THE CENTRALITY OF CONTEXT IN THE MARKETIZATION OF HIGHER EDUCATION DISCOURSE: FACULTY WORK IN THE PASTEUR’S QUADRANT

IHELG Monograph
07-07

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Institutions certainly are influenced by powerful, external factors such as demographic, economic, and political conditions, yet they are also shaped by strong forces that emanate from within (Tierney, 1988, p.3).

The marketization of higher education has become a popular discourse among scholars from various disciplines such as economy, research policy and management, sociology of science, and higher education. Among the higher education community, the tone of the discourse reflects a sense of anxiety due to the potential eroding effects on the public good of the increasing neo-capitalist practices of higher education (e.g. Geiger, 2004; Kezar, Chambers, Burkhardt, & Associates, 2005; Newman, Couturier, & Scurry, 2004; Slaughter & Rhoades, 2004; Tierney, 2006). In this article I argue that this discourse fails to properly acknowledge contextual differences, which results in an oversimplification of the trends affecting higher education today. Consequently, proposed conceptualizations, polices, and practices found in this discourse are less likely to steer higher education toward commonly desired goals. My intention is not to question the risks of the market well described in the existing literature. I agree with this discourse for the most part, and I strongly believe that higher education is facing new challenges that need to be addressed promptly. Instead, my objective is to contribute to the discourse by calling attention to the complexities involved that demand thorough contextual consideration in future studies, analyses, and dialogues. To build my argument, I focus on one particular aspect of higher education’s marketization—faculty collaborations with private firms—and present a case study portraying a context that challenges various premises found in the literature as an example of the centrality of context.

**Industry-Academia Collaborations: A Literature with Mixed Messages**

From a variety of perspectives and interpretations, scholars have examined the effects of industry-university collaborations on society and on different constituencies in academia and industry¹. Overall, these empirical studies agree on the following points: 1) The motivations of faculty and university administrators for seeking industry-academia collaborations include sources of business opportunities, funds, assistantships, and lab facilities; practical applications of research and research insights; jobs,
internships, and educational opportunities for students; and ways of furthering the university’s outreach mission. 2) Federal grants offer more financial stability than industrial grants. Companies are normally unable to maintain long-term funding commitments, and faculty occasionally face sudden cuts of industrial funds due to financial pressures experienced by private sponsors. 3) Faculty and industrial partners experience difficulties accommodating timelines suitable for both parties because in academia, research results are normally integrated within the education of graduate students, which demands longer periods of time than many companies are willing to entertain (e.g. Adams, Chiang, & Starkey, 2001; Debackere & Veugelers, 2005; Hall, Link, & Scott, 2003; Link & Scott, 2005; Mendoza & Berger, 2005; 2006; Mendoza, 2007; Mowery, 1998).

Some argue that industry-academia collaborations are beneficial not only to scholarly research, but also to society by giving higher education the opportunity to focus on research with real applications and aiding industries with needed knowledge and human capital (e.g. Geiger, 2004; Debackere & Veugelers, 2005). However, others disagree by showing that these trends bring overemphasis in applied research due to the specific needs and objectives of private sponsors, which distracts academia from its mission to further basic knowledge (e.g. Campbell & Slaughter, 1999; Slaughter, Archerd, & Campbell, 2004; Cohen, Florida, Randazzese, & Walsh, 1998). Others have adopted intermediate positions stating that industrial projects are complementary to basic research and a combination of both provides better training to students (e.g. Link & Scott, 2005; Mendoza, 2007; Mowery, 1998; Owen-Smith, 2005; Stephan, 2001). In any case, it is not clear whether there is a decline of basic research due to industry-academia collaborations. In fact, a few studies show that an overemphasis in applied research is not happening extensively because faculty are more likely to engage in collaborations with the private sector that involve a fair amount of basic science. These studies explain that industry tends to keep in-house research close to their products and seek academic expertise on the more fundamental aspects of their technologies (Mendoza & Berger, 2006; Mendoza, 2007).

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Faculty engagement in commercialization of research such as patenting and establishing start-up companies has become an area of concern among observers, given the business-like nature of these activities, which are facilitated by industry-academia collaborations. Faculty in state universities are public employees expected to contribute to the greater good of society through education, free production and dissemination of research, and service. Thus, the possibility of faculty to profit through public-subsidized resources by patenting and commercializing products derived from their research seems to be against expected faculty contribution to the public good (e.g. Blumenthal, Campbell, Anderson, Causino, & Seashore Louis 1997; Campbell & Slaughter, 1999; Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004; Slaughter et al., 2004; Gumport, 2005; Krimsky, 2003; Mendoza & Berger, 2005; Owen-Smith, 2005; Owen-Smith & Powell, 2001). Conversely, others argue that the commercialization of faculty research actually serves better the public good because it allows the transfer of technology to industry more efficiently. This transfer encourages economic development as well as new technologies and products available to the public (e.g. Geiger, 2004; Mowery, 1998).

The secrecy of knowledge needed in entrepreneurial activities is one of the most contested issues in the literature due to its stark opposition to free dissemination of knowledge, which is considered a cornerstone in the system of values, rewards, and expectations of the academic profession (Campbell & Slaughter, 1999; Cohen et al., 1998; Hall, Link, & Scott, 2001). However, a few empirical studies indicate that for the most part, faculty are typically more interested in publishing than patenting, and that most of their research is published despite their collaboration with industry (e.g. Agrawal & Henderson, 2002; Mendoza & Berger, 2005; 2006; Slaughter et al., 2004). Generally, the cases of biomedical and biotechnology are presented as an exception (Krimsky, 2003). Some studies indicate that university administrators are more eager than faculty to find alternative sources of revenues through the commercialization of faculty research (Adams, Chiang, & Starkey, 2001; Cohen et al., 1998; Debackere & Veugelers, 2005; Hum, 2002; Powell & Owen-Smith, 2002).

A few scholars have discussed potential negative implications of industry-academia collaborations on students including intellectual property issues and delayed graduations, concerns about the quality of

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education through industry-sponsored projects, potential labor and intellectual exploitations, and a socialization toward a culture that favors a business-like culture (Slaughter, Campbell, Hollernan, & Morgan, 2002; Gumport, 2005). However, positive implications for students are abundant in the literature as well such as meaningful educational opportunities, funding, networking opportunities for future employment, and social and academic involvement (Debackere, & Veugelers, 2005; Gluck, 1987; Mendoza, 2007; Stephan 2001).

**The Need for More Research and New Conceptualizations**

The mixed findings and interpretations in the literature indicate that all we know about industry-academia collaborations are bits and pieces of a colorful guild of many textures. Significant questions remain unanswered. Under which circumstances are academic freedom, basic science, free dissemination of knowledge, and education being compromised? This question calls for more research and new conceptualizations. In the same vein, Kezar (2004) makes the case that the marketization of higher education has brought the nature of higher education into question, to the point that we need to engage in dialogues to renovate the charter between society and postsecondary education. Kezar also indicates that more research is needed in order to comprehend the extent of implications involved. Tierney (2006) also discusses the need for a dynamic image of the public good, which has to be re-defined as society experiences significant changes through dialogues with actors from different cultural understandings—the polity.

Integrating multiple and diverse voices into a debate about the public good of higher education is the challenge ahead of us. I join the voices of Kezar (2004) and Tierney (2006) calling for more research and new conceptualizations of the public good of higher education in today’s socio-economic sphere. I add to this calling the need for close examination of contextual considerations and deeper understanding into future research and conceptualizations. The academic profession is a conglomerate of tribes spread along institutions and disciplinary lines with different cultural layers that define norms, values, rewards, and expectations (Becher, 1989; Tierney, 1988). Therefore, it is likely that each of these academic tribes experience and view the marketization of higher education differently. Unfortunately, the vast majority

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of empirical studies have been conducted with samples of faculty from multiple institutions and disciplines, with almost no consideration to the unique array of shapes and colors present in each academic tribe and academic unit. I argue that this might explain to some extent the mixed findings and conceptualizations found in the literature.

**The Contextualization of the Academic Profession**

In the 1970s, a consensus began to emerge about what should be the professional norms of the American professoriate, beyond the traditional task of teaching. Since then, faculty are expected to push the frontiers of knowledge in their disciplines and look after the quality of scholarship through peer review processes and rewards. Disciplines established professional organizations as a means to set standards of performance and provide a platform for the scholarly development of the discipline. These associations helped to foster communities of scholars beyond geographical boundaries and became the main source of professional identity for academic professionals. Academic freedom and free dissemination of knowledge became the cornerstones of the academic profession. These two attributes are rooted in the belief that the creation of knowledge needs to be free from political, economical, and social interventions, and that the faculty have the responsibility to disseminate new knowledge for the public good. Faculty are also expected to apply their expertise to the service of their departments, institutions, disciplines, and communities (O’Meara & Rice, 2005; Rice & Sorcinelli, 2002; Tierney, 2004).

**Disciplinary Tribes**

Organizations’ workings are shaped by external influences, and also by their culture. Organizational culture embodies the values, processes, norms, and goals shared by the organization’s members. It affects how things are done and how decisions are made. Culture is an interpretative frame of reality that gives meaning and purpose to the actions undertaken by its members (Schein, 1985). Culture in higher education has been conceptualized as a dynamic conglomerate of subcultures distributed along four layers: the external environment, the institution, subcultures within the institution, and individual actors (Kuh & Whitt, 1986; Tierney, 1988). For example, the marketization of higher education constitutes an
important shaping force in the current external environment in which higher education institutions are immersed. Each campus has a distinct institutional culture, which constitutes the second layer. Nevertheless, it is possible to recognize common traits of organizational culture across types of institutions. The third layer refers to the numerous subcultures that operate within institutions. Administrators, faculty, and students constitute the three main subcultures on campuses; however, multiple sub-subcultures are embedded within these three constituencies. For example, student organizations, departments, and administrative units represent sub-subcultures among students, faculty, and administrators respectively. Finally, the fourth layer refers to the role of individuals as shapers of culture, such as presidents, heads of departments, and individual faculty members.

Faculty members’ perspectives, experiences, and actions are shaped by a dynamic overlap of layers of culture. For example, the culture of academic departments is influenced by the culture of the institution and is a significant source of identity for faculty members. Similarly, the overarching core culture of the academic profession is also a key component of the cultural identity of faculty. This academic culture is shared by faculty regardless of their disciplines and it is based on the concepts of academic freedom, individual autonomy, production and dissemination of knowledge, collegiality, collegial governance, service to society through the production of knowledge, and education of the young. Nonetheless, discipline-based subcultures are the primary source of identity and expertise for faculty members. Disciplinary subcultures shape assumptions about what is to be known and how, about the tasks to be performed, standards for effective performance, patterns of publication, professional interaction, and social and political status (Becher, 1989).

The Pasteur’s Quadrant

To understand cultural differences across disciplinary boundaries, it is useful to consider common ways of classifying disciplines. The Kolb-Biglan classification of disciplines is a two-dimensional plane with one axis being applied-pure and the other being soft-hard. Hard disciplines are high consensus fields with well-developed causal theories and generalizable findings. Soft disciplines are low consensus fields with unclear boundaries, multiple perspectives, and loosely defined problems. Pure disciplines are
concerned with the search of truth not directly applied to real world problems, while applied disciplines explicitly seek applications to society. Located at the hard-pure end are the natural sciences and mathematics; at the pure-soft end, the humanities; at the hard-applied end, engineering; and at the soft-applied end, social professions. Both hard-pure and hard-applied disciplines are expensive and depend heavily on external funds, which makes them more vulnerable to external pressures (Becher, 1989; Kolb, 1981).

Later in 1997, Stokes offered a different conceptualization of disciplinary boundaries. His work is particularly informative for the understanding of the process involved in technological innovation, which is a major driving force behind industry-academia collaborations. His framework is based on the assumption that “the belief that the goals of understanding and use are inherently in conflict, and that the categories of basic and applied research are necessarily separate, is itself in tension with the actual experience of science” (Stokes, 1997, p. 12). Stokes argues that the separation of basic and applied research, inspired in great part by the ideal of pure inquiry in Western scientific philosophy, “is woven into the dominant paradigm of science and technology policy and perceptions of science held in government, the research community, and the communications media” (Stokes, 1997, p. 9). I argue that this paradigm of separation of basic and applied research is also embedded in the marketization of higher education discourse, which shades the realities of faculty work in certain contexts.

Stokes builds his argument through a series of historical examples. For example, the main goal of the Manhattan project was to create the atomic bomb. Some might place the Manhattan project at the applied end of the spectrum by arguing that scientists used the fundamental knowledge from nuclear physics to develop a warfare technology. However, although the goal of the Manhattan Project was clearly an applied technology, many of the scientists involved were focused on basic science. In fact, the understanding of nuclear implosion developed by the scientists involved in the Manhattan project became essential for the study of supernovae. On the other hand, a great deal of technological innovation has been possible without the development of fundamental science. For example, steam engines were developed without the knowledge of thermodynamics. The first steps toward the development of modern
theories of thermodynamics were possible thanks to Sadi Carnot's study of steam engines. Stokes also argues that science can be inspired by a specific applied goal and conceptualized as such by a given sponsor. However, that goal can be distant enough to allow scientists to focus on basic research. The research sponsored by the National Science Foundation (NSF) is a good example of this "goal oriented basic research." Finally, Stokes argues that basic and applied research has been defined not by the nature of the research per se, but by the location where it is performed. For example, research conducted within corporate walls is generally considered applied. However, some might argue that faculty in public universities might conduct more applied research than many scientists in corporate laboratories.

To solve these complexities, Stokes developed a framework that integrates basic and applied research with degrees of use resulting in four quadrants of disciplinary differences. Stokes' framework corresponds only with the hard side of the spectrum of the Kolb-Biglan classification of disciplines. The upper left quadrant—the Borh's Quadrant—includes basic research that is guided solely by the quest for understanding without thought of practical use. Astrophysics is an example of a discipline that has only the goal of understanding the physics of astronomical objects. The lower right quadrant—the Edison's Quadrant—includes research that is guided solely by applied goals without seeking a general understanding of the phenomena. The Japanese have mastered this quadrant by conducting extremely sophisticated research narrowly targeted on immediate applied goals. The upper right quadrant includes basic research that seeks to extend the frontiers of understanding but is also inspired by considerations of use—the Pasteur's Quadrant. This quadrant is exemplified by research that drives toward understanding and is inspired by potential use. The classical example is the science of Louis Pasteur, who was committed to understanding microbiological processes that he had discovered and, simultaneously, he was motivated to use that knowledge to control food spoilage and microbial-based disease. The lower left-hand quadrant, which includes research that is not inspired neither by the goal of understanding nor by use, includes research that is driven by the curiosity of the investigator about particular things. Stokes mentions bird watching as an example of research in this quadrant, which purpose is to systematically study the markings and incidence of species.
Seeking new knowledge and understanding is a cornerstone of the academic profession. Therefore, faculty work is located in the Bohr’s and Pasteur’s quadrants. Industry-academia collaborations are most likely to happen in the Pasteur’s Quadrant due to its proximity to applications in relation to the Bohr’s Quadrant. Throughout the remainder of this article, I present a case study that highlights how context in the Pasteur’s Quadrant shapes the canons of the academic profession and the impact of industry-academia collaborations.

**The Industry-Friendly Department: A Case Study**

The Industry-Friendly Department is a science and engineering department at a flagship public university in the Northeast. The Department was created to respond to the call from industrial leaders to educate workers in the basic science behind emerging technologies. Thus, the type of research conducted in the Department is inspired by use, which defines its faculty as an academic tribe in the Pasteur’s Quadrant.

The first day I went to the Department I experienced first hand the “haves” and the “haves-not” among academic tribes. After navigating through run-down classrooms and dull corridors escaping the cold winter, I finally open the last door to the Department’s $50 million state-of-the-art building I have heard about from many people and seen in many pictures. “Wow, is this part of a public university?” I said to myself in disbelief. It is a contemporary building that resembles a corporate facility in the heart of a metropolitan city but ironically located in a rural campus of a public university in budgetary strain. The chair’s office is in reality a suite behind glass walls with two receptionists and trendy furniture, a waiting room, and several offices along a hallway that leads to the chair’s office. The clerical staff looked like executive secretaries: well dressed, extremely busy, and yet ready to answer all my questions with swift diligence, professionalism, and a smile in their faces. “Dr. Chair is expecting you. Please have a seat,” I was told. I felt as if I was in an insurance company until the chair came to see me. As soon as I saw him I came back to the academic world thanks to his informality. He was wearing jeans, walking slow, and making clever jokes with an Asian accent. Throughout our conversation, I heard the voice of a professor, who had worked in industry for 15 years, talking about the value of education and basic research in the...
Department while recognizing the asset of industrial partners. In light of the discourse related to the potential corrosiveness of industry-academia collaborations, my objective throughout the study was to understand how faculty in the Industry-Friendly Department integrate industry-academia collaborations into their academic work.

**Methodology**

Qualitative research uncovers in-depth understanding of phenomena useful for conceptualizations rather than statistical generalizations. Denzin and Lincoln (2005) recently defined qualitative research as “a set of interpretive, material practices that make the world visible…. Qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them” (p. 3). Thus, I chose a qualitative approach to learn how faculty work is shaped by industrial collaborations in the Industry-Friendly Department, with particular attention to how faculty experience can bring meaning to industrial partners in their profession.

Due to my special interest in this specific department and given that faculty work in light of industry-academia collaborations is a contemporary phenomenon that we know little about, I used a case study methodology based on the works of Stake (1995) and Yin (2003). My interest in this department stems from the fact that it exhibits high levels of success in traditional academic terms, as well as close ties to industrial firms. As I illustrate throughout the study, this department represents a critical case that challenges some of the assertions made in previous works and highlights the centrality of context in the discourse related to the marketization of higher education. Deep understanding of how this context negotiates traditional faculty roles while partnering with industry will help future conceptualizations and investigations. Thus, this case study is not intended to make generalizations to other departments, but rather to expand understanding. In particular, this case study is instrumental to the illustration of the role of context in industry-academia collaborations. In order to draw focus to areas of concern and force attention to complexity and contextuality, I identified the following key issues from the literature as the conceptual structure that guided the design, data gathering, and analysis of the study: the impact of the

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Department’s collaborations with industry on 1) research, 2) academic freedom vs. intellectual property, and 3) education.

The type of case study used was descriptive and embedded where individuals involved in industry-academia collaborations were the unit of analysis. Although the study focused on faculty work, as a triangulation strategy, participants included not only faculty but also students, industry representatives affiliated with the Department, and the director of the Industry Collaborative Center of the Department. Data collection included semi-structured interviews, documents, direct field observations, and physical artifacts. I visited the site continuously during an academic year. In addition, I assisted with a job fair hosted by the Department, a graduate student conference in the field with representatives from other universities, and four sessions of a class on scientific and engineering management to prepare students in their roles as future academics or industrial scientists.

I used a stratified purposeful sampling strategy to select participants that would add to my understanding of faculty work in light of industry-academia collaborations. I interviewed 10 faculty members, which represented 85% of the entire faculty body at the time of the study. In addition, I interviewed 10 doctoral candidates that have been involved in projects sponsored by industry, 11 industry representatives of sponsoring firms, and the Center’s director. All interviews were recorded and transcribed. The interview protocol was adapted to each subgroup of participants and included questions about professional objectives and aspirations, experiences with industry-academia partnerships, and views related to the strengths and weaknesses of industry-academia collaborations. Also, participants were asked about issues related to secrecy of knowledge, intellectual property, commercialization of research, academic freedom, basic versus applied research, and education.

Analysis was based on the use of pattern matching techniques to match data to the issues defined as the conceptual framework of the study. As is true with any case study, the knowledge gained is mainly based on my interpretation of the evidence. However, to ensure the quality of the study, I followed Yin’s guidelines relating to validity and reliability. I used several triangulation strategies in addition to using multiple sources of evidence. In particular, I asked a colleague as a co-observer to interview with me the

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chair of the Department, and I consulted with him frequently throughout the study. I constantly searched for rival explanations or evidence and established a chain of evidence. I audited the research design, analysis, and final report with several peers in the field. Finally, I developed a case database.

**Lessons Learned**

The Industry-Friendly Department has around 180 doctoral candidates and postdoctoral fellows. Its diversity is above national averages for science and engineering fields, with about 30% of students women, 7% minorities, and 30% foreign. The Department enjoys a solid academic reputation in both research and education. It consistently ranks in the top ten in the field by the U.S. & News World Report and the National Research Council. The majority of its 15 male and one female faculty have won top notch international awards and are members of prestigious scientific societies.

The Department primarily accepts students into its Ph.D. program. Students who do not complete their doctorate might leave the institution with a M.S. degree. However, the Department’s doctoral retention rate is about 75%, which is well above national averages for doctoral degrees in general, which hovers around 45%. The Department also offers courses and research opportunities for undergraduate students. Students normally graduate from the Ph.D. program within five years and find jobs before graduation in industry or as postdoctoral fellows in prestigious universities. Admissions to the Ph.D. program are highly selective and normally the Department brings in potential candidates for on-campus interviews with all travel expenses covered. Students admitted are guaranteed five years of full financial support including tuition waiver, health insurance, and a competitive stipend significantly higher than the majority of assistantships offered in the University. In addition, students normally travel to several conferences throughout their doctorate with all expenses covered by the Department.

As is stated in a public document, the Department “takes great pride in... [the] extensive interactions with industries around the world,” which include more than 40 industrial partners such as 3M, ExxonMobile, Kodak, General Electric Company, and Procter & Gamble. All industrial collaborations are channeled through the Industry Collaborative Center, which is one of three research centers in the Department. Its objectives are to facilitate an industry-academia research consortium, one-on-one

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industry-sponsored research, unrestricted industry-research grants, and idea development of industry-related research projects. This center is one of the oldest Industry/University Cooperative Research Centers (I/UCRCs) founded by the NSF in the early 1980s to foster partnerships between universities and industry, with focus on new technologies, the education of scientists regarding these technologies, and the transfer of university-developed research to industry. Currently, there are around 50 I/UCRCs in the nation, with over 700 business partners providing 10 to 15 times the support from the NSF investment. According to the director, the Center is the longest running center of all I/UCRCs in the nation and has become a model for peer universities. Indeed, several faculty members also conveyed the success of the Center as one of the best of its kind. The other two research centers hosted at the Department are of less interest for the purpose of this study due to their lack of involvement with industry. These centers serve as multidisciplinary hubs of mainly academic researchers around the nation and are heavily supported by the NSF. However, it is meaningful to note that the Department is also actively involved in research that does not involve industrial sponsors, but mainly federal agencies.

Economic growth and wealth is clearly visible in the clean and sharp physical appearance of the Department. The six-story contemporary building has two wings connected by a hall where two modern elevators are constantly going up and down. The right wing consists of laboratories and the left wing of offices and conference rooms normally used for research group meetings. Students have offices in the left wing and spaces somewhere along the lab benches in the right wing where their experiments are located. Faculty normally share suites with a reception desk and several offices. As expected, the wealthier faculty have more clerical staff and bigger offices. Several times I found myself announcing my visit to a secretary and sitting in the waiting area of these suites. In other situations, when I wanted to visit faculty, I normally just knocked at the door. This is another example of how I experienced this blend of corporate and academic worlds. Faculty generally do not conduct experiments themselves, and the few times I saw faculty in the right wing was when they were either supervising or instructing students. Faculty are normally in conference rooms meeting with students, in their offices, or traveling. They resemble project managers in informal clothes more than scientists at the bench. Students work long
hours either in the lab wearing white lab coats and goggles or behind computer monitors. I always saw lights on, contrasting the dark campus each time I drove by late at night, even on weekends and holidays. The Department’s wealth is also reflected in the laboratory facilities and equipment. In public documents, the Department states that it is one of the largest centers of research in the field worldwide, with over $25 million in instrumentation. Several industry representatives told me that access to state of the art equipment was one of the main reasons why they seek collaborations with faculty. International students from developing countries vividly highlighted what they consider to be the outstanding facilities of the department. Domestic students also acknowledge the state-of-the-art facilities, but with less enthusiasm. Interestingly, one student from Mexico told me that back at home he normally had only 10 samples to run a experiment, whereas now he has unlimited samples thanks to the “ProCard” given to him that allows him to order as many samples as he wants. He explained how this has changed the way he conducts research from careful and thoughtful planning to trial and error.

Research

As members of the Pasteur’s Quadrant, faculty in this department engage in use-inspired research that aids the development of new technologies while advancing the basic science in the field at the same time. This is facilitated by industry-academia collaborations:

Academia is where some great ideas are born, where a lot of the core research gets done and is up to the companies outside to take it to the next level. Industry gives feedback to academia of what is actually doable on an industrial scale (Quote by a student).

In an attempt to gauge how close research was to industrial products, I asked faculty and students to describe their projects. Also, some students took me to their labs to show me their experiments. The objective of all the projects I learned about is to understand the fundamental science behind technologies rather than to contribute to the development of specific products. I further corroborated this by comparing the Department’s research with the products and services of industrial sponsors. This is partially explained by the fact that faculty are driven by intellectual challenge and fundamental understanding rather than by product development; and thus, they strive to engage in projects that meet

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these goals. Several faculty told me that if they were interested in product development and lucrative returns, they wouldn’t be in academia, but in industry:

I’m not interested in just cranking out the next thing because some industry thinks they want to do something [with it]. If there’s a fundamental challenge in it – if there’s an intellectual challenge in it – then I think [I will be] able to help (Quote by a professor).

Also, when I asked industry representatives why they seek collaborations with faculty, the most common response was to understand the basic science driving their specific products, and to invest in the knowledge needed for the next breakthrough technology in the future. None of the participants believed that the Department has an overemphasis in applied research because for them, applied research means product development:

[Faculty] shouldn’t look at industry as just coming in, trying to generate task-oriented work and gaining an extra pair of hands in helping them with problems. In many cases, they are really very interested in advancing knowledge and understanding the basics as to why things work the way they do (Quote by an industry representative).

Nevertheless, some faculty and students pointed out important differences between projects sponsored by the government and by private firms. Some faculty prefer NSF funding while others prefer industrial funding. Generally, NSF grants have longer timelines and support even more fundamental projects than companies’ grants. Interestingly, those involved with grants from the Department of Defense described these projects as very applied and restrictive and in the majority of cases, even more so than corporate funding. In sum, projects in this department lie all along the basic-applied spectrum of the Pasteur’s Quadrant and yet, quite far from product development.

Based on concepts of social capital, Tierney (2006) argues that individuals create structures and networks of more or less institutionalized relationships. These networks are rich sources of social capital that enables or disables individuals to accomplish particular goals. Faculty establish networks of social capital on their campuses, (for example, structured networks such as senates and informal relationships with colleagues) and in their disciplinary associations of academics, as the main source of intellectual

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networks and disciplinary culture. Based on this case study I argue that in the Pasteur Quadrant, where research is inspired by use, intellectual networks also include partners from organizations outside academia involved in technologies related to the science of the Quadrant.

In this department, industry is much more than just a funding source for faculty but also part of their intellectual network. It is a source of social capital for research ideas, insights, feedback, and scientific collaboration. Industry representatives normally lend assistance to academic conferences in the field and many collaborations start at these venues. Also, the Department hosts a semiannual conference where students showcase their research and industry representatives interact with students as potential future hires, while learning about the research in the department. Students who have participated in these conferences mentioned that one of the biggest benefits of industrial collaboration is research topics for their dissertations. They highlighted the quality of feedback received by industrial representatives in these encounters, and considered these relations a valuable asset for current and future investigations. Students valued this feedback particularly because it provided them with a different perspective, described as “down-to-earth,” “realistic,” and “useful.” Similarly, industry representatives consider that it is beneficial for academia to be in tune with industrial research as a source of not only potential funding, but also research ideas and as a way to contribute to the development of useful technologies for society. In the words of a faculty member:

Many of the positive aspects are ... exposure to new ideas ... just the opportunity to learn ... access [to] material that is covered under patents, intellectual property behind the veil of trade secrets that companies aren’t going to reveal. So working with industries you learn a lot in going and talking with each company and seeing what they’ve mastered.

Both faculty and industry representatives positively described their relationships as very collegial and helpful; as one industry representative put it, “I can call up anytime I want to discuss something whether or not we have a current project going on.” In some cases, these relationships have a long history of exchanges to the point that favors become common, such as last minute grants to help a faculty member support a student, or even testimony to help a firm with legal suits.

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In these collaborations, physical and human capital is also exchanged. These quotes by faculty members portray the complex exchange of capital that occurs as these relationships mature, as well as the controversies around them voiced in the discourse found in the literature:

We have a bunch of... expensive instruments... and if a company is supporting research in our lab... often times... we have more intellectual liaison than just that research project. People at the company know people here. They come to the meeting, students and post-docs know the scientists, they talk about things and they... get to a point that they say... “geez you ought to get a photoelectron spectrum of that” and the company will send a sample... and we’ll get a photoelectron spectrum of it and send it back because it interested us, they’re supporting our research... makes the world a better place. Now, someone might look at that with a sharp knife and say “wait a minute, that goes across the boundaries, here you’re using state facilities to do analytical services for a lab” and you say, you know, “I’m helping a friend out”... their company supports research here... I’m interested in what they’re doing... we want them to continue to support research here. If we can... do a quick measurement on something it’s all right then...

I have three post-docs... supported by industry at some point in time. They’ve been supported in lots of different ways. I’m not rich. I have to patch together money to get the paychecks out... They realize that they’re being supported by company X to do this. That doesn’t mean that is the only thing they do. That project is just what pays the bills.

Some observers view these exchanges in opposition to the public good of higher education. However, faculty in this department justify these actions as necessary means to accomplish their duties of educating and supporting students and conducting publishable research, given the current climate related to availability of funds for research. Also, faculty in this department do not believe that the public good is being compromised in these types of exchanges, because many times they occur within a mature scientific relationship that has evolved over many years. In these cases, faculty see industrial counterparts as part of their intellectual community working together for the advancement of knowledge and technologies for the public good.

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Faculty in this study believe that academic freedom is of paramount importance to scientific research. Therefore, they constantly negotiate with sponsors so that their freedom of research is not significantly affected and have found ways to satisfy their scientific interests with plenty of academic freedom while simultaneously pleasing sponsors. To accomplish this, faculty members explained several strategies that they use to maximize their academic freedom in light of funding constraints, such as keeping a diversified funding portfolio, and writing proposals in a way that appeals to the objectives of the funding agency.

Students also commented on the strategies used by faculty to protect their academic freedom:

If something on the way pops up that is of interest, we'd be allowed to pursue that, [as long as we] develop it as another side project and work on it a little bit and then maybe pass it to a newer graduate student. Certainly everyone has their personal interests, and they try to spin them in such a way to look like they fill in certain edge where they can make some money for funding numerous projects but still stay within their own personal interests.

This is possible due to their privileged position of being part of a top-ranked department, and their clever strategy to present their proposals in a way that appeals to funding agencies while leaving enough room for their own scientific interests. As faculty establish mature research groups that successfully attract both federal and industrial grants, they are able to accumulate enough wealth to pursue projects indirectly related to grants. This raises important questions about uneven distribution of wealth across academic institutions. Finally, this is also facilitated due to the nature of the research in the Pasteur’s Quadrant where faculty are naturally attracted to research that contributes to technologies in the short term or the long term. Thus, in this context, working on research related to products is not necessarily a constraint to academic freedom. Some faculty members prefer to work in research closer to existing technologies. For them, this is not a restriction of academic freedom but a matter of personal preference.

Participants indicated that one of the greatest inconveniences of industry-sponsored research that has potential to affect academic freedom was the short term nature of these sponsorships, and the uncertainty of forthcoming funding in the near future. Incompatible timelines between the academic and industrial

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worlds also constitutes a significant downside in these partnerships; as one industry representative expressed it, “We always want things on a schedule, which they might find burdensome.” Students are more likely to feel the pressure to produce timely results. However, here again, some faculty indicated that sometimes government grants can be just as or even more restrictive than industrial grants:

You also run into this with grants from DARPA… and these contract offices can turn around and say “We’re coming tomorrow.” I don’t have DARPA money. I’m very reticent about doing it because of that. (Quote by a professor).

Both industry representatives and faculty recognized that the value industry places on basic research to develop new technologies and gain a better understanding of their products is the key for academic freedom:

I think that people in academia have the impression that folks in industry are short-term, task-oriented, “get a product to market,” and they don’t think about pushing the frontiers of knowledge… But really, a number of large corporations do have activities going on in the background that, in some areas, are fundamentally ahead of what’s going on in academia. And honestly, I wish they wouldn’t worry so much about [short-term results]. We’re paying them to do things we can’t do. We really are paying them to learn from them. (Quote by industry representative).

**Free Dissemination of Knowledge vs. Intellectual Property**

Faculty in this department contested that secrecy of knowledge is not an issue in their work because they engage in science that is publishable and only remotely connected with proprietary knowledge. This is possible due to the fact that faculty are not interested in patenting as much as publishing, and industry is not interested in sharing intellectual property with universities. Some of the faculty in the department have patents but none of them receive substantial royalties from them. Faculty see their patents as byproducts and incidental. They all made it clear that what matters are publications. In addition, corporate and university lawyers sign an agreement beforehand to avoid conflicts. These agreements give industry a grace period where they can file for patenting any knowledge before publication. Normally

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this is not an obstacle to publishing because the timelines for publications are much longer than for patenting, and once knowledge has been filed for patenting, it can be published.

However, sometimes collaborations are frustrated because lawyers could not reach intellectual property agreements. In fact, most of the complaints that I heard were about the University's intellectual property (IP) policy. Faculty and industrial representatives feel strongly against this policy due to the unrealistic goals and obstacles that it represents:

More than 10 years ago you could generally fund a project at a university and all the intellectual property that came out of it belonged to the company. Now there is virtually nowhere in the U.S. where you can find a university that will do that... And that's part of the reason for us going to other countries... I think universities need to evaluate their policies on intellectual property... because they don't really have the infrastructure in place to commercialize a lot of this technology (Quote by industry representative).

Faculty dissatisfaction with the IP policy reflects an inherent tension between faculty and university administrators that is normally overlooked in the literature.

Due to strict IP policies and agreements that govern industry-academia collaborations, most of the faculty have not had intellectual property conflicts with companies. In fact, the public cases known in the University do not involve the Department. However, some faculty members talked about issues they had with grants from the Department of Defense due to national security. Also, one professor narrated how he experienced problems when competitors sponsored their research because inevitably, faculty and students might end up learning about trade secrets as they interact with industrial sponsors. Thus, companies fear leak of information to competitors through the multiple interactions with faculty and students.

Students mentioned that they knew of isolated incidents were students had to delay publications or could not talk during job interviews about certain aspects of their research. Sometimes students in these situations were hired by the same company that supported their research to avoid any leaking of information that might occur if these students were to work in other companies. Also, industry

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representatives are generally sympathetic with students’ inability to discuss their research during a job interview due to confidentiality agreements with sponsors:

They can talk about things in general terms and when we interview someone that has a restriction like that – for example, from work they’ve done as a graduate student – we understand (Quote by industry sponsor).

Actually, industry representatives are more impressed when students have been involved in a patent than in peer review publications:

Frankly, I’m a lot more impressed with a graduate student who shows me a resume that has patent applications on it than somebody who has six publications (Quote by industry sponsor).

Overall, these findings speak of portions of knowledge that are kept secret, which has been heavily criticized in the literature. Interestingly, faculty and even students in this department do not see an issue with it and say that the type of knowledge that might be kept secret is too specific to applications, which is not of much interest to the scientific community. Therefore, they do not see a conflict of interests if they have to keep technical details secret as long as the basic science can be publishable in general terms.

**Education**

All faculty emphatically stated that it is critical for them to engage in projects that have a clear educational component for students and “serve as a safeguard so that the students are: 1) protected; 2), get an education; and 3), they can get their thesis,” as one faculty member said. This is particularly important because most of the leg work related to faculty research is conducted by students:

There are many times when companies will say, “We want to work in this.” And we’ll look at it and say, “Well, that will fit with support of a post-doc.” And they say “Well, why can’t we do it with a student? It’s cheaper.” And we’ll say, “Because the research doesn’t make for a good thesis. It is good research, but it’s not something that would eventually lead or help them with getting their thesis. And that’s paramount here” (Quote by the I/UCRC director).

What’s important to realize is that we are an academic institution. We’re not here to make products, we’re here to educate students, to provide them with

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the ability to do basic research. This isn’t an industrial laboratory (Quote by a professor). Similarly, industry representatives highlighted the strong commitment of faculty to protect students. However, they also recognized that some institutions have more flexibility than others when it comes to engaging in industrial work:

The bottom line that you’ll hear from all of them is, “Our objective is that we have to turn students out with Ph.D.s, so we need to have Ph.D.-level work.” But then you get some institutions where they do have Ph.D.-level work, but they also have time to do industrial work and post-docs and such because their labs can handle that. (Quote by industry representative).

In fact, students in this study believe the department does a good job in protecting their education from corporate interests:

Projects sponsored by industry are in the core of students' research for academic purposes. My advisor does a good job of trying to incorporate multiple projects, and he usually tries to have them all tie in together. Faculty pointed out that they are able to accomplish this overlap of projects because industrial projects within an area normally share a common fundamental theme.

This quote highlights the centrality of context by suggesting that other departments in this same field might engage in industrial collaborations differently.

The discourse on the marketization of higher education voices concerns regarding the training of students through projects sponsored by industry, because these projects are conceptualized as product-driven with a lack of sufficient fundamental science to properly train students. Contrary to this view, both faculty and students in this study department believe that there is always fundamental science behind any applied research and, therefore, as one professor said, “Fundamental research and applied research are equally effective venues for educating students.” These assertions also agree with Stokes’ view of research in the Pasteur’s Quadrant (1997). Industry representatives also value the training of potential future workers in fundamental science:
We’re really looking for how competent the individual is, how well do they understand the underpinnings of the science, and what have they done in planning out their research and carrying it out, rather than the specifics. We’re not as much interested in the specifics. (Quote by industry representative).

Overall, faculty, students, and industry representatives in this study strongly believe that the impact of industry-academia collaborations on the education of students is very positive. Some of the benefits mentioned include: exposure to the industrial world; assistantships; networking opportunities for potential jobs after graduation; research projects with industrial applications; learning opportunities about different communication styles; and seeing the impact of their research on society:

Seeing a reactor that is 50,000 gallons is mind-blowing the first time you see it. I mean, you’re dealing with research that is real... a lot of those people are going to work in industry, where you have to tie in what you’re doing with some results that have impact, and I think the interaction with industry helps students realize that (Quote by the I/UCRC director).

These partnerships provide students with a realistic understanding of the industrial world, which helps them in deciding whether they want to follow an academic or an industrial career. In fact, about 80% of the students end up working in the companies that sponsored their doctorates after graduation:

I think the most positive aspect of industrial sponsorship – and this is most powerful for a student who in his mind wants to go into industry – is that you have the opportunity to hook the students up with the people from the company, have them tour the lab, meet with them, see how these people think, see how this particular company’s culture is... and the student can get a very quick and clear insight as to whether this is really for them. (Quote by a professor).

And for industry representatives, partnerships with industry are an effective recruiting tool:

The other main reason they are here is so they can attract our students. Several companies have said to me, “We don’t care what you do with the research money, we just want to be there to meet your students so they know who we are and so we know who they are (Quote by the I/UCRC director).
Participants believe that interactions with industry are also critical for those students who might follow academic careers, given the applied nature of the field and the current funding trends, from both federal and industrial sources, which depend heavily upon industrial needs. In addition to this, both students and faculty mentioned that industry-academia collaborations expose students to other avenues of communication outside of the academic world, with students personally interacting with industry representatives individually, giving presentations, or writing reports to industrial sponsors.

The only negative impact of industrial sponsorship on students voiced by participants was the funding insecurity associated with these types of grants, which does not allow faculty to support students throughout the entire length of a doctoral program with one grant, forcing them to find similar projects to make a dissertation. There have been instances where funding was suddenly cut, causing significant harm to students:

There was one instance [where] their funding dried up in the middle of their research and they had to go choose a whole different project... they had two chapters of their thesis done, working on their third, and then, Boom! Done! So then they had to go and get permission to publish and had to go start something completely new, [which] delayed them from graduating. (Quote by industry representative).

In summary, there is an overwhelming belief among participants about the educational benefits of collaborations with industry. However, things might look different in other academic departments, as it was hinted by industrial sponsors who interact with faculty from other institutions.

**Discussion**

The lessons learned in this case study mirrors the mixed discourse in the literature. However, these mixed messages can be attenuated significantly if we place the results within proper contextual boundaries. This case study revealed areas of concern for the public good such as secrecy of knowledge, instability of corporate funding, sponsors’ constraints of research, and encouragement of a culture that favors research useful for private companies. However, these concerns were found as isolated and minor incidences when compared to the benefits that industrial partners bring to the Department. In fact, for the

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most part, faculty work is shaped by the traditional cannons of the academic profession of academic freedom, the quest for knowledge and understanding, free dissemination of knowledge, and education. From their perspective, faculty are committed to the traditional values of the academic profession and the public good. This is possible due to the nature of the discipline and how it shapes the academic culture in this particular tribe. This department belongs to a discipline in the Pasteur Quadrant, where by definition, research is inspired by use; therefore, industrial products and technologies become the source of inspiration for research. Moreover, industry representatives are part of faculty’s intellectual network and an important source of social capital in this department.

My intention is not to de-emphasize those areas of concern found in this case study but to frame them within the proper context. Dialogues, conceptualizations, research, and practices should focus on how to minimize those issues in the Pasteur Quadrant, rather than on questioning whether industry-academia collaborations should exist. This is out of question, given the central role of industry in academic tribes working on use-inspired scholarship. However, it would be more beneficial to society if this department expanded their collaborations to non-profit organizations such as hospitals and environmental agencies.

These results are not generalizable to all disciplines in the Pasteur Quadrant. In fact, the worst cases of academic corruption and misconduct most likely occur in biomedical research, which is also located in the Pasteur Quadrant. Krimsky (2005) presents an impressive account of cases in biomedical research where corporate intervention and academic entrepreneurialism has broken the integrity of the public charter between society and academia. Ironically, Ramaley (2005) argues that faculty can best serve the public good if they tailor their scholarship towards the Pasteur’s Quadrant. She blended Boyer’s concept of engaged scholarship (1990) with Stokes’ notion of use-inspired research (1997) to build a case claiming that it is possible and desirable to integrate research, teaching, and service into an engaged scholarship inspired by useful application not only for industry, but for the betterment of society at large.

Both Ramaley and Krimsky are painting two real and plausible worlds in the Pasteur Quadrant. Again, this exemplifies the centrality of context. The critical factor that distinguishes them is profit. I argue that the public good of higher education is seriously compromised when the academic world enters

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the world of profit-making. However, it is possible for faculty to partner with the private sector as a source of social capital and funding for research without the quest for personal profit, as I found in this study. In the Industry-Friendly Department, faculty are not interested in personal monetary gain from their research. Thus, the academic culture in this department preserves, for the most part, the traditional canons of the academic profession. Faculty in this department lie somewhere between the faculty described by Krimsky and Ramaley. The cases reported by Krimsky portray successful scientists in biomedical research as individuals that make contributions to the advancement of knowledge, while actively profiting from the commercialization of such knowledge. This image is in stark opposition with Ramaley’s image of engaged scientists advancing knowledge while serving communities without personal profit.

Isabelle (forthcoming) developed a framework that is particularly useful to conceptualize industry-academia collaborations. This framework expands Stokes’ two dimensional taxonomy of disciplines (1997) into a three dimensional classification that adds the critical role of profit-making in the academic profession. Isabelle contends that Stokes’ framework does not capture the complexities of knowledge production in today’s global economy, where proprietary knowledge has become an engine of economic growth. Stokes’ quadrants have to be embedded within a third dimension, that of proprietary vs. open-access research. This dimension refers to the norms of appropriation and control of research results. In other words, this dimension states whether knowledge is published through traditional venues such as scientific journals or use for profit through patents and by simply keeping it secret. In this framework, research in the Pasteur’s Quadrant can be open-access-use-inspired in one extreme or proprietary-use-inspired at the other end. Ramaley’s world lies at the former extreme whereas Krimsky’s world lies at the latter. The Industry-Friendly Department is somewhere between, but much closer to the open-access-use-inspired side.

The contextualization of the marketization of higher education has to consider not only differences across disciplinary tribes but also across the various layers of academic culture that shape faculty work.

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For example, industry representatives in this study described how each institution relates to them differently and has a distinct culture. Some departments seem to have a culture more receptive of research related to industrial needs. Also, institutional differences in relation to industrial partnerships might be influenced by levels of prestige and wealth. In other words, less privileged departments might be more willing to serve industrial needs than departments with a comfortable stream of research funds, as is the case in this department. Within the institutions, the conflicts around the University's IP policy in this case study illustrate cultural clashes between the subcultures of university administrators and faculty. This policy is eagerly enforced by university administrators, who hold a different culture and objectives than faculty, in hopes of generating streams of revenue from faculty research. However, this policy is very unpopular among the faculty in the Department and it is seen as the main obstacle for them to engage in collaboration with industry that would provide faculty with significant social capital for their academic purposes.

In sum, the implications of industry-academia collaborations highly depend on contexts. Cultural frameworks offer a powerful lens with which to understand the impact of these collaborations on the public good of higher education. This is true because higher education is composed of many subgroups and layers of culture, each interpreting and acting differently within the marketization of higher education paradigm. I have presented a critical case highlighting the paramount need to situate the discourse on the marketization of higher education within cultural boundaries of understanding. The culture associated with each nation, institution, academic tribe, department, and individual shapes academic work. I contest that democratic dialogues to redefine the public good of higher education in the global economy should include multiple voices from multiple contexts, which are all part of higher education.

References


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