of foreign DNA in a host microorganism in 1973 was quickly followed in 1976 by the founding of small entrepreneurial firms to make industrial applications of this new genetic technique in the production of new drugs and chemicals.

The Origins of Academic Entrepreneurship

During the late 19th century, lack of a formal research funding system except in agriculture placed a premium on individual and collective initiatives to obtain resources to support original investigation and to minimize costs. By that time, loose interpretations of hierarchical German academic models of investigation appeared in the emerging research universities of the United States. The attempt to institutionalize the 19th-century German model of a single professor representing a discipline surrounded by a permanent staff of assistants at the professorial level, introduced into Johns Hopkins and the University of Chicago in the late 19th century, soon broke down. Departments with relatively autonomous professors of different levels replaced some of those professors with lower-cost support staff (Oleson & Voss, 1987).

The reinterpretation of the research university model on a more egalitarian and democratic basis had, as its side effect, the broadening of the introduction of an entrepreneurial ethos into U.S. academia. A larger number of professors, at various stages of their academic careers, had the responsibility to seek research support. An assistant professor in a U.S. university had considerably ability to set the direction of research, especially if he or she could convince an outside funding source. Professors, already paid for teaching, assumed research responsibilities as well. With relatively
modest financial support, graduate students assisted the professor, and each other, at the same time they received their training. Faculty and students began to work together on research projects, typically after the achievement of a secure methodology in fields such as genetics, supported by small amounts of funds initially from universities themselves and then from philanthropic foundations.

Departments comprising both junior and senior academics were created instead of institutes led by an individual professor. Teaching colleges, based upon the traditional unitary classical curriculum, such as Harvard and Columbia, expanded into research universities with graduate schools in the arts and sciences and separate technical schools. New universities such as Johns Hopkins and the University of Chicago, founded to further newly defined notions of “pure” research, typically did not have technical departments, thus tending to reinforce the distance between research and practical application (Storr, 1953).

In the late 19th century, the university was a relatively weak institution with a need for strong boundary maintenance. A clear demarcation was attempted between the university and other institutional spheres through the creation of an ideology of basic research. The basic or “pure” research model was propounded most notably by Henry Rowland, a physicist at Johns Hopkins University, in his presidential address to the American Association for the Advancement of Science (AAAS) in the late 19th century. Rowland proposed a model of starting from curiosity-driven science moving to applied research and eventually to long-term benefits. This became accepted as the institutional ideology of the major universities that were being founded in the late 19th century by the holders of great industrial fortunes. In some ways, that ideology was a useful fiction, a way to protect those universities from expected and feared intervention from their founders.

The source of funding has been a key element in the critique of university–industry relations. However, if the past provides any guidance, one era’s controversial science funding scheme soon becomes another’s taken for granted reality (Guston & Kenniston, 1994). Thus, academic scientists rejected proposals for federal funds during the 1930s’ depression, calling it “tainted money,” whereas the present generation knows no other support mechanism. During the intervening period, U.S. scientists volunteered their contribution to weapons research during the Second World War, accepting research funds from government and acceding to their continuation after the halt of hostilities under conditions that were amenable to influence
if not control (Bush, 1945). Indeed, federal funding of research is now the taken-for-granted guarantor of academic independence, a complete reversal of attitudes that has occurred within the life experience of some longtime academics (Ginzberg, personal communication, 1995).

The implications of research for economic development are the basis of a multifaceted legitimating framework for science policy. Research funding strategies and research programs with multiple, interrelated goals have become central to computer science, materials science, and transdisciplinary fields such as bioinformatics and nanotechnology. Although traditional disciplines and funding sources persist, they are encompassed within an overlay of strategic research objectives and funding sources. For example, Sweden’s quasi-governmental Strategic Research Foundation supports center initiatives that integrate researchers who also receive funds from discipline-based Research Councils.

Changes in Funding Flows Indicate a Reordering of Inter-Institutional Relationships

Patronage arrangements in science have taken a variety of forms ranging from prizes for results to grants on the basis of promise of results (Sobel, 1995). There is a dialectic between prospective and retrospective funding arrangements, those with intended and those with unintended consequences. The prize, such as the one offered by the British government for a naval navigation system, exemplifies intended_retrospective funding in which the donor established a specific goal but did not pay out until it judged that the objective was achieved. Moreover, it is a winner-takes-all game in which investments of other competitors are not recompensed. On the other hand, there is the prospective/unintended consequences model of the basic research grant in which funds are offered on the basis of theoretical promise and methodological rigor without expectation of results, although given the track record of the “meandering stream of basic research” certainly some long term results are expected from basic research even if they cannot be specified in advance. Between these two endpoints on a continuum are hybrid models of directed basic research in which novel areas are explored with a view toward specific technological advance such as Bell Laboratories establishment of a basic research group in semiconductor physics with the objective of creating a new telephone switching system (Riordan & Hoddessen, 1997).
The advent of federal funding in the mid-20th century appeared to support traditional academic models of autonomy. Nevertheless, the internal workings of these forms were modified through scientists’ interactions with granting agencies and by attending to their priorities as part of the process of securing research funds. In addition to writing articles when they felt ready to present knowledge to peers, scientists had to at least project a future “product” from their research such as a cure for a disease or a militarily relevant technology. Because support for research was virtually guaranteed by the government during the early postwar era, researchers could afford to be relatively unconcerned with the practical outcomes of their research. Nevertheless, an entrepreneurial dynamic emerged as part of the increased emphasis on research that produced useful innovations as a by-product.

The creation of an infrastructure at universities to transfer technology is significant not only for the incorporation of a marketing arm in the university but also for its ability to enhance the marketability of academic knowledge. By taking such technologies through additional steps in the development process, the economic uncertainty associated with the very earliest stages of development is reduced (Arrow, 1962). An important function of such offices is to improve the quality of information associated with these nascent technologies. Indeed, by providing a search mechanism to find the most appropriate sources for sale of knowledge, the university technology transfer office itself plays an important role for firms in reducing their uncertainty.

New social relationships are created within academia as well as with industry. For example, a technology transfer unit typically maintains ties with various research groups in different fields and may play an informal role in bringing about new collaborations across disciplinary boundaries. In serving as a transport mechanism for knowledge spillover, the academic technology transfer office also functions as generator of social capital and provides an efficient search mechanism (Etzkowitz, 2011).

Such formal mechanisms make it possible to cast a wider net, smoothing the exchange process and reducing the friction in transactions. It is increasingly difficult to separate a series of cognitive and entrepreneurial activities that often occur along a continuum rather than in dichotomous spheres. Thus, some university-originated firms located in incubators appear as much, if not more, committed to research goals as to making money, despite the best efforts of incubator administrators to focus their attention on the latter. Conversely, some academics are so attentive to the commercial implications of findings produced in their research groups that they attune their research program to produce results that will be amenable to commercialization.
Convergence between Academia and Industry

The academic scientist and the business entrepreneur would appear to be distinctly different social types, yet there is a certain commonality in their tasks. The businessperson must make a rational calculation of risks in starting a new enterprise; the scientist must persuade potential funding sources in order to conduct research. Academic science is entrepreneurial in its inner dynamic in countries where an academic job does not come with funds to support research. The necessity to raise research funds is the initial impetus of faculty entrepreneurship and is the underlying driving force of entrepreneurial science even before commercial possibilities appear in research findings.

Research groups operate as firm-like entities, lacking only a direct profit motive to make them a company. In the sciences, especially, professors are expected to be team leaders and team members, with the exception of technicians, scientists in training. As group size increases to about seven or eight members, professors who formerly were doing research are typically compelled to remove themselves from the bench to devote virtually all their time to organizational tasks. Often, persons in this situation describe themselves as “running a small business.” To continue at a competitive level with their peers, they must maintain an organizational momentum, finding it extremely difficult to function again as individual researchers, so every effort is made to sustain leadership of a group (Etzkowitz & Kemelgor, 1998).

Academic research groups and science-based start-ups exist along a continuum, with attention to rewards of recognition and finance. Indeed, companies developed based on discoveries made at universities tend to continue to publish new findings based on their elaboration of the original discovery. Licensing, joint ventures, marketing, and sales of products provide additional venues for knowledge dissemination to broader areas of society, above and beyond the traditional means of academic dissemination. These commercial channels bring with them informal social relations that also provide pathways of dissemination.

The widespread effects of the scale-up of federal research funding postwar and its translation into economic activity were confirmed by a study of the firm formation activities of graduates of the Massachusetts Institute of Technology (MIT) who had founded 4,000 companies, creating more than a million jobs (Bank Boston, 1997). More specifically and locally, the biomedical research activities in Boston have generated significant
employment gains in the Kendall Square area adjacent to MIT and in the neighborhood surrounding the Harvard Medical School (Pierce, 2003). An earlier wave of university-generated technology growth in mini-computers catapulted to suburbia, clustering along Route 128. The contemporary generation of biotech firms chose to remain close to home, indicating the enhanced importance of maintaining ties to academia. Hopefully, these ties will renew the industry with new ideas and products so that it will not wither like the small computer firms isolated in suburbia.

The translation of knowledge into economic activity has emerged as a visible university function alongside research and teaching in response to economic downturns and loss of traditional industries. During the past three decades, a broad range of universities, both private and public, have established one or more of the following mechanisms for academic–industrial relations: offices to manage patenting and licensing of technology; interdisciplinary research centers with industrial participation; and research parks and incubator facilities. In addition, many schools have established procedures to manage potential conflicts of interest and commitment as faculty members play dual roles on both sides of the academic and industrial divide.

Conflicts of Interest and Commitment

Several forms of academic conflicts of interest arising from industrial ties can be identified. For example, university-industry attachments cause conflict because both traditional basic researchers and researchers working in centers supported in part by industry are often dependent on identical departmental resources such as space, equipment, secretarial time, and so on. Allocation of time can also result in conflict of interest disputes. The trend toward external attachments may face particular resistance from professors who hold power over and have traditional conceptions of what constitutes academically appropriate work leading to conflict of interest charges against professors attempting to conduct industry-supported research programs.

Under what conditions are conflicts over time likely to arise? Faculty members typically support their firm-formation efforts by reducing their academic involvements often to a formal minimum during the very early
start-up period when funds are scare. However, if the firm makes it past the initial start-up period, funds often become available to replace academic salary allowing a leave of absence. After the leave period, the academics typically decide to devote themselves to the firm full time or return to academia with a reduced involvement in the firm that is compatible with the one fifth rule on consulting time. If the firm is a quick success or failure, time disputes resolve themselves voluntarily or involuntarily along those lines. Thus, the maximum strain occurs in situations when the initial start-up phase drags on and the firm is not a clear candidate for success or failure. Under these conditions, lacking sufficient funds is the greatest likelihood of conflict over allocation of time.

As faculty roles expand, time and resource constraints demand faculty and administrators set criteria for allocation of time and commitment. One head of a department in the Biex study described later in this chapter said,

I find faculty members don’t understand conflicts of interests. [They] are structural . . . faculty see it as impinging their integrity. A question of policy has arisen when a company wants to take a license and it turns out that someone in the department is on the board of directors.

Another informant described the situation as

...a tangled picture. A little startup gives a grant to an institution, and the owner of the company who is also a faculty member uses that to support a graduate student to do research which may or may not be relevant to the company.

Thus, if a professor who is also the owner of a company uses company funds to support the research of a graduate student in the university, questions will be raised as to whether that arrangement is being made to support research contributing to the profitability of the company at the expense of renown for the university.

Can both ends be achieved simultaneously? Even when two different research programs are clearly underway in the company and the academic laboratory, the dual roles of the professor create an appearance of conflict between the economic interest of the firm and the disinterested pursuit of knowledge. Ever since the professorial role was redefined to include research as well as teaching, the allocation of faculty time has been at issue. Various mechanisms were developed to accommodate faculty research
commitments such as the use of research funds to replace the professor with adjuncts or graduate students. Nevertheless, most departments place limits on how much teaching can be bought out, requiring a certain minimum involvement no matter what funds are available to replace the investigator. With respect to time spent on interaction with industry, the earlier resolution of this issue, the one fifth rule, allowing faculty to spend one day a week on off campus activities such as consulting, breaks down as it becomes loosely interpreted by faculty to include afternoons, evenings, and weekends. One of our informants in the Biex case said, “Some of our early fears were legitimate, particularly in terms of too much time being spent by the faculty” on off-campus involvements such as the formation of firms. At this campus, a dean started an ombudsman system to deal with student complaints that “their mentors weren’t there and they felt they weren’t getting as much attention from them.” Even when formal obligations are met for teaching and supervision of graduate student research, the focus of the faculty member’s attention lies elsewhere and concerns over allocation of time escalate into disputes over conflict of commitment.

The main ways in which universities have attempted to engage in relations with industry while resolving or regulating conflicts of interest over the commercialization of research can be captured in two models: (a) separating academic and business activities and (b) integrating research and business activities under the rubric of a broader institutional mission.

Resistance to Entrepreneurial Science—The Biex Story

When faculty members become involved in entrepreneurial activities, they may be looked at askance by their colleagues who are traditional academics. Controversies over entrepreneurial science, not surprisingly, are especially likely to erupt in academic systems that are culturally and organizationally isolated. In the United States, conflict-of-interest issues arose in academia in the late 1970s and early 1980s as a consequence of the formation of biotechnology firms from a discipline, which heretofore had few commercial connections (Teitelman, 1989). Such disputes were adumbrated by issues raised earlier by academic researchers’ acceptance of funds from government agencies (Genuth, 1987). However, the direct
participation of academics in two organizational entities was not the primary issue in those disputes. When faculty members are the principal figures in a firm that engages in production, rather than consultation, and retain their positions on a university faculty, the issue is clearly joined.

We have examined these issues in a public research university, over a thirty-year time span that began in the early 1980s, including a controversy over firm formation that erupted in a science department in the early phase of the study. The founding of Biex by four faculty members to commercialize a biotech innovation created a controversy in a biology department with some department members opposing the firm as harmful to academic life and others, more or less, becoming resigned to it. One teacher left to work for the firm full-time, but the others retained their academic positions, claiming that their campus-based research groups were their primary focus. The founders thought their company was potentially beneficial to the university, bringing in new resources to support a system under financial stress. Other faculty members viewed the issue in moral terms, arguing that scientific creativity and progress were at risk and that participation in a firm was incompatible with the aims of the university. They also questioned the motives of the firm's founders and were skeptical of their claim to be observing university limits on time devoted to consultation. One said, “I think it’s a conflict of interest…I don’t know where their loyalties are—with the company, where they make a lot of money, or with the university, where they have their primary appointment. I think it’s dishonest.” Another raised the issue of conflict of commitment, that even if the letter of the rule was observed, “it’s a matter of priority time. You can spend your time somewhere else but still be thinking about that other thing…Most of us have the feeling that these faculty are spending more than one-sixth of their time thinking and working at this other venture…neglecting their responsibilities here.” Yet another said, “Many people feel that these individuals aren’t carrying their full course load of teaching and are frequently inaccessible to the people who work in their research labs.” The very mechanisms utilized to separate academia from industry, different academic and firm labs, thus became a part of the problem. Two venues inevitably require division of time, with the potential for division of loyalties.

The firm's founders held that they kept their campus research apart from

1. This case study is based on interviews conducted by the author, Anne Lanier, and Michael Neuschatz as part of a National Science Foundation–funded study of university–industry relations that began in 1983.
the work of the firm, as captured by this quote from one of them: “That’s by design… I can honestly say I have not had an idea in which I felt a conflict.” As to his ability to pursue his academic and business commitments simultaneously, he said, “I think I have the energy, within the bounds of the one-sixth rule to work at [Biex], in what the University considers to be my spare professional time, and to do my job at the university.” Nevertheless, the founders were aware of their colleagues’ feelings. One said, “There are people in our department who hate the fact that I was involved in [Biex]. They considered it a trashing of the sense of universities as cloisters. They are people who think that by doing this sort of thing you have broken a vow.” One founder viewed the company as a new stage of scientific accomplishment, “directly part of your professional growth as a scientist, something that ought to be encouraged.” Nevertheless, he conceded that in his work at the company, there were restrictions on publication that were at odds with the open communication that ideally takes place among academic researchers. Another pointed out that many of the conflicts engendered by involvement in a company echoed issues such as the conflict between teaching and research demands, resolved for grant-supported research by provisions to “buy out” some teaching responsibilities.

Other faculty, taking a middle position, viewed the issue in terms of loyalty to the community. They were especially concerned that the firm founders were moving away from participation in the department and might be about to resign. If the community were enhanced by access to new sources of funding, the firm would be welcomed. However, if a few received huge financial rewards while others had difficulty in gaining research funds, then the collective would be harmed. They were withholding judgment until they could determine whether, on balance, such commercial involvement hurt or helped the department.

Control or Avoidance of Conflicts of Interest

Conflict of interest restraints as reflected in the Biex case have traditionally been based on the presupposition of the separation of institutional spheres. We have noted four main approaches to the control or avoidance of conflicts of interest: prohibition of the activity, a requirement of disclosure, separation of activities, and integration. These four approaches reflect
an analytic classification as well as a possible sequence of responses to a perceived conflict of interest. An activity may be seen as too desirable to prohibit; disclosure is too weak to be effective or does not end the controversy. An attempt may then be made to reinstitute a clear separation of activities or, alternatively, the route of integration may be pursued.

On the separation approach, the financial interest is separated from the research interest by defining boundaries or creating structures that mediate between the two activities (differentiation and separation). This involves placing as much distance as possible between the activities leading to advancement of knowledge and those leading to commercialization. It is believed that conflicts of interest can be controlled by drawing the different interests apart as much as possible, restoring distinctions between institutional spheres that have become blurred. Adherents of this approach believe that commercialization can be successfully achieved while at the same time protecting the integrity of the academic enterprise.

In the integration approach, research and commercialization are combined in a common framework. This involves carefully spelling out the rights and obligations of all involved parties: professors, students, the university as an institution, and industry. Adherents of this approach hold that separation constitutes an unnecessary and costly interference in the transfer of technology and that conflicts can be resolved by drawing the two spheres together under a common regulated framework.

It is hypothesized that the separation model will be chosen when an attempt is made to conflate new roles with existing missions and that the integration model will be selected when the new mission is explicitly recognized. This latter course of action can be most clearly seen in Brazil, where the recent innovation law allows research groups and firms to share personnel and equipment and locate in a common space on a university campus. For example, a biotechnology firm in the incubator facility of the Pontifical Catholic University of Rio Grande del Sol has the same leadership as the research group. The same persons, allocated in varying degrees across the workday, carry out firm and academic tasks. The “production facility,” a bioreactor, is located in a corner of the lab. Its products are shipped by airfreight to customers in San Diego. The 2004 Innovation Law, which allows but does not mandate this organizational convergence, has been especially utilized by teaching universities transforming themselves into research universities, attracting entrepreneurial faculty from traditional research universities who wish to combine their teaching, research, and entrepreneurial roles in a unified framework.
Conclusion: Wither the (Entrepreneurial) University?

It is held, from opposing ideological perspectives, that the market is a vortex that sweeps everything into its path. Once an activity has demonstrated some commercial value, it will inevitably be “commodified” with other attributes corrupted. This is why some believe strong boundaries must be maintained between academia and industry. The latter’s commercial values will inevitably subsume the formers’ intellectual independence (Bok, 2003). However, is closeness and engagement necessarily prima facie evidence of subordination or may interactions take more subtle and variegated forms? An alternative hypothesis is that the entrepreneurial university increases its independence through its self-generating capacities (Etzkowitz, 1983).

Directly generating the funds for research support through the creation of equity in firms or the sale of intellectual property rights introduces a new principle into the so-called science/society relationship with scientists on both sides of the contract. As universities gain the ability to generate their own research support, they may become less dependent on government and industry.

Will the university be transformed into quasi-business, or will business be transmuted into a quasi-university, or will the two formats merge into a common framework? These competing possibilities will be tested by future academic and industrial development. The question of who influences whom in university-industry-government interactions is always an empirical one, with the answer weighted toward the actor with the most valued good under varying societal conditions. The presumption of an unequal relationship between university and industry in industrial society recedes in knowledge-based societies in which intellectual property gives its holder significant say in setting the terms of its utilization.

The enhanced role of the university calls for a reconsideration of theoretical frameworks in which either political or economic institutions are primary in favor of a triple helix model that includes knowledge-producing institutions as well. The production of scientific knowledge has become an economic as well as an epistemological enterprise even as the economy increasingly operates on a knowledge resource base. Science has emerged as an alternative engine of economic growth to the classic triumvirate of land, labor, and capital, the traditional sources of wealth. The premise of economics as a rationing of scarcity is transformed by a repeal of some “limits to growth.” Products based on “intangibles” like computer
code are not subject to all of the laws of traditional economics, when they can be reproduced without significant cost. Moreover, such intangibles increasingly influence the content of products based on physical resources, such as automobiles, even as they constitute entirely new classes of products themselves.

For the most part, this growth of science-related technologies has remained, “outside the framework of economic models” (Freeman & Soete, 1997, p. 3) even as the institutional spheres of science and the economy, university and industry, hitherto relatively separate and distinct, have become inextricably intertwined, whether through governmental or private sector initiatives. SEMATECH, a joint industry-government research and development consortia formed to rescue the U.S. semiconductor industry from Japanese competition in the 1980s, is one instance of a joint initiative that has since become commonplace internationally (Berlin, 2005). Even given the efflorescence of “open innovation” collaboration among firms, there has been a shift in emphasis from enhancing existing firms to promoting start-ups. Expectations that multinational firms or so-called national champions will be central economic actors in the future are receding (Block & Keller, 2009). Rather, the key economic actor is increasingly expected to be a cluster of firms emanating from, or at least closely associated with, a university or other knowledge-producing institution.

A new “great transformation” is underway, with the university taking a role in society in the 21st century comparable to the enhanced role of the market in relation to other social institutions during the 19th century (Polanyi, 1944). Science and academia are no longer supporting players to the major institutional spheres of government and industry, the basic public/private institutional dichotomy of modern society since the 18th century. Rather, they are becoming ever more significant players in an emergent institutional infrastructure, shaping as well as shaped by the course and direction of knowledge-based economic and social development. Pecuniary values are often expected to overwhelm science and academia once introduced (Veblen, 1918). We suggest that the university is attaining the status of a leading social institution, capable of protecting its essential interests as well as providing a model other spheres can emulate. The horizontal institutional stratification system of university-industry-government is in flux. An entrepreneurial academic sphere is emerging as a coequal institutional sphere in the transition to a knowledge-based society.
References


