UNDERSTANDING THE ENVIRONMENT OF THE COMMERCIALIZING UNIVERSITY RESEARCHER: CASES FOR COMMERCIAL SUCCESS

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By

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The undersigned, appointed by the dean of the Graduate School,

have examined the Dissertation entitled

UNDERSTANDING THE ENVIRONMENT OF

THE COMMERCIALIZING UNIVERSITY RESEARCHER:

CASES FOR COMMERCIAL SUCCESS

Presented by James R. Gann

A candidate for the degree of

Doctor of Education

And hereby certify that, in their opinion, it is worthy of acceptance.

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DEDICATION

To my wife, Marilyn, thank you for your unwavering support and love as I completed this journey. OLYMPIC.

To my daughters, Callie and Abigail, thank you for your patience with me as I spent time away from you.

To my Mom and Dad, as you look down from above, thank you for creating me as I am. I only hope that the commitment and service to business and education you instilled in me continues to shine through this document and my life.

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ABSTRACT

UNDERSTANDING THE ENVIRONMENT OF

THE COMMERCIALIZING UNIVERSITY RESEARCHER:

CASES FOR COMMERCIAL SUCCESS

As the U.S. continues its transition from an economy based upon manufacturing to one based upon innovation, one must look at the environment of the person at the epicenter of this change: The commercializing university researcher. This investigation provides insight into the cultural and regulatory life of the commercializing researcher, with the outcome an overview of conditions that either facilitate or hamper the process of technology transfer. Codified by this investigation, these conditions would be informative to those seeking an improvement in institutional technology transfer success.

CHAPTER 1 - INTRODUCTION

Public research universities tend to organize themselves around the missions of teaching, research, and public service. Historically, the teaching mission of the institution was heavily subsidized by the state, which saw student access to higher education as an important public interest. Research was conducted primarily for governmental agencies, and was largely for basic science to expand the frontiers of the known. The mission of public service was more loosely defined, and came to be a catch-all for all of the other ways the institution would impact the world around it (Rhoten & Powell, 2011). Today, these same institutions find themselves "…challenged in the wider society as calls for commercial engagement, broader impacts, and economic development have echoed throughout the country" (Rhoten & Powell, 2011, p. 320). Public support for higher education is declining. The demand for applied research from governmental agencies and industry is increasing, and institutions must position themselves as being relevant to serve the emerging, technology-based economy; a key value to the locale, the state, and the nation (Basken, 2012; Slaughter & Leslie, 1997).

At the center of this metamorphosis is the researcher who creates technologies that can be commercialized. This study yielded insight into the departmental culture and organizational policy conditions that directly impact individual researchers. Collectively, these impacts facilitate or hamper the transfers of technology from academia to the commercial world through by directly affecting the researcher's actions.

The environment of a commercializing researcher at an institution that performs technology transfer more successfully varies greatly from the researcher environment of

an institution that performs this function less successfully. This study sought understanding in these differences with the purpose to inform the practice about the conditions that may contribute to more successful transfers of technology from the institution to the commercial world. For the purposes of this study, success is defined as the ratio of total research expenditures consumed by the institution to the number of license agreements and license options executed as defined by the *overall commercialization pipeline* (DeVol, Bedroussian, Babayan, Frye, Murphy, Philipson, 2006) This ratio was computed by summing the most recent 5 years of data, and institutions were compared and ranked from "more successful" to "less successful" institutions in technology transfer.

Problem Statement

Background

Recent years have seen a marked decline in state support for higher education. Using the University of Missouri as an example, state appropriations accounted for 55.8% of operating revenues in FY 2000, and by FY 2009 this percentage had fallen to 38.8%. As state support dropped, the University looked to its students to make up the difference, with students shouldering the majority of their educational costs beginning in 2004 and continuing to the present ("State Funding for Higher Education and the University of Missouri - Key Points," 2009).

During the same time period (FY 2000 to FY 2009), the University of Missouri System grew its external support for research by 102% and is now receiving just under $200 million per year (Kordal & Sanga, 2010). This amount is equal to approximately

one-half of the revenues from state appropriations currently as compared to one-third 10 years ago.

Prior to the Bayh-Dole Act in 1980 ("The Patent and Trademark Law Amendments Act of 1980,"), universities subordinated their rights to intellectual property created through federal funding to the U.S. government. After the enactment of Bayh-Dole, universities could claim intellectual property funded the government as their own. This change led to the establishment of *technology transfer offices* and fostered the concept of technology-based economic development as society slowly shifted away from an economic base of manufacturing and toward an economic base of innovation (Longworth, 2008; Rhoten & Powell, 2011). This transition has been magnified during the recent economic crisis during which manufacturing has declined at a much faster rate (Uchitelle, 2011).

This economic transition, and the role the university can play in it, has not been without controversy. A review of pertinent literature has enlightened me to the issues around academic capitalism, research integrity, and inherent conflicts of interest. There is much discussion within some segments of academe as to whether the path of commercialism is one higher education should take (Rhoades & Slaughter, 2004; Slaughter & Leslie, 1997; Thursby & Thursby, 2002; Zax, 2010). I understand this sentiment, but do believe that an opportunity exists for win-win-win relationships, where industry obtains access to technology that increases competitiveness, higher education benefits from the revenue generated from the application of that knowledge, and students can actively work solving “real” problems from industry rather than simulated problems contrived by an instructor.

Statement of the Problem

Why are some institutions more successful in technology transfer than others? There are a multitude of possible explanations, of course, but I cannot locate substantive literature documenting the academic climate around the researchers, and am curious if differences in culture, both social and policy-induced, can account for some degree of difference in measurable outcomes.

Rationale for Significance

In 2010, the 150 institutions of higher education responding to the Association of University Technology Manager's Annual Survey reported total research expenditures of $53.2 billion (Kordal & Sanga, 2010). A substantial portion of that amount was spent on basic science for the expansion of the base of human knowledge, but one output of this research was the creation of 988 licenses and options of technologies to commercial entities with the intent to better our lives (Kordal & Sanga, 2010).

As a proxy for a commercial product, I have chosen to use license agreements and options on licenses. Licenses represent a financial commitment on behalf of a commercial entity to contractually use the technology selected. Assuming that a license or option agreement represents a new commercial product, and divide that quantity into the amount of funded research, the product will be a yield of research dollars to licenses issued. According to Kordal and Sanga (2010), The University of Nevada at Reno executed one technology transfer license agreement in 2010 with inputs of $95.4 million in total research expenditures. Conversely, Brigham Young University consumed $28.5 million in total research expenditures and yielded 27 license agreements. Instead of $95.4

million per license in the case of the University of Nevada at Reno, Brigham Young yielded one patent on $1.1 million in research – roughly 90 times the productivity.

I believe that institutional culture and local policy can affect the efficiency of technology transfer both positively and negatively. Imagine the potential benefit to society if the enabling policies and cultural attributes of efficient institutions can be adopted by those that are less efficient. I believe that any improvements in this arena could not only better humankind, but assist in hastening the economic transition being experienced by our country.

Research Purpose

The purpose of this multiple case study was to explore the social factors that may affect the environments of researchers participating in the transfer of new technologies from academia to the commercial world. The intent was to gain environmental understanding of the life of a commercializing academic researcher. By comparing the social environments in institutions that are more successful in technology transfer to the social environments in institutions less successful in technology transfer, illustrative differences were discovered. It is believed that these differences can be used to inform the practice, and assist those institutions in becoming more successful in technology transfer if they so desire.

Research Questions

The research questions guiding this study are:

1. When comparing more successful institutions with less successful technology transfer institutions, what cultural factors contribute to the work environment of the commercializing researcher?

2. When comparing more successful institutions with less successful technology transfer institutions, what policy factors contribute to the work environment of the commercializing researcher?

Conceptual Framework Guiding Study

Organizational Culture

For a researcher to function effectively within an academic unit, the researcher must be able to integrate effectively within the unit and understand how to behave, as well as understand the behaviors of others. These norms become shared traditions for the unit and are communicated internally and externally by symbols and ritual (Bolman & Deal, 2008; Bush, 2003). Useful for determining the dimensions of the departmental culture were Dimmock and Walker's (2002) "seven dimensions of societal culture", which address issues of power, self-orientation, aggression, activism, innovation, relationships, and gender dominance. Through a holistic view of the researcher situated in a department, departmental values were determined to understand organizational will in the realm of technology transfer.

This portion of the conceptual framework guided participant interview questions on all 7 dimensions. The purpose of these questions was to assess the thoughts of the researchers within the environment as well as those participants viewing the environment externally to gain understanding on departmental reality regarding the dimension. For example, on the dimension of power, is there a difference in the concentration of power between the two institutions being compared? To determine the answer to this question, the assessment of each sample department was required, and a determination was made to

the question: Is power distributed amongst the various levels of the culture, or is the power concentrated within one level?

This same concept of continuum and relative placement along the continuum holds for the other six dimensions of culture as well. Does the department perceive itself to be group or self-oriented? Is the department prone to give consideration or promote aggression in interpersonal relationships? Does the culture of the department hold a proactive view of the future or a fatalist view? Does the culture promote the generation of new ideas or does it merely replicate the ideas of others? Are departmental relationships limited to work or do they extend more holistically into other areas of social life? And lastly, does the department operate in a male-influenced or female-influenced manner?

Policy

Concurrent with a researcher's participation in departmental activities, the researcher is also situated within a larger university bureaucracy. As a recipient of federal funding for research, the organization is subject to the Bayh-Dole Act ("The Patent and Trademark Law Amendments Act of 1980," 1980), but the actual rules governing implementation are locally set, which can lead to an internal quasi-legislative process of negotiations between competing agendas to create a set of internal rules that are not uniformly enforced (Smith & Larimer, 2009). This study focused on the actions of the institutional technology transfer office and the interpretations of policy and rules made by the *street-level bureaucrat* (Lipsky, 1971, 2010; Weber, 1964) housed therein. Typically, this person is a licensing associate charged with rule interpretation and management of the intellectual property created by the researcher. Of specific interest were those rules that are viewed as barriers to technology transfer and those that accelerate the process.

Design and Methods

Design

A *multiple case study design* (Stake, 1995; Yin, 2009) was chosen because the attributes of culture and impact of institutional rules lend themselves to *thick, rich qualitative descriptions* (Cresswell, 2007; Mertens, 2005). Because the purpose of the study is to inform the practice on conditions that may or may not exist in comparative sample institutions, it was believed that these differences might be best illustrated with this methodology. The phenomenon of the case study was the process of technology transfer from academic research into a commercial product. The *quintain* (Stake, 2006, p. 4) of the case study was the department of the commercializing researcher. Individual mini case studies consisted of commercializing researchers at multiple sites. Data from these cases were enhanced by interviews with departmental and college administrators and document reviews of the sample institutions. The study involved multiple sources of information from two sites. The study was bounded by the subject matter of culture and policy and their impact on the commercializing researchers chosen at each site.

Methods

The study commenced by examining the most recent technology transfer data collected by the Association of University Technology Managers (Kordal & Sanga, 2010). Quantitative analysis of the data created a list of institutions that participate in technology transfer ranked by the efficiency of the institution's overall *commercialization pipeline* (DeVol, et al., 2006, p. 101). From this list, a *purposeful sample* (Cresswell, 2007, p. 246) institution was chosen from the upper quartile of success as well as one picked from the lowest quartile of success, yielding comparative sample institutions of

maximum variation (Cresswell, 2007, p. 127). The discriminating features for the purposeful samples were a matching of institutional disciplines between the selected quartiles, with departmental overlap between the institutions. For example, each sample had a medical school and a college of engineering. To further enhance consistency among sample institutions, both were located in the Midwest and members of the American Association of Universities.

After the sample institutions were identified, arrangements were made to interview a number of stakeholders associated with the particular institution examined. Selected for their individual perspectives on the environment of a commercializing researcher, representatives from departmental administration, college administration, and research faculty were chosen. An interview protocol based upon the conceptual framework was used to assure consistency in data collection.

In parallel with the effort focused on the sample researcher environment, representatives of the corresponding technology transfer office were interviewed to understand the regulatory environment affecting a commercializing researcher within that same institution. These data were compared to a comprehensive document review of published institution technology transfer policy. Documents were located in institutional collected rules and regulations, published on technology transfer websites as well as employee contracts, employee handbooks and departmental standard operating procedures.

Adapted multiple case study techniques, including *cross case analysis* were employed for data enquiry (Stake, 2006). Using an electronic database for the management of data, after the interviews and individual mini case studies were

transcribed, I reviewed the data collected within the context of the research questions and created a report of the case organized around topics from the conceptual framework. This report included a synopsis of the case, situational constraints, uniqueness of topics, utility of the case for developing multi-case *themes* and *findings* (Stake, 2006, p. 39). Notations were made to *triangulate* (Stake, 2006, p. 33) data within the mini cases to confirm data interpretation.

After the interpretations of individual "mini" cases were complete, the three-track process of cross-case comparisons began. Stake (2006) recommends a three-track system to subgroup and analyze the collected data in different constructs. The point of this exercise is to

> …set up a'case-quintain dialectic' – a rhetorical, adversarial procedure, wherein attention to the local situations and attention to the program or phenomenon as a whole contend with each other for emphasis. Each needs to be heard while the other is being analyzed (p. 46).

Track I was comprised of the individual case findings, case situationality, and other collected sources to generate case *assertions* (Stake, 2006, p. 50). Track II merged similar findings from individual cases to create assertions, and track III focused on the creation of overall *factors* (Stake, 2006, p. 64). Factors were then clustered into multi-case themes, ranked by importance and presented as assertions.

This process yielded me assertions created from three different tracks of constructs. These assertions were compared across cases, and based upon the evidence provided by the data and relevance to the quintain; the assertion was either discarded or kept as being relevant to the study.

Trustworthiness and Transferability

Study trustworthiness is insured through the use of triangulation of responses and data dependability is assured through the use of member checks. Triangulation was achieved through the coding process to ensure that themes developed originated with corroborating sources (Cresswell, 2007). Member checking consisted of interacting with participants during the development of case study results. Preliminary assertions of my work were shared with selected participants from each case, giving them the opportunity to provide "critical observations or interpretations"(Guba & Lincoln, 1989, p. 115) of the work presented. Each interview participant was provided a copy of a transcript of their interview, and allowed to make corrections, additions, or deletions to the data. These steps were undertaken to ensure the rigor of the study.

Study transferability was achieved through the use of thick, rich descriptions of the cases. Ultimately, transferability will be assessed by the institution contemplating the adoption of conditions not currently existing at their own institution.

Study Limitations

There are a number of limitations associated with the proposed study. First, the ranking of success from "more successful" to "less successful" institutions was based upon a longitudinal survey conducted yearly by the Association of University Technology Managers. The underlying data from this study is self-reported by responding institutions and may hold hidden anomalies beyond my control. Therefore, the population for the study was limited to the respondents of the Association of University Technology Managers survey, which may exclude members of the population of all United States universities participating in technology transfer. Beyond these

structural limitations, there were a number of limitations inherent with the design of a qualitative study, such as researcher or subject bias, and unequal credibility between subjects.

The method of determining technology transfer success is based upon the number of technologies that have been licensed or optioned by the institution. However, there are other ways that an institution can positively affect technology transfer other than licensing. For example, researchers may perform consulting for industry where intellectual property is created to the benefit of the company or industry. However, there are no studies published to quantify these economic impacts. Therefore, this study is constrained to licenses or options granted by an academic institution.

Study Assumptions

The study assumes that regardless of the limitations above, that understanding can be derived from the sample case study interviews. I assume the best proxy for a commercialized idea to be a license or option granted for intellectual property by the university, because a commercial entity saw enough value in the idea to make a contractual economic commitment.

As an active participant in the technology transfer process within an institution that would be a peer to the samples, my career gives me insight into the daily issues that confront researchers. Therefore, I do assume that there are organizational barriers to technology transfer in any institution. However, I do have intellectual curiosity as to why some institutions of higher education perform this process better than others.

Further, I assume that success in technology transfer is a good thing by bringing innovations into commercial existence sooner rather than later. I also assume that some

faculty value this contribution to society and a researcher's bent toward applied research verses basic research may play a role in this orientation. Because of this applied research aspect, some disciplines may be seen as being more active in the technology transfer arena. That does not mean that I assume a discipline to be more commercially or academically valuable than another. Rather, I see all of academia with a role to play in innovation; it is just that some disciplines are much closer to the creation of an actual product.

Definition of Key Terms

The quintain of this study is the environment of a commercializing researcher in a research institution of higher education. Consistent with that positioning, the following phrases are defined:

Technology Transfer Success. For the purposes of this study, success will be defined as the ratio of technology transfer licenses and options for licenses in a given timeframe to total research expenditures (DeVol, et al., 2006).

Technology Transfer. For the purposes of this study, technology transfer will refer to the process of licensing an intellectual property from a university to a commercial entity for commercial use.

Significance of the Research for Leadership Practice

The study expands the body of literature on the subject of technology transfer by focusing on the environment of the commercializing researcher. An extensive review of the literature failed to find substantive study in this area. The study contributes to the practice by identifying and comparing traits between institutions exhibiting "more successful" technology transfer practices to those exhibiting "less successful" production.

There may be many causes for this difference, but the study results could be informative to institutions wishing to become more successful through the comparison of their policy and culture attributes to this study's more successful performers.

Summary

As supporters of educational institutions and consumers, we all have a vested interest in the costs and the outcomes of scientific research. Despite all of the national investments in science, the process of transformation of science into technology and the transference of this technology to the commercial world where we can enjoy the fruits of this investment remain exceedingly difficult. By more fully understanding the cultural and regulatory environment of the commercializing researcher, it is believed that institutions with a desire to become more successful in this transfer process can develop insights and understanding from institutions that are more successful.

Increased success in this process holds many benefits for the commercializing researcher, the research institution and the public in general. Many believe that the United States is in transition from a manufacturing economy to an economy based on knowledge and the creation of intellectual property. Therefore, our next wave of economic prosperity may be on the shoulders of those who create and commercialize.

CHAPTER 2 – REVIEW OF RELATED LITERATURE

This chapter will present information from books, research journals, and periodical articles to situate the process of technology transfer in three planes: Research universities generally, effects within individual institutions, and effects on the individual researcher. Particular attention will be paid to institutional measures currently in place and the effect these measures have on the individual commercializing researcher. Further, the ongoing national economic crisis is causing the entire system of technology transfer to be re-evaluated. Therefore, articles pointing to an upheaval in the system will further sensitize me to emerging issues in the practice.

Situating in the National Landscape

Commencing in 2006 with the bust of the housing bubble, and becoming more fully realized in 2010, the current economic downturn has had profound effects on higher education. Generally, tax revenues to support higher education have decreased at a rate much faster than tuitions could be reasonably raised to cover the shortfall (Lyall, 2011). At the same time, enrollments are increasing as traditional students and the unemployed take steps to make themselves more marketable for the jobs that are available. Institutions are finding themselves being called upon to serve many more students with many fewer financial resources (Douglass, 2010). This gap in funding has caused institutions to evaluate every expense, maximize efficiencies, and extract every possible source of revenue. Income from the licensing of intellectual property is often cited as an under-utilized financial resource (Just & Huffman, 2009).

The current model of technology transfer through licensing began with the Bayh-Dole Act ("The Patent and Trademark Law Amendments Act of 1980,") in 1980. As the practice of licensing increased over time, researchers began to be more introspective about the process, questioning whether or not it was appropriate for an institution to be involved in such matters (Nelson, 2001), the need for Bayh-Dole and effect on institutional research direction (Thursby & Thursby, 2003), and the examination of how the process of technology transfer actually worked (Colyvas, Crow, Gelijns, Mazzoleni, Nelson, & Rosenberg, 2002). Others took a larger view to understand the missions of institutions in overall economic development, where technology transfer was an essential element (Feldman, 1994; Florida, 1999; Parker & Zilberman, 1993; Shane, 2002a). Some institutions quickly embraced their role in economic development and processes granted under Bayh-Dole, while some institutions were slow to accept and adopt the practice of technology transfer. Even before the recent economic downturn, there was a realization that universities could think entrepreneurially, and have financial success to increase institutional resources (Powers, 2004; Shane, 2002b).

During the same period of time that some institutions were adopting licensing as method of technology transfer, other institutions were finding a different demand in an adjacent technology transfer space: Industry-sponsored research. To some, this shift was a relatively minor change from government funded research, making the mindset much easier to adopt. The demand for innovation from institutions was being caused by desire from industry to get innovation at a cost much less than staffing and operating industrial research and development departments. In the end, this path (along with the license path)

required an institutional shift to entrepreneurial thinking and resource seeking (Basken, 2011; Henderson, Jaffe, & Trajtenberg, 1995; Santoro & Bierly III, 2006).

As state support for higher education declined over the last decade, institutions were asked by governors and legislatures to become more effective, to cut costs and to find alternative revenues. In response to this request, institutions also began to examine their overall role in state and regional economic development. Many believe that the next wave of national prosperity will come from the evolution of a knowledge-based economy (Longworth, 2008; McDowell, 2011; Pisano & Shih, 2009). As creators of intellectual property, many higher education institutions have recognized their role in this new economic paradigm and have used this concept to their advantage when expressing relevance to state leadership (Bercovitz & Feldman, 2006; Gailbraith, 2010; Tornatzky, 2000).

Those institutions of higher education which took an aggressive stance on economic development now find themselves in a position where they can influence regional economies, gain new sources of revenue – and most importantly – claim the mantle as an economic driver for state government. If universities are successful in repositioning and expanding their purpose, they will show themselves to be relevant in the changing economic world, and therefore, of increased importance to their stakeholders. While a laudable strategy, many wonder if this transition can be made (Coleman, 2011; Lane & Bertuzzi, 2011; Zax, 2010).

Situating at the Institutional Level

The Difficulty in Managing University – Industry Relations

The vision of an institution as a leader to economic prosperity is much more pleasing than an image of the institution being a drag on state resources. It is no wonder this image is very appealing to university leaders. However, complex and multifaceted organizations like universities are neither repurposed quickly nor singularly focused. University administrators have to balance many different competing forces within an institution, and relationships with industry and government for economic development purposes can be far down the list of institutional priorities when it comes to the management of daily operations. The institution's administrators are forced to balance this charge against other aspects of institutional mission, as well as basic vs. applied research, public interest vs. private interest, and managing the will of a self-governed organization. Actually performing the role of economic engine can be exceedingly difficult (M. S. Anderson, 2001; Lee, 1996).

Within the context of technology licensing, all United States institutions are bound by the same framework as established in Bayh-Dole ("The Patent and Trademark Law Amendments Act of 1980," 1980). This framework created the concept of technology transfer, and generally outlines the legal relationships between government, university, and industry in the technology transfer process. This process model has come to be known as the *triple helix of innovation* (H. Etzkowitz & Leydesdorff, 2000, p. 111).

At the granular level of consummating individual contracts, the relationships between academia and industry can get quite cumbersome. Universities and businesses do not relate to each other very well, and issues surrounding intellectual property rights,

speed of decision-making, bureaucratic hurdles and overall culture can impede or inhibit the process of technology transfer altogether (Leydesdorff & Etzkowitz, 2001; Markman, Phan, Balkin, & Gianiodis, 2005; McHenry, 1990; Schmiemann & Durvy, 2003)

The Effect of the Revenue Generation Paradigm on the Academe

Not all faculty members are comfortable with a new institutional priority on economic development and revenue generation from intellectual property. Some see this shift as a challenge to organizational governance (Rhoades, 2005; Thursby & Thursby, 2002) while others believe that refocusing on revenue generation will cause the academe to let economics dictate the creation of knowledge, thereby making the knowledge less "pure" (Feldman & Desrochers, 2004; Geuna & Nesta, 2006; Powers, 2003; Rhoades & Slaughter, 2004). Critics from outside academia believe that the transformation from traditional education to a market-driven paradigm would be much welcomed change from the status-quo (Lewis-Kraus, 2010).

For as much as individual institutions are self-governed, they must also survive within external constraints like the law. Internally, policies, rules and regulations are promulgated to set the boundaries of university-industry interaction and how those relationships bind the university researcher. Sometimes, institutional policy cannot keep up with this ever-changing environment as relationships can have completely different structures from one instance to another (Goldfarb & Henrekson, 2003; Shane, 2004).

Institutional Measures of Technology Transfer

After the enactment of Bayh-Dole ("The Patent and Trademark Law Amendments Act of 1980," 1980), most universities established offices to manage the process of technology transfer. These "Technology Transfer Offices" (TTOs) became the entity

responsible for managing university – industry relations, and were responsible for establishing a system of recording discoveries, patenting viable candidates for commercialization, and negotiating contracts with licensees. (Eisenberg, 1996; Phillips, 2002).

Individual TTOs began recording activities of their own office as well as institutional activity in the technology transfer arena. Eventually, this information created a data set that could be used for tracking institutional activity. As more TTOs were formed, the Association of University Technology Managers established a common survey across many participating institutions. These data (while somewhat imperfect) are the only longitudinal set of data on TTO productivity available, and allow individual institutions to benchmark themselves against peers (Kordal & Sanga, 2010).

Quite a body of research has been developed on the subject of TTO operation, with quantitative comparisons made between institutions to determine factors including TTO performance, characteristics, economic impact, and number of faculty business startups (Carlsson & Fridh, 2002; O'Shea, Allen, Chevalier, & Roche, 2005; Thursby, Fuller, & Thursby, 2008; Thursby, Jensen, & Thursby, 2000; Tornatzky, 2001).

Focusing on license agreements specifically, institutional benchmarking and productivity performance has also been well studied. These attempts have been an effort to compare institutional output, efficiency, allocation of resources, etc. but have been hamstrung by a lack of standards for comparison. Many of the studies propose new standards to be adopted across institutions (T. R. Anderson, Daim, & Lavoie, 2007; DeVol, et al., 2006; Gorling, 2006; Kordal & Guice, 2008; Kurman, 2011a; Phan & S., 2006; Powers & McDougall, 2005b; Snyder, Johns, Mongan, & Utaski, 2003). A lack of

standardization, inconsistent self-reporting to the AUTM survey, and a process managed by those who can benefit most have led some to believe that there simply is not a good way to measure institutional performance in technology transfer (Di Gregorio & Shane, 2003; Kurman, 2011b).

One emerging way to measure organizational technology transfer is through the quantification of university equity positions taken in companies whom license technologies from the institution. This relatively new form of university-industry relationship has been caused by the inability of the university to collect a license fee on a technology, or a the creation of a technology in which the university sees such a significant revenue potential that the university is willing to take on capital risk to bring the product to market (Feldman, Feller, Bercovitz, & Burton, 2002).

Focus on the Individual Commercializing Researcher

Researcher Attributes

By looking deep into the organizational structure that is an institution, one finds that the true creator of intellectual property is the individual researcher. Generally, the research area of interest pursued represents the life's work of the individual (Breen, 1999). In some disciplines, institutional support is granted to junior faculty, but over time, it is expected that an individual's agenda become financially self-supporting (Link, Siegel, & Bozeman, 2006). In addition to research duties, these faculty members also teach and supervise students within the chosen discipline. And while they enjoy a certain degree of independence, they are required to operate within a much larger system of governance and adhere to many rules and guidelines directing their work on a daily basis.

Researchers who wish to self-commercialize can find this structure both rewarding and constraining, rewarding because of the resources afforded by an educational institution and constraining because of same rules that allow the organization to operate (Hsu, Roberts, & Eesley, 2006). Sometimes this employee-employer relationship can become adversarial over commercialization activities ("Curators of the University of Missouri vs. Galen J. Suppes, William R. Sutterlin, Renewable Alternatives, LLC and Homeland Technologies, LLC," 2009).

Researcher Environment: Institutional Policy

The framework for institutional policy regarding technology transfer is embedded within the Byah-Dole Act ("The Patent and Trademark Law Amendments Act of 1980," 1980). However, there can be significant differences in the actual application of these rules. Not only can there be a difference between institutions, but there can also be differences in interpretation between different TTO officers within the same institution as each individual officer is forced to interpret each circumstance independently. TTO officers are often in a situation where demands for services expand to fill the resources available, and are therefore resource constrained in terms of time to do the work at hand. This arrangement may lead to a work environment where the TTO officer is asked to navigate relatively rigid federal and institutional guidelines in technology transfer while simultaneously performing the ambiguous task of maintaining positive interpersonal relationships with researchers and potential industry partners. This arrangement allows for the emergence of a *street level bureaucrat* (Lipsky, 1971; Smith & Larimer, 2009; Weber, 1964). To cope with their working conditions, TTO officers can evolve to the point where their patterns of practice can lead to service rationing, inequality in

administration of the rules, the controlling of clients and the mentality of client processing for processing sake (Lipsky, 2010).

Efforts to combat inconsistency in policy interpretation are ongoing, and remain a common topic at Association of University Technology Managers professional development seminars. Research has been conducted in an effort to codify office "best practices" (Sampat & Nelson, 1999; Siegel, Waldman, & Link, 1999) and determine if individual office policy falls within the bounds of local public policy (Bozeman, 2000). Often-cited factors that contribute to inconsistent policy application include: constraints of legal relationships, lack of office resources, and costs of patent filings and enforcement (Jensen, Thursby, & Thursby, 2003; Lockett, Wright, & Franklin, 2003).

For many years, TTOs were focused exclusively on potential "high revenue" licenses that would be offered to large industrial conglomerates that could afford significant up-front licensing fees and be willing to pay the costs necessary to bring complex products to market. More recently, TTOs have begun to embrace the concept of researcher self-commercialization as a path to the market. In these cases, the inventor would license the technology, but the conditions governing the license can be much more flexible (Powers & McDougall, 2005a). Researchers who do pursue this path are required to follow institutional rules regarding conflict of interest, academic integrity and fiduciary responsibilities to the institution as well as students and post-docs.

Researcher Environment: Organizational Culture

A researcher who chooses a path of self-commercialization must be highly motivated to do so. This drive may come from entrepreneurial longings, or it may be for a practical need for resource attainment within the university, improved stature within the

department, college or institution or improved compensation (Feldman, et al., 2002; Friedman & Silberman, 2003; Huq, Goldberg, & Meagher, 2009; Lach & Schankerman, 2008; Markman, Gianiodis, Phan, & Balkin, 2004; Renault, 2006; Wright, Birley, & Mosey, 2004).

The work environment experienced by the researcher will likely be dictated by departmental culture. These norms become shared traditions for the unit and are communicated internally and externally by symbols and ritual (Bolman & Deal, 2008; Bush, 2003). Useful for determining the dimensions of the departmental culture are Dimmock and Walker's (2002) "seven dimensions of societal culture" which addresses issue of power, self-orientation, aggression, activism, innovation, relationships, and gender dominance.

> These dimensions, defined as core axes around which significant sets of values, beliefs and practices cluster, not only facilitates their description and measurement in terms of societal culture, but promotes comparison between cultures. Dimensions provide a common baseline against which cultural characteristics at the societal level can be described, gauged and compared (Dimmock & Walker, 2002, p. 73).

These topical areas describe the situation in which the commercializing researcher resides at the departmental level, and act as a continuum that is useful for comparing the departments housing the participants:

1. Power (distributed vs. concentrated): When comparing the two departments, is there a difference in the way that power is distributed across the departmental culture? Does the tenor of the culture rely on the direction of the department

chair alone, or does the culture come equally from all of the faculty members within the department?

2. Orientation (group-oriented vs. self-oriented): When comparing the two departments, is there a difference in the way each department describes their reliance on each other? In academic terms, do the faculty members within the department tend to be collaborative or self-reliant?
3. Aggression (consideration vs. aggression): When comparing the two departments, is there a difference in the way they describe their individual competitiveness? Do department members compete with each other at all costs or do they prefer to maintain relationships through consideration expressed through compromise and negotiation?
4. Activism (pro-activism vs. fatalism): When comparing the two departments, is there a willingness to change the departmental culture by the members or is there a disposition to accept the departmental culture placed upon them by others?
5. Innovation (generative vs. replicative): When comparing the two departments, is there a propensity to generate new ideas from within the department, or are the resources of the department used to refine and improve the ideas of others?
6. Relationships (limited vs. holistic): When comparing the two departments, are they different in the manner by which the faculty members relate to each other on a personal level? For example, are they bound by their official rank with direct reporting lines, or do they treat each other as colleagues and friends?

7. Gender dominance (male influence vs. female influence): When comparing the two departments, is there a difference in influence on the culture caused by gender orientation?

There are many competing purposes that drive the work agenda of the faculty member beyond the creation of research that may be commercialized. Differing priorities between the researcher and the department as a whole may influence the actual work day of the faculty member. The departmental goals for funding, scholarship, and community service may culturally outweigh the researcher's own agenda. Therefore, an alignment of agendas between the individual and department may be required for success (Ward, 1998).

It should be noted however, that previous research shows that commercializing researchers often find a collaborative, mutually-supportive atmosphere created by other commercializing researchers (Bercovitz & Feldman, 2003, 2004; Blau, 1954). For those researchers that self-commercialize, their own financial interests may cause the researcher to change course and alter a proposed research agenda to give priority to projects that are more likely to be commercialized (Miller, 2011).

Possible System Upheaval

In light of the current national economic situation, and the expectations placed upon the role of universities in the "knowledge economy," those outside of academia have begun to question the entire process of technology transfer. The Kauffman Foundation recently suggested that the abolition of TTOs would hasten the process of technology transfer, and remove the major obstacle that impedes commercialization

(Litan & Mitchell, 2010). Litan and Mitchell believe that the researchers themselves are much closer to the technology as well as the commercial problem the technology solves. Therefore, the researcher should be given the freedom and flexibility to negotiate on behalf of the institution in the creation of contracts and licenses. According to the authors, the benefits of this proposed arrangement would be a lowering of overall license transaction costs, reduced time to commercialization, and a binding of academic research to industrial need, thereby creating an optimized system of technology transfer (Litan & Mitchell, 2010).

This stance drew a strong response from those inside the TTO community. The counterpoints offered in rebuttal present a much more positive economic impact under the current system than the statistics offered by Litan and Mitchell (2010). The rebuttals also brought into question the underlying assumptions used in the creation of the Kauffman report (Coticchia, 2010; Pradhan, 2010). Nonetheless, the Kauffman Foundation's reputation in the world of entrepreneurism and visibility did begin a dialog about the subject of TTO restructuring that is just now receiving thoughtful reflection about the concept (Truman, 2011).

In addition to systemic changes proposed within institutional technology transfer process, the organizational framework presented by Bayh-Dole ("The Patent and Trademark Law Amendments Act of 1980," 1980) itself is being reconsidered on several fronts: The Rochester Institute of Technology fundamentally changed its view on patent rights, preferring to collect research fees upfront rather than seek any license income from the intellectual property created from research activity (Blumenstyk, 2010). Other institutions, such as Penn State, have adopted a version of this model that excludes

government funded research, but does allow the faculty inventor to direct intellectual property rights (Danahy, 2011). These fundamental changes in university policy have resulted in a number of legal challenges, and members of the academe have questioned the new processes adopted by these institutions (Allen, 2011; Kenney & Patton, 2009).

Summary

This chapter provided an overview of the technology transfer process at the national, institutional and researcher levels. While significant literature exists on the national and institutional levels, it is believed that insights gleaned from the policy and culture constructs of the individual commercializing researcher will be useful to inform the practice on differences between institutions that are efficient in the process of technology transfer when compared to institutions that are less efficient. The next chapter will provide detail about the research and methodology to be used in this study.

CHAPTER 3 – RESEARCH DESIGN AND METHODOLOGY

The commercializing university researcher straddles a chasm between academia and the industrial world. While radically different, both types of entities need each other to allow the country to enjoy the benefits of sustained technological innovation. This study investigated the conditions that exist to facilitate the transfers of technology from academia to the commercial world. The focus was on the departmental life of the commercializing researcher in two dimensions: the culture surrounding the researcher, and the organizational policy that defines and directs the researcher's actions within the institution.

The design of the investigation was a multiple case study, with sample institutions being drawn from an overall population of 150 respondents to the Association of University Technology Managers survey of United States licensing activity for 2010 (Kordal & Sanga, 2010). The population was ranked in efficiency of technology transfer to determine relative success in the process of technology transfer. From this ranking, a purposeful sample institution was drawn from the upper quartile of the ranking as well as one purposeful sample institution from the lower quartile of the ranking. Interviews were conducted at the sample institutions and included those with the ability to describe the environment of the commercializing researcher. Mini cases were performed with the commercializing researchers themselves. Once gathered, the data were analyzed using a process and coding schema consistent with multiple case study analysis (Stake, 2006)

It is believed that the environment of a commercializing researcher at an institution that performs technology transfer well will vary greatly from the researcher

environment of an institution that performs this function less successfully. This study explored these differences to inform the practice about the conditions that may contribute to more successful and timely transfers of technology from the institution to the commercial world.

Research Purpose and Questions

Purpose

The purpose of this multiple case study was to explore the social factors that may influence the environments of researchers participating in the transfer of new technologies from academia to the commercial world. The intent was to gain environmental understanding of the life of a commercializing academic researcher. It was believed that by comparing the social environments in institutions that are more successful in technology transfer to the social environments in institutions less successful in technology transfer, that illustrative differences will be discovered. Once found, these differences can be used to inform the practice, and assist those institutions in becoming more efficient in technology transfer if they so desire.

Research Questions

Within the context of this study, the following research questions were addressed:

1. When comparing more successful institutions with less successful technology transfer institutions, what cultural factors contribute to the work environment of the commercializing researcher?
2. When comparing more successful institutions with less successful technology transfer institutions, what policy factors contribute to the work environment of the commercializing researcher?

Research Design

I chose a *multiple case study design* (Stake, 1995; Yin, 2009) because the attributes of culture and impact of institutional rules lend themselves to *thick, rich qualitative descriptions* (Cresswell, 2007; Mertens, 2005). Because the purpose of the study is to inform the practice on conditions that may or may not exist in comparative sample institutions, these differences are best illustrated with this methodology. The phenomena of the case study is technology transfer, and the *quintain* (Stake, 2006, p. 4) of the case study is the researcher's department. Individual mini case studies consist of commercializing researchers at multiple sites. Data from these cases are enhanced by interviews with administrators, document reviews from sample institutions, and observations made by me on sample institution visits. The study involved multiple sources of information from two sites. The study was bounded by the subject matter of culture and policy and their impact on the commercializing researchers chosen at each site.

Case Selection

The beginning population for the study was the 150 respondents to the Association of University Technology Managers survey of United States licensing activity survey for fiscal year 2010 (Kordal & Sanga, 2010). The institutions included in this survey were then ranked by relative success in technology transfer as defined by the *overall commercialization pipeline* (DeVol, et al., 2006). In an effort to normalize the data, the overall population was reduced to include only those research universities which sponsor a medical school and have reported results to the Association of University Technology Managers for the last 5 years. Through summing the total of all individual

institution research support for 5 years and dividing that total by the sum of the same institution's licenses and license options, a figure was calculated to represent the total number of research dollars per license or transaction as averaged for the 5 year period.

Licenses and license options were used as a proxy to represent a product of commercial value. Licenses or options require the exchange of something of value between the university and a commercial entity. Therefore, the intellectual property underlying the license has been validated by an external commercial party as having commercial value.

After the ranking was established, institutions were separated into quartiles of performance in relative technology transfer success. Prospective case study institutions were selected from the upper quartile of success, as well as the lowest quartile of success to create a pool of each type of institution. Purposeful samples from each pool were chosen based upon institutional similarities, such as American Association of Universities membership, availability of a medical school, and geographic region. The availability of a medical school was chosen as a selecting factor because of the likelihood of high-value discoveries that are associated with medical devices and treatments. This effort yielded samples of maximum variation for the case studies (Cresswell, 2007; Mertens, 2005). Relationships maintained by me within the University of Missouri system were leveraged to gain access to prospective sample institutions.

Participant Selection

After sample institutions were identified, contacts were made to establish relationships with the target "more successful" sample campus. Participants in the study were determined through a process of nomination within the sample institution. The

institution's Dean of Engineering was asked to nominate two commercializing researchers to be interviewed for this study. These nominations were made with the expectation that the participants nominated will possess experience in technology transfer projects and hold the most insight into the culture and policy guiding the sample institution. The college of engineering was selected due to the high likelihood of commercial activity and the ubiquity of the discipline across multiple institutions.

After the participant researchers were named, appointments were made with those individuals as well as the respective Department Chair, Associate Dean of Research, and Technology Transfer Officer with purview over the participating researchers.

The process of participant selection for the "less successful" sample was very similar to the selection process used in the "more successful" sample except the commercializing researcher nominees for the interviews were limited to a college and department similar to the "more successful" participant.

Two researchers, their department chair, their associate dean of research, and their technology transfer officer participated at each sample institution. Three other participants were identified as well. In the "more successful" institution, I was provided with an additional technology transfer officer, and at the "less successful" institution, I was provided a technology transfer officer from the system level as well as a researcher with commercial experience from an adjacent department. These interviews were conducted, transcribed and considered as additional data on the quintain.

Data Collection Methods

The multiple case study portions were informed through multiple sources of information to include observations, interviews, and the review of documents (Cresswell, 2007; Mertens, 2005; Stake, 2006).

Observations were made during the participant recruitment process as well as the physical visit to the sample institution, to give me an overall sense of institutional environment relative to the quintain. An *observational protocol* (Cresswell, 2007, p. 181) was developed to record my reflective notes of the physical setting, "hustle and bustle" of the department on a school day, informal faculty interactions, and overall mood of the persons with which I came into contact during the visit to the institution.

I personally visited the sample institutions and conducted interviews with the people holding the positions listed. All interviews were conducted within the working environment of the participant, and my presence there allowed me to immerse myself in the physical surroundings of the department for more than one workday. My desire was to contact a cross section of individuals who have direct knowledge of the cultural and regulatory environment of the commercializing researcher while providing the *broadest scope of information* (Guba & Lincoln, 1989, pp. 177-178).

Individual interviews were semi-structured. Prior to the interviews, an interview guide was created to assure a consistent range of topics related to culture and policy was covered in each interview. The guide content was derived from topics developed through a thorough literature review, bound by my conceptual framework and pertinent to the research questions. Structurally, the guide consisted of open ended questions designed to

elicit thick, rich descriptions. The interview was structured to allow the participant to add topics of interest to them. Each interview lasted approximately one hour.

The document review of the sample institution consisted of an examination of documents either provided to me by participants, or through publically available sources such as institutional websites (Mertens, 2005). Sample contracts, promotion and tenure procedures, governance documents and success stories were available from the sample institutions. These data were helpful to find confirmation of informant viewpoints, or indicate situational conflict between institutional rules and the implementation of rules by the street-level bureaucrat (Lipsky, 1971, 2010).

Human Subjects Protection

Interview procedures were guided by the University of Missouri Institutional Review Board protocol to ensure full human subjects protection. After a participant for the sample institution was selected, contact was made with the subject to determine a willingness to participate in the study. After the consent for an interview was granted, the interview was scheduled, and informed consent documentation was supplied to each participant. This documentation was reviewed at the beginning of the actual interview. At each sample institution, I inquired about the need for approval by the sample institution's institutional review board. The administrative point of first contact at each institution was satisfied by the exempt status issued by Missouri's institutional review board, and deemed that no further action with the sample institution was required.

All data and records created for use in this study are kept secure by me to ensure ongoing participant confidentiality. All storage, maintenance and disposal of records will

be performed consistent with University of Missouri Institutional Review Board guidelines.

Data Analysis Procedures

Modified multiple case study techniques, including *cross-case analysis* were employed for data enquiry (Stake, 2006). After the interviews and individual mini case studies were transcribed, I reviewed the data collected within the context of the research questions and created a report of the case organized around topics from the conceptual framework. In this effort I was assisted by an electronic database for analysis that varied slightly from manual approach suggested by Stake. This report included a synopsis of the case, situational constraints, uniqueness of topics, and utility of the case for developing multi-case *themes* and *findings* (Stake, 2006, p. 39). These outcomes were *triangulated* (Stake, 2006, p. 33) by the data within the mini cases to confirm data interpretation.

After the interpretations of individual mini cases were complete, the three-track process of cross-case comparisons began. I followed the Stake (2006) recommended three-track system to subgroup and analyze the collected data in different constructs. The point of this exercise was to

> …set up a 'case-quintain dialectic' – a rhetorical, adversarial procedure, wherein attention to the local situations and attention to the program or phenomenon as a whole contend with each other for emphasis. Each needs to be heard while the other is being analyzed (Stake, 2006, p. 46).

Track I was comprised of the individual case findings, case situationality, and other collected sources to generate case *assertions* (Stake, 2006, p. 50). Track II merged similar findings from individual cases to create assertions, and track III focused on the

creation of overall *factors* (Stake, 2006, p. 64). Factors were then clustered into multi-case themes, ranked by importance and emerged as assertions.

I have assertions created from three different tracks of constructs. These assertions were compared across cases, and based upon the evidence provided by the data and relevance to the quintain; the assertion was either discarded or kept as being relevant to the study.

Role of the Investigator

As a participant in the ecosystem supporting technology transfer at the University of Missouri, I hold a bias that higher education research institutions are not as successful in technology transfer as they could be. I have first-hand knowledge of instances where university bureaucracy has impeded the process of technology transfer, or made life much more difficult for a researcher seeking a commercialization path. However, this same bias is one that feeds my intellectual curiosity on the subject. Therefore, a conscious effort was made to minimize any bias injected in the study in order to find true, beneficial understanding that can be transferred to all in the technology transfer arena. This possibility of bias was reduced through my reliance upon the experiences of my participants rather than my own, in addition to using techniques to enhance trustworthiness as described below.

Strategies to Address Issues of Quality

Trustworthiness

Study trustworthiness was insured through the use of triangulation of responses and data dependability was assured through the use of member checks. Triangulation was achieved through the coding process to ensure that themes developed originated with

corroborating sources (Cresswell, 2007). Member checking consisted of interacting with participants during the development of case study results. Preliminary assertions of my work were shared with selected participants from each of the sample institutions. The participants were offered the opportunity to provide "critical observations or interpretations" (Guba & Lincoln, 1989, p. 115) of the work presented. These steps were undertaken to ensure the rigor of the study. Member checking was also employed to ensure the accuracy and reliability of all participant interviews. After transcription, each participant was provided a copy of their transcribed interview and offered the opportunity to correct, make additions or subtract from the data gathered.

Study transferability was achieved through the use of thick, rich descriptions of the cases. Ultimately, transferability will be assessed by the institution contemplating the adoption of conditions not currently existing at their own institution.

Study Limitations

There are a number of limitations associated with the study. First, the ranking of "more successful" to "less successful" institutions were based upon a longitudinal survey conducted yearly by the Association of University Technology Managers. The underlying data from this study is self-reported by responding institutions and may hold hidden anomalies beyond my control. Therefore, the population for the study is limited to the respondents of the Association of University Technology Managers survey, which may exclude members of the population of all United States universities participating in technology transfer. Beyond these structural limitations, there will be a number of limitations inherent with the design of a qualitative study, such as researcher or subject bias, and unequal credibility between subjects.

The method of determining technology transfer success is based upon the number of technologies that have been licensed or optioned by the institution. However, there are other ways that an institution can positively influence technology transfer other than licensing. For example, researchers can perform consulting for industry where intellectual property is created. However, there are no studies published to quantify these economic impacts. Therefore, this study is constrained to licenses and options granted.

Another possible study limitation involves the recruitment of participants. Colleges of engineering were solicited in the respective institutions, and administrators were asked to nominate individual faculty members for participation in the study. I requested that the faculty members be participants in, and be knowledgeable of, the technology transfer process. This process of selection may have induced bias on the part of college administrators.

Summary

This chapter provided a detailed description of the research methodology used in this study. A multiple case study was chosen to illustrate differences in technology transfer success between two institutions by way of maximum variation. The sample institutions were chosen by ranking relative success in technology transfer based upon longitudinal data from the Association of University Technology Managers. Once ranked, I selected purposeful samples based upon similarity of disciplines, American Association of Universities membership and geographic location. Through a process of nomination, the more successful institution chose mechanical engineering as the quintain most appropriate for my study, and I requested this department for comparison at the less successful institution.

Data collection was achieved through interviews, document review, and observation. First using themes suggested by the conceptual framework, the data were coded for analysis, and through a process of comparison to the literature and the other data collected, interpretations and conclusions were drawn to form assertions and emergent themes. The assertions and emergent themes were then compared, contrasted, and analyzed to produce the key themes presented by the study. Credibility and trustworthiness were accounted for though various strategies including member checking of interviews and preliminary assertions, triangulation of data, and my own critical reflection. While there are limitations to this study, I believe the data presented and synthesized into recommendations will be useful for those institutions and departments seeking to become more successful in the process of technology transfer.

CHAPTER 4 - RESULTS

The purpose of this multiple case study was to explore the cultural and policy environments that influence a commercializing researcher at the academic departmental level. The cultural and policy environments are compared and contrasted between two different institutions, one that is more successful in the technology transfer process and one that is less successful. For the purposes of this study, success was defined as the averaged ratio of licensed or optioned technologies to total research expenditures consumed by the institution during the same time frame. I believe that an increased understanding of these differences could be helpful to those institutions that aspire to be more active in the arena of research with commercial outcomes, as the institutions might consider policy and practice changes in light of these findings.

This chapter presents findings analyzed from observations, document reviews and 13 in-depth interviews conducted at two different institutions. My findings will demonstrate that there were cultural and technology transfer policy differences between the two institutions. The mechanical engineering departments served as the cases at the two institutions. These departments were chosen through a nomination process during the recruitment of the more successful institution because the deans of the respective institutions believed that the mechanical engineering department best represented the department on campus that participated in the transfer of university-developed technologies. During the recruitment of the less successful institution, I specifically asked to study the mechanical engineering department.

Descriptions of the Cases

The recruitment process itself seemed to foreshadow the relationships I would develop with these institutions. The dean of engineering at the more successful institution (MSI) immediately and enthusiastically responded to my request to visit their campus and conduct interviews. The Associate Dean of Research for the college was my primary point of contact, and after negotiating a 1 week window of time where I might travel to the institution, he personally scheduled meetings for me with my participants. In my telephone calls with him to clarify the travel details surrounding my site visit, the Associate Dean was effusive with information, and directed me to a number of websites for background information. He seemed thrilled to be asked to participate, and viewed my visit as an opportunity to showcase the work done by his institution.

The recruitment of the less successful institution (LSI) was much more difficult. My inquiry for interviews was first directed to the dean of engineering, but the inquiry was soon forwarded to the director of technology transfer at the system level, where the request was, in turn, referred to a subordinate, and ultimately to the administrative assistant of the subordinate for scheduling. It was comparatively difficult to find a date for my site visit, and my final schedule for interviews was not completed until the day before I was scheduled to arrive on campus. Later I would learn that there had been significant disruption in the leadership of the college and the department that may have caused my first inquiry to be offloaded to the system level. However, from my perspective, there seemed to be a series of miscommunications between the technology transfer office and the mechanical engineering department, and I felt as if I was a nuisance for wanting to come and conduct research on the campus.

The More Successful Institution

The more successful institutions' campus is in an urban setting, with the campus being very compact and contiguous. It is less than a 10 minute walk across the entire campus. Immediately surrounding the campus are businesses that cater to the students such as bars, restaurants, and apartment buildings as well as businesses that appear to be located near the campus to have access to campus research resources. Examples of nearby businesses include those involved in health care, nanotechnology, and medical devices. The campus itself is immaculately kept, and has a number of building projects underway in different areas.

The mechanical engineering department at MSI is comprised of more than 40 faculty members and served by nearly 50 staff members. The department is housed within two floors of one building devoted to engineering, which is one of a complex of buildings housing the college. The physical structure is that of an older classroom building that has been expanded to include newer office spaces, conference rooms, study areas and niches for students to gather. The walls of the department were covered with a mix of research poster presentations and flyers for activities within the department and across the campus. I observed the interactions of students within the building, and immediately outside, where there were groups of students working on projects, students working on homework, and those simply relaxing between classes. The "vibe" of the place was that of busy, yet comfortable.

Faculty member offices were arranged in groups sharing a common outer office entrance that allowed them to share common resources such as copy machines and coffee makers. It appeared that the offices were arranged to allow one administrative assistant to

serve six to eight faculty members. Individual faculty member offices had windows that overlooked green spaces on campus. Looking outside, one could see the "hustle and bustle" of the campus through student activity. The furnishings in the faculty members' offices were modern and modular, consisting of light woods with brushed metal accents. Each office was outfitted with desk space, desk returns, lateral files, and book cases. Each faculty member either had a conference table within their office or had one available in space immediately adjoining their office.

Administratively, the mechanical engineering department within the more successful institution is situated within a college that houses much more than traditional engineering disciplines. This arrangement allows for collaborative relationships to form without administrative approval from beyond the Dean's office. Additionally, I learned that the department chairs within the college serve at the pleasure of the Dean, and are not elected by departmental faculty according to Adam, the associate dean of research. This arrangement allows decision making across departments to occur at a very quick pace – a sentiment first aired by Adam, and confirmed by Bill, the appointed department chair.

The department has a very collaborative relationship with the technology transfer office. Each person I interviewed could tell me the technology transfer officer responsible for their inventions, and could cite upcoming trainings on process and policy related to technology transfer. The participants commented that the technology transfer office was very service-oriented and progressive; the office interacted with them on a daily basis. The researchers seemed to truly value the relationships with the technology transfer officers, and viewed them as part of the research team.

Prior to the on-site visit with the department, I reviewed relevant sample contracts, promotion and tenure documents, governance documents, and success stories I found from the institution's website. At MSI, these documents were relatively easy to find and well indexed to show a history of changes in policy and procedure. Contracts, governance documents, and promotion and tenure documents were held at the system level, while technology transfer documents were held by the technology transfer office. The forms documenting the technology transfer process were all electronic, and were presented in the form of an online checklist. The section of the website directed toward commercializing faculty members is prominently positioned and labeled "for inventors."

The Less Successful Institution

The main campus of the less successful institution is located in a suburban area and is spread over several square miles. The terrain and layout of the campus does not promote easy walking between sections of the campus proper, and walking is not possible to those sections of the campus that are more than 30 miles from the main campus. For example, a mechanical engineering researcher must travel more than 3 miles from the department to meet with a technology transfer officer and travel more than 30 miles to meet with potential collaborators in a different discipline. The distance to significant numbers of potential industry partners is more than 40 miles.

The appearance of the campus in the less successful institution was uneven. The campus itself was a dichotomy, with new construction occurring in some places and obvious signs of deferred maintenance in others. For example, small apartments that resembled married student housing did not appear to have been updated from the early 1960s, and showed of torn shingles, flaking paint, and missing balcony railings. Less than

one block away, campus improvements in excess of $100 million were being developed. In addition to this discrepancy in buildings, there were other places on campus where the roads had recently been resurfaced juxtaposed with areas where the roads were filled with potholes less than 500 feet away.

The mechanical engineering department of LSI is comprised of just fewer than 20 faculty members and 5 staff members. The department is housed on one floor of a very large building devoted to engineering, and is in a complex of four buildings devoted to the college. The newest building in the complex was just constructed and is not yet open for occupancy. During my visit, I learned that the college will be adding a minimum of 20 faculty members over the coming year, and that the college has received funding for two additional new buildings to the complex to create room for the new faculty as well as lab space to support collaborative teams.

During my visit to the department, I observed that it is housed in one long, featureless hallway within a building I would date to the late 1950s or early 1960s. The hallway was constructed with a terrazzo floor, tile wainscoting with drab paint above the tile. Standing on the end of the hallway near the elevator, I was struck by how long and straight the hallway was. The doors to each classroom and office opened directly into the hallway, and as I neared the office area for the department, I noticed a few plaques memorializing alumni and faculty awards, a dusty trophy case, a bulletin board, and 2 or 3 faded research posters. Other than these few items, there were no accoutrements to the hallway.

Faculty member offices were furnished with desks and tables that appeared to be of the same era as the building; they looked to be well worn, with some seemingly

repainted numerous times. The faculty members with windows in their offices were treated to a view of the adjoining building, with vistas that included a gravel rooftop and air conditioning units. Each faculty member appeared to have their own coffee maker or cooler for drinks and refreshments, and each seemed to have their own printer. In my time within the department, I did not see a room that could be used as a conference room, or common area.

As I waited between interviews, I looked for a place to lounge, and could not find one within the department, so I decided to follow some groups of students at class change to see where they stayed between classes. The students all appeared to be of traditional college age, with the group mixed in gender and ethnicity. All immediately left the building and headed elsewhere on campus. I resorted to returning to my car to wait between interviews. In a stark contrast to the MSI, there wasn't enough student activity to give this place a "vibe" at all.

Administratively, the department at LSI is housed within a college supporting a total of eight fields and disciplines. Prior to my site visit, there was a change in the leadership of the college and department. I also sensed that questions about the turnover were somewhat unwelcome, and I chose not to probe too deeply into the underlying issues. The Dean left to accept a higher position at another institution, and the department chair had recently stepped down. When I interviewed the now former department chair, he seemed guarded about my visit generally, somewhat defensive on my questions, and challenged me about my agreement to confidentiality. In addition to my invitation to participate documentation, and my approval from my institutional review board, he requested that I outline my security efforts and pledge my agreement to confidentiality in

writing once I returned home. I complied with his request. My sense is that this leadership change at the departmental and college level contributed to the difficulties I faced during the recruitment phase of the study.

The department is very disconnected from the technology transfer office. The technology transfer office is formally situated and governed at the system level, but is not administratively housed within the system. The office is technically a separate entity funded, in part, by internal licensing efforts and augmented by funding from external research foundations. The researchers within the mechanical engineering department could neither tell me the name of their technology transfer officer nor could they accurately describe the technology transfer process in detail. My participants indicated that they saw the navigation of the technology transfer process as somewhat mysterious and very difficult.

Prior to the on-site visit with the department in LSI, I also reviewed relevant sample contracts, promotion and tenure documents, governance documents, and technology transfer success stories I found from the institution's website. At LSI, these documents were more difficult to find than at MSI. Similar to MSI, contracts, governance documents, and promotion and tenure documents were held at the system level, while technology transfer documents were held by the technology transfer office. At LSI, navigating the technology transfer office website was difficult. The forms documenting the technology transfer process were presented to be electronic, but I could not find links that worked for the online forms, thus rendering them non-existent. No technology transfer success stories were featured. With these descriptions in mind, I present the findings of my project.

Findings

Constrained by the two basic research questions and guided by the conceptual framework on culture and policy, six major themes emerged from this study. In the findings presented, my intent is to let the realities of the participants be demonstrated through their own words. My selection of illustrative quotations is an attempt to portray the subject matter in a manner that describes both the complexities of the environment as well as the view from the participant. In an attempt to gain a holistic view of the quintain, participants were selected from multiple levels of the organization specifically for their diversity of viewpoint. In the quotations that follow, I have used a pseudonym for the name of the participant, but have included their generic title for reference.

The Departmental Ecosystem Influences Individuals

On the surface, both MSI and LSI seek the same type of faculty to join the department: excellent scientists and researchers. A commitment to basic academic research is considered to be of the most value during searches to fill departmental vacancies, and the quality of research agenda, as judged by peers, is paramount. When it comes to the departmental view of commercializing research, however, the outlooks of the two institutions differ.

The more successful institution views good basic scientists as most valuable; a natural extension of this good science is that they create ideas that can be commercialized. This thread runs from the associate dean through the department chair and to the researcher level. Adam, the associate dean for research shared:

> Publications first and funding and so forth, and then what comes out from the technology transfer side is a result of those. So, sort of an organic way

of, of generating commercializable products out of that basic research. That's not where the, the goal is when you get in to it.

Bill, the chair of mechanical engineering at MSI continues this sentiment.

I think that we expect every faculty member to be, to have the potential to be strong in basic research. I don't think we would hire someone in mind with um, with doing just applied research that could be taken up by companies and so on. Every faculty member we hire, we want to feel that they have the potential to publish a paper in *Science* and *Nature*. Not everyone will because it's very difficult to get in there, but, everyone we hire, we want to at least have the potential to publish there, and, so, to have the potential to perform basic research at the very high level. I think by the nature of our institution, this is a research institution where I think the bias is towards basic research. I think just by the nature of our institution, a lot of the IP (intellectual property) is created out of basic research, which then finds certain applications. I see us as a research institution, not as a development institution. We do applied research, with the goal in mind or the fixed goal to actually create intellectual property.

Researchers at MSI share this commitment. Edward, a researcher, stated:

Well, there are still some faculty on the hiring (committee) that wouldn't look at the ability of the candidate to be innovative in a commercial sense as very important at all. But, that's rare I think now a days. Clearly, however, if there isn't a strong basic science, basic engineering credibility, they don't have a chance. … I think people would think if a person had no

idea of how commercial, commercialization happens, they would see that as, is that a complete person? Not that they would come in here and run a company, but, I think … let's say you get a candidate that come from Asia and they totally don't, in questioning, when they come in for an interview, won't even know anything about patents or how they translate their findings to the good of mankind. I think that would be a negative.

Even outside the department, Fran, the technology transfer officer, understands the primacy of basic research with commercial application:

So, … this department, has a history of inventive faculty that produce patentable inventions that they go on to be successfully licensed and actually generate revenue, and so, there's a good culture here of sort of continuing the basic science, but also producing things that have potential commercial value. And, so, there's a consistent level of respect and expectation.

The LSI also views basic science as most important, but researchers who work in the commercial world are seen working outside of the normal bounds. According to Kenneth, the acting dean of the less successful institution:

On the traditional side, I would say there are very much typical. One Prof, one grant, one student, one career. On the bio side it's very different. One of them has a joint appointment in (city) at the med center, a number of them work with pharmacy people and those are very interdisciplinary. The teams that are put together are made up of everything from biologists to chemists to physicists; to engineers to you name it. And, I think people

that get into bio-engineering recognize that's going to be the case. They are going to have to work with other folks. They don't know enough, I wouldn't know enough, I would have to have partners and I think that group is much more team-oriented.

John, the department chair at LSI, echoes viewpoint of researcher expectations:

[regarding commercial activities] … basically in the past, that would be pretty, I won't say negatively looked at, but certainly not anything very exciting as compared to, you know, get a patent or publish a paper. Publish a paper. Go get a patent. Not that one wasn't counted, there was a place to list it, but still as comparatively what's the, what's going to get you your biggest bang for your effort? To publish a paper? I think that's a viewpoint from a long time. It's our tradition. It's our viewpoint. It's what we've been doing for a long time. That's changing and I think that's going to change, I would say, almost dramatically in the next couple of years, 3 years.

Irene, a researcher at LSI acknowledges departmental attitudes about working in commercial activities, but senses that change may be coming:

Innovation. Okay, some of the old faculty are retiring [lowers voice] and there are more people in the department now that view it as a positive. So…not that our previous Dean was against it, but he didn't absolutely support it. It wasn't mentioned in every State of the Union, State of the School address or retreats or anything like that. Little things like that make

> a huge difference. I'm really hoping that someone comes in that has [commercialization] on their agenda, who promotes it and then makes it a worthwhile activity to engage in at the department level.

Beyond the general outlook of the departments on commercialization and innovation, I found a substantial difference in the propensity to collaborate within each department. The faculty members within the department at MSI openly collaborate amongst peers, and within the university. These collaborations yield creative and technical resources to problem solve, and are a source of inspiration and creativity for the whole team. Edward, a researcher at MSI, views collaboration as a normal way of life:

> Yeah, I think we, as I indicated, we collaborate with each other quite a bit, so we just mutually encourage each other and if help is needed, we have our student who teach other faculty student how to do this type things. So, yeah, so, I think we, we just tend to collaborate a lot.

His peer, Charles, another researcher within the department; echoed a similar view:

> We are more collaborative than most I have seen around. There are a lot of centers and there are a lot of groups that work together. We're very small number of investigators here, which is nice. I like that. So, usually somebody on your team has more experience. You know, the reality is if you have had some good stuff in the past, you get um, more attention and you sort of, they get to know people who are um, either creative or have a creative group and do some good stuff. So, that helps.

Adam, the associate dean for research at MSI, sees this culture of collaboration as not only important, but necessary, in advancing team-based proposals:

> There are a lot of team based proposals that go out of that program and, not just within, within, their own department. Many of the faculty have collaborations with other programs, both inside our college. (Our college has a different administrative structure) So, that means it is very easy and very common for a number of faculty members in mechanical engineering to collaborate with people in chemistry, which is from the science side, and certainly a lot of collaborations with chemical engineering material science. Those are probably, and then some electrical engineering, within the college, those are probably the biggest groups that mechanical engineering tends to collaborate with. And, then, outside of the college, there are many collaborations with the medical school.

Collaboration extends beyond the department, college, and university and stretches into industry as well. According to Edward, a researcher at MSI:

> Yeah. For university, we file a patent. University helps us with filing patents and then after that then, university has an office for commercialization that will go out to the company and discuss with them of their interest. Now, for (company), since we have such a long history of collaboration, something like twenty of their products, … so, we have a high level of trust that um, is a lot easier for us to, for entry for us.

Those affiliated with the department at LSI see collaboration as less important and even support an administrative structure that requires independent work. Kenneth, the acting Dean of Engineering at the less successful institution stated:

> I think that most departments that I've seen across the country recognize that there are team oriented players and there are not team oriented players. You still have to come up with a credible record at the end whatever years it might be, uh, five, six, whatever. You have to have, according to our rules and regs, some independent grant activity where you are the PI and that means that there may be just you, no co-PIs.

John, the department chair at LSI agreed that collaborations are not typical within the department. In response to a question about collaboration being interdepartmental or intradepartmental, he stated:

> Mostly probably outside. Most probably among different departments. Not one hundred percent, but mostly, yeah.

When I attempted to probe further about departmental collaborations with John, I sensed some unease.

Harriet, a researcher within the department at LSI describes collaborations that happen within her research group but not with other researchers within the department:

> I think for the most part we work within our research groups, but under one faculty member. I don't think we happen to be doing innovations teamed between faculty here in our department. I have a team in my research group, but it's not with another faculty member.

Irene, her colleague at LSI shed a bit more light about the nature of collaboration within the department. Regarding interpersonal relationships and the divisions that have developed within the department; she said:

> Okay, there's several different factions. Some work well. Some are very mutually beneficial. One is very detrimental, and in fact, malicious. I don't think that is uncommon. [laughs] … It's probably much better here than it is most places, although that one faction is really bad! [laughs]

Institution Administration Sets Department Agenda

When undertaking this study, I was curious to find the root motivation within a department that had a bent toward commercial activities. I suspected that the motivation could either come from personal motivation, being an intrinsic motivation within the individual researcher, peer motivation at the departmental level, or a motivation generated by institutional expectation. Overwhelmingly the participants in this study agreed that institutional administration set the agenda when it comes to commercial activities. There are individual faculty members whose research agendas lend themselves to commercialization or applied technologies, but personal agendas advance very slowly without an institutional affirmation that work in the applied areas are permitted and encouraged.

At MSI, interest in commercialization initiatives began 8 or 9 years ago as an initiative of the system president and was endorsed by the Board of Regents. More recently, the campus chancellor views it as a top priority. In reflecting on the commercialization process Adam, the associate dean for research at MSI stated:

Well, I think it is something that has improved significantly over, I would say, the past 5 or 6 years. There has been a major shift in the way the office is organized, it's leadership and the attention that it gets and the support it gets from the Vice Presidential level, actually, from the President's, all the way from the President and Vice President for Research.

Charles, a researcher at MSI describes the influence the president has had on commercial activities:

Well, I have to say that we have a new sheriff in town. We have a new president who, I don't think it's coincidental that we have this new IP policy a couple months after he started. I think he's very pro commercialization for the right reasons. We've signed some research agreements that I think he was helpful with and um, these are with companies with the idea that IP is going to come out. I like the direction where he is going and some of the things they are doing now. Fifteen years ago I would have said what? You know, the program where you have CEOs and residents? What?! You have a venture center, huh?!

I was curious about the president's background, so I asked Charles whether the president was an academic by training or a former business leader:

He's an academic. He got his Ph.D. from (institution) and I think he was a dean at (institution) and (institution). Then he became the provost at (institution). I think he's done a little bit of commercialization on the side. From what I can tell he is the real deal and the right person for the time.

Participants at LSI described a changing attitude among administrators regarding commercialization. The "new" chancellor outlined it as a strategic initiative 2 years ago, and while the initiative is known by the entire campus community, colleges are just now taking the concept more seriously. However, the initiative has not yet resulted in changes in polices and practice at the department level. Irene, a researcher at LSI is aware of the changes in practice regarding commercial activities and reflects:

> That's what it's called within the university, engaged scholarship for public service. And, it's becoming a more and more popular term. If you search the internet. It's not just here. But, that creates value for faculty, within their ecosystem, for what they do on innovation. But, if that only matters in the provost's office, it doesn't matter for faculty as much because you live in your department ecosystem. You don't live in the provost's ecosystem. Although it looks really good for the department on a higher order, for the individual, it hurts. And, that's a big disconnect right now in where we are. I'm hoping that (the) Provost's environment will come down in the departments more and it seems to me that they've been working toward that, but it's still not here, at least not in my department. It's still not valued, still not looked on as, it's valued, but not for tenure and promotion.

Harriet, a researcher at LSI who is a junior faculty member, is conflicted somewhat about the institutional attitudes about commercial activities:

> So, I guess what I'm saying is I get mixed messages about, you know, this is good, you know, that's good activity to do, make sure you still get all

those papers and yeah. And our provost, it's not a mixed message; (the provost) is pretty clear about it too. Like, these are good activities; you still have to do scholarly research.

At the college level, however, the institutional goals for commercial initiatives have translated into action. Kenneth, he acting dean of the college relates:

> Up until about a month ago I was associate dean for research and graduate studies. I had that role for 10 years and I am now the associate dean in the school of engineering for what's called development. So,… in that role, one of my primary responsibilities is to identify opportunities, (commercial) research opportunities, for faculty teams who are working on interdisciplinary research, to permit them to capitalize on those opportunities with assistance of my office. It stops at that point. In other words, I am involved in the search for and identification of, and in some cases, the writing of a portion of the proposal. For example, in the last 2 years I think I have written five. And, the reason I was on those was in part because we needed a management team at the Dean's level and so I was able to be their PI or co-PI on those grants. That just made sense.

Proactive Technology Transfer Officers Matter

When I undertook this study, I was curious about the manifestation of regulatory policy, and how it could be different between institutions. The Byah-Dole Act ("The Patent and Trademark Law Amendments Act of 1980," 1980) regulates technology transfer, but I wondered how this policy played out at the local level. While I did not find

any substantial differences in the administrative process or technical compliance between the departments at the two institutions, I did find differences in how the researcher was expected to navigate the commercialization process. MSI's technology transfer office espoused a researcher-friendly stance that was committed to service, yielding a process that shepherded a researcher through the steps. The technology transfer office at LSI did not share this view, and expected a researcher to self-navigate all the steps involved in technology transfer.

At MSI, the technology transfer officer is very proactive, and makes appointments with departmental researchers on a frequent basis to see if there is anything the officer could be doing for them. The officer is very engaged in departmental activities, and maintains a very high level of customer service towards the researchers. The technology transfer office offers classes multiple times a year to educate the researchers on the process of technology transfer and to set expectations about the process in advance of researcher participation. The faculty members in the department were quite engaged with the technology transfer officer. Most everyone I encountered at MSI could tell me not only the technology transfer officer's name, but also that there was a class on technology transfer procedures to be held later in the week. These informational classes and all meetings with the technology transfer officer are held within the building housing the academic department for the convenience of the researchers. This commitment of service is a point of pride with Fran, the technology transfer officer at MSI. Her colleague, George, describes Fran's initiative:

> [Fran has had] hundreds of meetings with individual faculty. (She) presented at department meetings about our office, so the visibility has

> gone up because we have strategy managers like (Fran) that goes out there and makes these personal connections with faculty. So, they know her and trust her and want to work with her. She understands them, what motivates them, what their concerns are, answers their questions. I think they are very comfortable and very willing, interacting.

In these meetings, Fran is able to communicate her purpose within the institution and educate the researchers about the process that endears her to the researchers. Her engagement with researchers is informative and succinct:

> The process we actually have a step by step guide that we share with faculty. It's got ten steps. The first step is research, the second step is call us if you think you have an idea, the next step is file an invention disclosure, then the next step is evaluating that invention disclosure, make a protection decision, we file something if we decide to go forward. Fifty percent of the time we don't go forward. And, then, from that point on its (name)'s piece which is basically marketing and licensing deal. Company takes it through commercialization and then hopefully we see revenue. So, there should be ten steps in that.

Faculty members in the department reflected on the support she provided to facilitate commercialized research. Bill, the department chair at MSI commented:

> I think that pretty much every faculty member in the department, when they have been here for a few years, will know who their contact in (the technology transfer office) is, and if they have something which they feel

could be of interest for pursuing a patent. I think everyone knows that they should contact them and the office will work with them to first of all determine whether it makes sense to go forward for a patent and then if that determination is made, to actually apply for the patent. So, my, my experience with that has been very, very positive.

Edward, a researcher, describes the relationship with the technology transfer office as an extension of his research team, conceding that there are parts of the project that his team does not have to investigate because of the resources held by the technology transfer office:

> Well, department support innovation and entrepreneurial spirit, but I think that uh, we don't really have any mechanism to build a team towards getting it out. It's more for us to contact (the technology transfer office) like Fran, we talk to her all the time. So, so she is responsible for mechanical engineering innovation, helping us with bringing this technology to the attention of industry. But, so, if we consider Fran as part of the extension of ME [mechanical engineering] then I would say yes, but, if we, if we characterize her as part of the, of university central, which is the case because she's hired by university central, then, then uh, I don't see any need for the department to have an organized effort because in the end we are to talk to Fran anyway. So, I don't, I don't see any advantage other than perhaps it might be a good way to help our younger faculty member who doesn't know how to handle this sort of situation. But, they

can always ask the department head. I'm quite sure the department head will guide them to the appropriate person.

Charles, a researcher within the department also gives the technology transfer office high praise for their work. His research center within the department creates a high number of invention disclosures, and as a result, he has a high level of interaction with the office:

> [Describing the relationship with the technology transfer office] … Excellent because of the center. And, maybe because, uh, we have many disclosures a year. We have done it long before the center. So, I couldn't even count how many invention disclosures came out of my group over time. So, that is sort of a credibility issue and we've had um, [pauses] we have probably have had 20 meetings between (the) center and people in (technology transfer office) since we started because when we first, actually, I remember the first recruiting weekend we had 12, I think, and (technology transfer officer) volunteered to come in on a Saturday, and, so, (he/she) was part of that process. And, at the end of the day (he/she) says, you know, we're not ready for you guys. If you're going to come out with 15 to 20 patent disclosures, I gotta go back and talk to my people.

The technology transfer office adapted to this influx of invention disclosures over time, and was eventually able to meet the expectations of the center. Charles continues:

> So, um, and they've been great. You know, it's been arduous at times and frustrating on both sides and so forth, but we have come through that and

as I said, we have a special path way that actually other, um, faculty don't have.

Charles also takes pride in being a trailblazer to help continuously improve the technology transfer process:

But, I can also say that these new policies around here, I would like to think that based on those discussions, have broadened out to the general community. I guess. I assume that. I have never asked them if that's true or not, but, it's my guess.

Fran, the technology transfer officer at MSI reflects on the progress she's made during her time interacting with mechanical engineering faculty:

So, I would, so the way it really works is really that. I mean, I know it sounds funny, but, I don't know if we've trained the faculty or the faculty have trained us, but really, they do their research and if they think they have something they give us a call, so, somebody thought they had something, saw me walking in the building, stopped me and said, "hey, I think I have something, related to this earlier idea that we talked about, can I talk to you sometime soon?" And, then, you know, we have early discussion if it looks like the technology is right and that it is ready to be evaluated then we send them down the path of fill out the invention disclosure form and then we'll evaluate it and go from there.

This mutual respect and partnership building continues even when inventions have not met the expectations of the researcher. Fran relates a story about an encounter just prior to my interview:

> I mean, to give you an example, on my way in, I stopped at Professor (name). I always run in to him. I don't know, I must be on the same wavelength. And he's disclosed to our office with license stuff, his technologies. We passed on a bunch of his technologies for a bunch of reasons. One, he publicly disclosed more than a year ago, one thing was on his website. A couple of other things we looked at we said we just don't understand what problem you are really solving, and what the economic advantage is. But, even, and he gets upset. I mean, he really kind of toys with it over and over and I know that it bothers him. But, he stops me in the hallway and says, "Hey, you know, that thing that you said no to a year ago? Well, I think I have something slightly related that we should talk about." So, I think it's a healthy relationship because they're not sort of shunning us. When I started 6 years ago, people wouldn't even talk to our office. That was one of my jobs, actually, to rebuild the relationship, kind of like a white horse coming in. so, even if we say no, people still come back to us.

Further reinforcing the customer service posture maintained by the technology transfer office at MSI, the office maintains a robust website including all of the forms, checklists, and contact information for engagement with their office. The website is organized and indexed to allow different stakeholders (campus departments, campus staff, external departments, industry) to quickly find information. The website is updated often and contains an active web log of activities, as well as a calendar and rotating "success stories" to highlight researcher's achievements.

Participants in the department at LSI could not tell me the technology transfer officer's name, and tended to describe the engagement with the technology transfer office as difficult and inconvenient. Any meetings with technology transfer office personnel were conducted at the technology transfer office located more than 3 miles off campus. With some chagrin, the technology transfer officer told me that the office was not currently focused on being a service organization to the researchers, and that there had been communication issues between the office and the engineering department in the past. In describing the change in service standards offered by her office, Laura, the technology transfer officer at LSI relates her feelings:

> I have, during most of the time that I was here, I was under a different management. We have new management that came in in the last few years. So, there's kind of a difference between the two styles. When I first came here, there was, I think more of an emphasis on serving the faculty, providing a little more, I guess, customer service to them. And, recently it's a little more geared towards revenue generation. And, I'm not saying, you know, there's obviously aspects in both, under both management, it's just where the emphasis seems to be.

In addition to limited outreach to researchers, there seems to be historic communications issues between engineering fields and the technology transfer office. Laura further discusses her relationships with the engineering departments, noting that these relationships have the potential to improve:

> I get along with all the engineering departments. It is really funny because neither of my supervisors either of any of my past supervisors understands

> engineers very well. But, I have an engineering background, so I know how to talk to them. And I'm not saying there is something wrong, it's just that sometimes they have a very direct way and they have a tendency to keep, especially like to keep asking the same question over and over until they get the answer they want. And, I'm not saying that it's a different answer, but maybe you're just not giving it in a way that they perceive it. I don't know if I've explained myself well, but, um, I remember one time we had a, we were doing a license negotiation and the inventor called and was an engineer and he kept, he kept asking questions. He had a list of questions and we would answer them all and he would go away. Then he would come back and have a whole other list of questions and basically he was going through everything with a fine tooth comb, having to understand little detail and my supervisor was about to pull his hair out. But, I knew what he was doing, so, I just kept answering his questions and then he finally went, okay! [laughs]

Because the technology transfer office at LSI is more passive with the departments, the researchers at the departmental level are left to navigate the process in a more self-directed manner. John, the department chair relates his impression of the technology transfer process:

> I'm not sure I know all of that. I mean, as such, but, uh, if you're looking for qualitative as opposed to what process they actually go through, I mean, it seemed to be um, still seems to be rather convoluted, rather difficult for someone to go through that process. I'm not saying it's any

> different than any place else, or any other situation if you were someplace else, it might be exactly the same. But, it seems to be a pretty complex process and um, in general, I think it deters people from being that interested in going that route.

As John continued, he considered the internal conflict that researchers face when prioritizing their time between purely scholarly activity and commercial activity. From his vantage point as department chair, he sees the resources needed just to interact with the technology transfer office may be a burden that is too great given the relative worth commercial activity is given in promotion and tenure. When asked about this burden, he replied:

> Those that are really excited about it (technology transfer), manage it just fine. I mean, basically if they really want to do it, then they'll do it. But, but those that maybe if you're looking for people who could but weigh that cost/benefit ratio, and I'm not talking about money, but I mean, time (taken away from other scholarly activity).

Reflecting on the opinions of the technology transfer office held by other faculty in his department, John related:

> So, they just say it's too much effort to do this, essentially. So, that would be my general guess. I mean, it's not like it's, again, a pointing at any one group, it's more like, it's just the way, it seems the way the bureaucracy is put together.

This opinion is reinforced by Irene, a researcher:

It is still very passive in that it requires faculty to make invention disclosures, but there's more efforts, more money is being put toward it, more people are being put toward this to reach out to faculty and encourage them look at starting businesses, not even just starting businesses, but to take their technology to that commercialization. There is still, in my opinion, not a good system for saying when to take your technology. And, helping faculty realize, you know, okay, so you've been working on this for years, when is the cutoff time that it's ready to go out? Or should you disclose immediately? It's still not very clear at all.

Irene is optimistic about changes in the future, however. She is aware that management changes have occurred in the technology transfer office, and she believes that the future is brighter because of overall institutional attention to technology transfer generally:

I'm sorry, but, the process itself hasn't changed the way it works, but I think their (new management) influence will probably make it more business driven, but the actual steps, what input they bring, maybe that is what I'm trying to say, is making it possibly better, but still the management side is a weird thing going on now. I don't know what is going on with that, but hopefully it won't affect me other than making it better, that's all. [laughs]

Irene's optimism is shared by her colleague, Harriet:

There's generally a lot of frustration with them [the technology transfer office] here [laughs] to be honest. They are trying to improve because I

think they, uh, they're supposed to be a service organization, but they seem to be more trying to, they also have to do compliance, so they're also more on the regulating possibly hindering sometimes. But, things are getting better. The tech transfer, I think, now is separated out from that somehow, but, um, they're a service. I don't mean people are frustrated with them, but the research center in general, people have general gripes about what service to they provide? We give all this overhead, what do we get?

Indicative of the limited service extended to researchers, the technology transfer office's website at LSI is much more dated, but does have links to electronic forms. The organization of the site is somewhat less user-friendly, and is not organized to serve different stakeholders that may have business with the office. It does not appear that the website is maintained as a primary source of outreach for the technology transfer office. For example, website has newsletters available, with the most recent dated 2008.

Again, I did not find any substantial differences in the administrative process related to commercialization for the departments at MSI and LSI when considering the rules promulgated by Bayh-Dole ("The Patent and Trademark Law Amendments Act of 1980," 1980). However, I did find a difference in how conflict of interest rules were enforced locally. These rules apply to a subset of commercializing researchers who participate in the self-commercialization of technologies developed as a result of their role at the institution. The conflict of interest rules have been relaxed for faculty at MSI which enables researchers to

establish companies more easily. Charles, an MSI researcher, is also a member of the university-wide conflict of interest committee. He related:

> Well, a lot of faculty, toggle toward well, I'm going to start a company on this, so, now there's a group that is also underneath (name) that evaluates, you know, should this be a license or can it make it as a start-up company? So, I think they have gone from two to three year to nine or ten or eleven. So, they've increased that. Another hat I wear is I chair one of the conflict of interest committees on campus, so I go to all the meeting for all three committees. And, there we've uh, actually changed and eased our policies to allow faculty more freedom in the beginning of this process, um, versus what was in the past. …Well, you know, if a faculty member or staff member wants to run a company then they want to own a higher percentage and there was a rule in place, I think, you know, if the threshold of triggering a potential conflict of interest is 5 %. Well, in the beginning you own a lot more than 5 %. And, so, we've eased that a bit for a while and it's helped. Just being realistic and having a number of meetings with the uh, the folks over there joint meetings where they say, well, you know, this is how business really works and um, if they're raising capital then they need to be involved and you know, president versus chief operating officer versus chief financial officer versus chief tech officer versus chair or part of the administration.

While this is an administrative accommodation created for those that self-commercialize at MSI, documents and participants from LSI indicated that conflict of interest rules were

uniformly applied in their institution, and no accommodation was given to those faculty members who intend to self-commercialize.

Organizational Structure is Important

The college that houses the mechanical engineering department at MSI is administratively organized to include all of the sciences and engineering within a simplified administrative unit. This arrangement lowers any possible administrative barriers to collaboration and gives the administrative unit the ability to form multi-disciplinary research teams on an ad hoc basis. These research teams form often and have become an expected practice within the administrative unit. This collaboration culture appears to extend campus wide.

Reflecting the collaborative nature of the college is a special center created to invent medical devices. Adam, the Associate Dean at MSI holds the center as a model for reducing bureaucracy and enhancing intercollege collaboration:

> Now, I mean, you'll talk to Charles, you'll find the other side as well because we have intentionally also focused a particular program to drive the innovation side separate from basic research, but it's a relatively small program that's focused, that's actually intentionally structured. He directs a center, it's a college center, it's actually a collaborative center between our college and the Medical School in the area of medical device design. And, that program actually, we fund eight fellows, eight innovation fellow a year out of that program. These are people that come in to the program with experience. Some of them are MDs, some, many of them are engineers that have been working in the industry, come for a year. And

> their focus is actually to find needs in the medical space and then create products. So, they made, last year they put out something like a hundred disclosures. So, that program is focused on that. They are not there to do basic research. They are not getting research grants or anything.

Outside of the college, MSI's technology transfer office is also administratively arranged to accommodate a division of labor between the technology transfer officers who interact with faculty and the technology transfer officers who interact with industry. The two officers operate as a "matched pair" to facilitate the commercialization process and act as shepherds to those researchers navigating the process. This arrangement allows for one officer to actively market technologies for the institution while the other engages faculty members and scouts new inventions. Fran, the technology transfer officer at MSI describes the arrangement:

> So, my role is Technology Strategy Manager. And, so here at (MSI), we don't have the typical cradle to grave structure that most tech transfer offices have. We sort of split the process in two. And, so, I have the front end of the process, so I am the one who is developing the relationship with faculty and seeking out their inventions and evaluating if those inventions have commercial potential and also facilitate the IP (intellectual property) strategy.

In contrast to MSI's administrative structure, LSI is organizationally siloed, separating the department from potential external collaborations. Until recently, the primary collaboration group for the department was housed in a separate "institution" requiring approvals to flow through two chains of command. This organizational

separation was likely the result of separation by distance, as the two campuses are more than 30 miles apart. Recently, LSI initiated a change in organizational structure to bring the remote campus under the umbrella of the main campus. Administrators cited cost reduction as the motivation for the change. However, this transition has not necessarily made it easier to collaborate from the point of view of Harriet, a researcher at LSI:

> We are actually are separate entities in some sense. Like, our research institutes are separate entities, but they've actually managed to make the tech transfer span both very smoothly. So, our tech transfer officers actually spend time each week on both sides, both campuses.

Direct Financial Incentives Play a Minor Role

In a time of economic transition and a contraction of university resources, research has shown that faculty may be less resistant to external influence on the direction of faculty inquiry, and be predisposed to consider research as a business enterprise rather than one driven by science (Slaughter & Leslie, 1997). Personal financial gain is often cited as a potential motivating factor for those researchers who participate in the technology transfer process. In theory, within these two cases there is the possibility of financial gain, as both institutions offer the commercializing researcher (or research team) one-third of licensing income as an incentive to participate in the process of technology transfer. However, this was not mentioned as a primary motivator for the researchers I interviewed. Bill, the department chair at MSI currently has a several technologies that have been licensed by the university to commercial entities. While he concedes that there is some possible financial incentive to participate, he indicates that a greater reward is to impact humanity:

> Well, so, first of all there is in case a license was commercially successful, the university has a royalty or profit sharing agreement which gives one third of the royalty income to the inventors. I think that is very generous compared to what the corporate world does, I think. So, from that point of view, faculty members, I do believe, have an interest in participating in that process. But, I also believe that for every faculty member, it is very rewarding to see their technology actually make some significant impact on the marketplace.

Fran, the technology transfer officer at MSI sees the motivation slightly differently. She believes that researchers participate not for personal enrichment, but for additional resources to perpetuate their research agenda:

> So, when I first started, I went around meeting folks, just to, I had a slightly different role when I started, and one of the questions that I asked them was "What is your motivation for even engaging with our office?" … most of the time it was "I want to see my invention used." It usually wasn't about the money. It was, "this is a way I can get jobs for my grad students." Um, you know… I mean, I think the ones, yeah, I think the ones that actually get money from the licensing, think it's great. But, I tell them all, you know, don't count on it. Like, this is a little bit like a lottery or a really high risk investment, so, don't think that you're going to fund your daughter's college education because you can't bank on it.

John, the department chair at LSI sees the potential impact from participation in commercial work as one of scholarly credit rather than money:

> One of the biggest things to hurt would be, is the faculty put their efforts into those things and then they don't get credit, "credit" for those. Again, not talking about money, you know, talking about credit as far as their credentials, their, that that means something on their vitae. That means something on their yearly evaluations and so forth.

Irene, a researcher at LSI also has inventions that have been licensed to commercial entities. She does not think the perception of her position as a commercializing researcher matches reality:

> It's different now. Okay, there is a perception by some people, not so much in engineering, but some in engineering too, that you're doing it just for the money. And, if they knew [laughs] how few innovations actually bring in substantial money, if at all, they might change their mind or how long it takes often for that to happen that it's not just we're working on the, we license it and bam. If they know how much work went into it, they might think differently. But the perception that you're out for money inhibits, I think, a lot of people or the lack of understanding.

Harriet, also a researcher LSI, has technologies that have been licensed. Indicating her lack of concern about personal revenue was her comments about how the compensation would actually work to her benefit:

> Okay, yeah, that return on that investment is [pauses] oh, I used to know these off the top of my head. Let's see, well, first, the tech transfer office regains the money they've spent on filing it. What is complicated and not clear to me, but I finally ascertained that it didn't affect my split if this

other institute is now paying some of our files. I'm not sure who gets their share, but I let them figure that out.

Beyond the direct financial compensation offered by the prospect of license revenue, work in the commercial arena may put the commercializing researcher at a disadvantage during the promotion and tenure process. Each institution sees this consideration as changing, albeit slowly. In a relatively recent change in guidelines adopted by the board of regents, MSI now considers all forms of commercial activities and success to be listed in the promotion and tenure dossier. Adam, the associate dean with MSI sees this as a monumental change in institutional policy. He is almost giddy when he describes the change:

> I think one of the things actually I forgot I was going to get this for you, um, my colleague, (name), who is the associate dean for faculty affairs oversees this. I believe that for the promotion and tenure documents, every program and certainly the college, have to have a document that describes the elements of what, what drives those considerations. And, I believe that uh, patents, in addition to publications, patents are now explicitly mentioned in those documents. That never existed before…. I think that's a clear and very important high level, official validation as to why this kind of an activity is viewed as being important, at least in principle. [laughs] In the end, its faculty vote for these promotions and so on and everybody has their own personal view of the importance of these things.

He continued describing the difference in how commercialization activity consideration was viewed by faculty:

(It's made a) real difference. I think the difference is, I think the numbers have been going up. Certainly people are aware and are encouraged, but I wouldn't say that it's been, I see change of sorts that a lot, once everybody is jumping around and putting out disclosures, but, uh, but, it is certainly at the official level, I mean, we have workshops and we have training programs.

The department does not consider "all" forms of commercial activity by the researcher, rather those that must have some degree of impact. Bill, the department chair, relates how consideration is given in a practical sense:

Yeah, well, a license is something different because it means that something was created and there is a commercial entity that actually has a significant interest in that, so, yeah, that is something that demonstrates an impact. With papers, it is much easier to find out what the impact is because specifically if a paper is written and published, a year later I can go and find out, are there actually people citing it and is there impact on these papers? With patents, it is often more difficult to measure, but it clearly plays a role in the merit process.

Bill's comments reflect yet another dimension of possible financial motivation beyond strictly licensing, which is merit pay. Bill explained that raises in base pay within in his institution are based upon the merit (or performance) of the individual, and his ability to give these incremental raises are within his sole discretion as department chair. His comments and non-verbal cues during the interview led me to believe that he views commercial research endeavors

favorably when determining merit pay increases. Therefore, the possible financial incentives that may accrue to a researcher may exist in three spheres; merit pay, salary increases due to promotion and tenure, and income from licensed technologies. Of these, participants in both departments seem to focus least on the licensing revenues for individual monetary gain.

In reviewing LSI's promotion and tenure policies, I could not find that any explicit consideration was given for work in the commercial arena. However, researchers indicated that some consideration was given for patents that had been issued. In response to a question about promotion and tenure considerations for faculty, I asked Laura, the technology transfer officer LSI about policy. She replied:

> [Whether consideration is given to commercialization] Not too much. And, I understand, and I haven't checked this lately, but I understood if they have an issued patent, it helps. But, if they don't have an issued patent, it's not necessarily beneficial and it takes a lot of their time. It's more beneficial for them to publish.

This was reinforced by Irene, the researcher at LSI:

> They don't look at a provisional patent as value at all. They don't look at a filed patent as value at all. It's only five years down the road, maybe when it's a proof patent and for a tenure track or even promotion track faculty, that hurts you. It doesn't help you. Unless it's recognized and this is something at (institution) that is exciting but it hasn't trickled down to the departments yet. (name) our Provost is very cool. He is promoting this idea of engaged scholarship for public service and entrepreneurship.

> Things like patenting and things like that would fall into that as being equal to scholarship, just a different form of scholarship.

While Irene is looking forward to a possible policy shift to include commercial activities in promotion and tenure process, her colleague, Harriet is feeling the pressure of current expectations. Her research agenda lends itself to applied engineering in commercial products rather than basic science. While she is generally optimistic, she remains tentative:

> So, I think the outlook is pretty good. I don't know if you're going to ask me about this, but there is still a debate about how much time like tenure track faculty should be spending on (commercial activities). I don't know if you were going to be asking me that.

I asked her about the debate:

> I think they've decided to count an accepted patent as a publication when you go for tenure. But, it has to be completely, what's that, accepted or filed, not just filed, but approved, which would be, is hard to do in that tenure track time frame. So, I guess what I'm saying is there is some discussion about whether that's a good use as a tenure track faculty member, is it a good use of my time to be doing this? Because I'm doing this work, I've got a patent filed, but there's nothing else to show on my CV. It's not going to count other than maybe someone who appreciates it will look at it and say, "Oh, she seems to be entrepreneurial." So, I think there are some people in our university like our Provost who is very positive about entrepreneurial activities. I think that people would look at

that and say, “Oh, that’s good for her career later on.” Other people would look at that and say, “That’s nothing. Where’s the papers?”

Because the timeline to reach the milestone of an issued patent can be so long, junior faculty on the tenure track at LSI can feel some pressure to work in basic science first. Harriet expands on her previous thoughts:

> Um, I just think mostly what’s on my brain about it lately is that I’m going to submit a tenure package next year and um, so, I’m really like, everything I do, will this go on my form and help me get tenure? And increasingly I am realizing the commercialization stuff, probably not. [laughs] In the short term, it won’t provide that. So, I’m definitely feeling the pinch about how to spend my time on things. You know, if I do a lot of work to file a patent, that’s just going to be like, whatever. That’s hard.

Consistent with the changing attitudes at LSI, but reinforcing the lack of complete buy-in by the department, Kenneth, the acting dean contemplates academic output, collaboration, and academic stimulation:

> Well, first of all, there has to be a, and I believe we have it here, there has to be an acknowledgment that individuals are rarely going to make major contributions if they’re asked to publish every little twit that they put together. …I would turn that around and I would say if you are a member of a group, your publication possibilities and your ability to get funding will skyrocket. …But, the big benefit is when your name is number three out of ten because all ten of those people know you. And when it comes time for promotion, you don’t have to look down a list and say, “I wonder

> if that person remembers me?" I'll send them my vitae and see if they'll be willing to write. There will be people on your team who will say, "call me in." they'll be people who hold name professorships. How do you beat that? …You can't beat that. So, there is a great benefit for being involved in a larger scale project, more than you'll ever guess. I cannot imagine that that doesn't make the clock tick to your advantage more quickly. You might go up in year four. We've got one guy who is in year four, he's brilliant! They promoted him to full professor. They just said the hell with it, why should we go through this twice? And, he deserves it. There's no doubt about it. He's in a group, a large group that does exactly what I'm saying and he's an internationally known expert at 33.

Recognition for Work in Technology Transfer

In addition to the differences in the promotion and tenure process between institutions as previously discussed, there is also a significant difference in the ways each institution recognizes those who participate in technology transfer. MSI celebrates commercial activity in a number of different ways, but most prominently, the president of MSI hosts an annual awards banquet. At the gala, trophies are presented and inventors recognized for their commercial success. In addition to this very public display of recognition of commercial activity, MSI has adopted an ongoing program for recognition that includes periodic newsletters and ongoing blogs to offer examples of commercialization success.

In comparison, LSU has no similar activities to recognize or herald commercial success. There is neither a recognition banquet nor electronic communication (newsletter,

blog or otherwise) to publicize commercial activities. As mentioned earlier, the latest electronic newsletter on the technology transfer office website of the less successful institution is dated to 2008.

The concept of peer and institutional recognition is a theme that emerged from my interviews, and as I talked to the researchers at MSI, I discovered how important this topic, recognition, is to them. Charles, a researcher at MSI offered:

> Well, they have started a yearly celebration, which I think is really good. Most companies, do that where they give you a little plaque or something like that, which I think is the right thing to do.
>
> … I think it's, around here it's prestige for most colleagues. I've had people from, that I know from different colleges say "congratulations, I saw your name on the website, you know, you had a patent come" or something like that. It's, that's new, and that didn't happen before. All those things are good.

This recognition is an overt act by the technology transfer office at MSI to gain visibility for the researcher, the technology transfer office and the university as a whole. Fran, the technology transfer officer comments:

> So, we have annual inventor's recognition event. It's kind of like a reception/party. We're starting to promote the list of issued patents in various logs/newsletters at the university put out. They get a little thing to put in their office…A trophy…I think they actually display it too.

In fact, each researcher I interviewed pointed their trophies out to me as a matter of pride.

Summary

This chapter presented themes that collectively shape the cultural and policy environments of commercializing researchers in their respective departments at MSI and LSI. The findings were organized by key topics from the conceptual framework and data were collected and analyzed primarily from interviews with those in the commercializing researcher environment and those in a position to view the environment closely. Through the heavy use of quotations from the participants, I aim to build confidence in these findings by allowing the reader to understand the details of the participant's perspective. All themes were corroborated either by other participants, document review, or my observation.

In the next chapter, I will discuss these findings as well as make recommendations to policy and practice that may be informative to those departments and institutions seeking to engage more successfully in commercial activity.

CHAPTER 5 – ANALYSIS AND INTERPRETATION OF FINDINGS

Whereas the previous chapter was organized into themes informed by the conceptual framework, and included themes that emerged from the data, this chapter is an attempt to reconstruct a more holistic understanding of the environment of the commercializing researcher through the layering of conclusions. I analyze and interpret the themes identified in chapter 4 to inform recommendations to those institutions that wish to improve their commercial success. The chapter is organized by the original research questions, which were focused on culture and policy:

1. When comparing more successful institutions with less successful technology transfer institutions, what cultural factors contribute to the work environment of the commercializing researcher?
2. When comparing more successful institutions with less successful technology transfer institutions, what policy factors contribute to the work environment of the commercializing researcher?

To these two major divisions I have added a section that involves mixing of the frameworks of culture and policy, as there are some instances where I conclude that the two are very much intertwined. I conclude with recommendations for further investigation.

Commercializing Researcher Departmental Culture

When comparing the mechanical engineering departments at MSI and LSI, I found a number of cultural factors that shaped the work environment of the commercializing researcher. These factors include a cultural commitment to "good

science" that evolves to a continuum of innovation, cohesive relationships with the technology transfer office, and a propensity to collaborate with departmental peers and across campus.

Departmental View of Commercialization

The first research question sought insight into the environment of the commercializing researcher culture in seven dimensions (Dimmock & Walker, 2002). On the surface, both departments and their universities described as "typical." Participants at both sites viewed their roles as academic researchers to be of utmost importance. The recognized skill of the researcher formed the basis for departmental hiring decisions, and promotion and tenure. This focus on research expertise grew largely out of the need for the researcher to become self-funded over time through grants and contracts, with more successful department members seen as those attracting enough funding to support themselves, post-docs, graduate students, and administrative staff. This self-funding support structure creates a de facto validation of the researcher's work as well as revenue for the institution. The outcome of government funded research is largely the expansion of the body of knowledge on a particular topic as evidenced by peer-reviewed journal articles, conference presentations, and similar academic pursuits (Frey, 2003). The point at which the views on academic impact diverge between MSI and LSI is when the research produces a discovery with potential commercial value.

MSI sees commercial products as a natural outcome of good basic research. Because the publication of the research is the more immediate benefit of the work done, the financial benefit of a licensed discovery is seen as secondary. The overriding viewpoint is that knowledge is the primary product, but commercial acceptance is a

bonus, a benefit from good basic research. The departmental culture reflects that while commercial products can come from good research, it is not the primary motive for day to day activities. Collectively, the researchers in the department produce a pipeline of innovations with commercial benefit with different researchers producing discoveries with commercial potential at different times.

At MSI, both researchers and technology transfer officers described the purpose of research similarly. The technology transfer officer is viewed as a valued member of many of the research teams, and researchers referred to her by name. The officer was not seen as an impediment or distraction to the research process, but a valued contributor. All viewed the officer as someone who would "run with the ball" after the technology reached a certain point and had commercial value. The officer was a regular presence in all of the research labs producing intellectual property with the potential for commercialization. As the participants described their relationships with each other and the technology transfer officer, I gave them values in Dimmock & Walker's (2002) framework that would rate them towards the ends of the spectrum identified as *distributed in power*, *group oriented*, and *considerate* (Dimmock & Walker, 2002, p. 158) in their culture. The *pro-activism* (Dimmock & Walker, 2002, p. 158) of the technology transfer officer for the department was very apparent.

Conversely, the departmental faculty members at LSI tended to view the creation of new knowledge as the end deliverable from research performed. If something of commercial value was created, it was considered to be out of the normal bounds of responsibility for the researcher. Researchers whom work in areas where commercial application is possible are seen as a bit "different." This view was also reflected through

the relationship with the technology transfer office, which was described by the participants as difficult and cumbersome.

No one in the department at LSI could name the technology transfer officer assigned to them although the officer has been in place for 6 years. Meetings with the technology transfer officer (when required) necessitated the researcher drive in excess of 3 miles for a meeting. By the officer's own admission, the previous administration of the technology transfer office saw this department (and college) as difficult communicators, which may contribute to a strained relationship. Additionally, the officer indicated that during the past 2 years, the office had taken a stance away from a focus of serving the researchers toward a focus of generating revenue. I found this priority on revenue generation to be somewhat odd, given that the underlying source of the revenue (institution intellectual property) can only be harvested from working with commercializing researchers. Over 2 years ago, LSI reorganized the management of their technology transfer process, and the timing of this reorganization seems to coincide with the office priority on revenue generation. This stance seems to be incongruent with the university's strategic plan, which is placing a high priority on the recruitment of faculty and expansion of infrastructure to generate intellectual property.

When I compared the participants at LSI to the participants at MSI in Dimmock and Walker's (2002) seven dimensions, I found them to be much more *self-oriented, aggressive,* and *limited in relationships* (Dimmock & Walker, 2002, p. 158). Specific to LSI's technology transfer officer, I found her to be much more *fatalist* (Dimmock & Walker, 2002, p. 158) in her approach to relationships within the department as compared to her MSI counterpart.

Admittedly, the culture of a department does not change quickly, and may be subject to a lag in adoption from broader institutional initiatives (Damanpour & Evan, 1984). However, the more successful department approaches the concept of technology commercialization from the same basic viewpoint as the less successful department – focus on science first. The difference is what happens after a discovery is made. The more successful department sees this as an opportunity and draws upon the resources of the university to provide the department with some (hoped-for) long term benefit through license revenue. The less successful institution does not avail itself of that opportunity well.

Departmental Collaborations

Expanding upon the collaborative theme explained above with the technology transfer officer, the department at MSI is more team oriented than the department at LSI. The culture of the more successful department appreciates a mix of solo efforts as well as collaborative, with the dynamics between peers to be quite fluid. The outlook of the more successful institution is that federal funding for research is trending toward collaborative teams to solve problems, and the culture of collaboration within the department, within the college, within the university and beyond are necessary to secure federal funding in the future (Salter & Martin, 2001).

A benefit from a culture that supports basic research collaboration is that the same approach also applies to solving commercial problems as well. Again, the department at MSI sees this application as a logical progression of what it is already doing. When asked about sources of inspiration for problem solving, the participants were quick to include peer relationships as one of the primary sources, which is widely accepted in the creative

industries (Drake, 2003). Comparatively, the departmental culture at LSI values independent work much more. Collaborative teams among departmental faculty members are nearly non-existent.

Commercializing Researcher Policy Implications

When comparing the departments at MSI and LSI, several policy factors contributed to the work environment of the commercializing researcher. These topics include organizational structure, policy differences in promotion and tenure considerations, conflicts of interest, and public recognition of commercial activities.

Promotion and Tenure Considerations

Like the participants at MSI, I do not believe that the gap between the worlds of the traditional basic academic researcher and the applied academic researcher with commercial applications is really that far. In academia, the expansion of knowledge through peer reviewed journals of is the most highly regarded form of societal benefit (Frey, 2003). Academic impact is considered by the contribution of the researcher to the body of knowledge, and validation occurs through peer review (Donald, 1990). In the basic sciences, discoveries that are made may not have any use beyond the scientific challenge for decades to come as new enabling technologies are created to use the underlying basic science or connections are made between the basic science and problems that need to be solved (McMillan, Narin, & Deeds, 2000). Nonetheless, basic science remains important and in our national interest as an industrial (and coming) knowledge-based economy (Salter & Martin, 2001).

For those who have created intellectual property with commercial appeal, the time to realizing the benefit of scientific discovery are typically much shorter. The path from

concept to bench top to factory to consumer can be quite arduous, with technical problems to solve at each step (Nelson, 2004). Layered upon this science is the need to assess economic viability of the idea through market acceptance and ability to deliver (Etzkowitz, Webster, Gebhardt, & Terra, 2000).

In each case, the scientist was prompted by intellectual curiosity, and received funding to solve a problem. Each path presented the scientist with numerous technical problems to solve, but each reached some degree of completion. The traditional academic contributed to the world of the known, while the commercializing scientist contributed to the economic vitality of a commercial enterprise. Both positively influenced their intended audience, and demonstrated the fruits of academic research. The difference lies in validation, public disclosure, and consideration during the promotion and tenure process.

At MSI, a fairly recent change in promotion and tenure policy allows for all types of applied research and commercial activities to be included in the dossier for consideration by the promotion and tenure committees. By allowing these activities to be considered, the institution has elevated the comparative worth of applied research and given a tacit approval for its researchers to work in applied disciplines. As described previously, the participants at MSI were eager to tell me of this change, and seemed to be energized by organizational validation of their work in applied fields.

Conversely, LSI only gives promotion and tenure consideration for patents that have been issued, a process that may take more than 4 years. One of the participants at LSI was an untenured junior faculty member whose research agenda tended to be applied science. Because of the competing timelines of tenure consideration and patent

processing, she was internally conflicted and likely to change her research agenda simply to generate publications. She felt like she needed to refocus her efforts because scholarly output via publications was highly valued in the tenure process and it was unlikely that she would have an issued patent by the time her review was required.

Departmental Engagement with Technology Transfer Offices

By institutional policy, the technology transfer office at MSI was organized in a much different manner than the technology transfer office at LSI. At MSI, the office is a university department, staffed by university employees. At LSI, the office is a separate unit, funded by two other separate research entities. The employees of that office are not institutional employees. Beyond this technical difference, there is a substantial difference in the resources provided to the technology transfer offices by the respective institution.

The technology transfer office at MSI has resources necessary to invest time and energy in developing formal relationships within the mechanical engineering department. The technology transfer office staff at MSI numbers more than 30, with four officers assigned exclusively to engineering. Of those four, two develop researcher relationships, while two are focused on developing relationships with industry. Formal relationships with the department were evidenced by frequent visits, professional development opportunities for department researchers and exceptional customer service. Through a division of labor in the office, the officer's workload was kept at a point where mutually-beneficial relationships could be fostered, and the officer was able to transact technology transfer office business at the convenience of the researcher. She was afforded this luxury in time because the expectations of her position were to focus solely on the researchers creating intellectual property.

The technology transfer office at LSI was much less researcher oriented, which could be explained, in part, by a lack of resources. The entire staff of the technology transfer office at the less successful institution numbers less than ten, with one technology transfer officer responsible for interacting with not only engineering researchers but other colleges as well. In addition to managing researcher relationships, the officer is charged with managing technology cases through a license agreement with a commercial enterprise. This apparent workload, amplified by an office focus on revenue generation, causes the office to be viewed as lacking in customer service from the viewpoint of the commercializing researcher.

MSI commits resources to commercializing researcher recognition as well. The institution, through its technology transfer office, works diligently on celebrating successes in a very public manner. Newsletters, web logs, press releases and an annual gala hosted by the institution president were all warmly received by faculty. In my interviews, this recognition seemed to be much more important to the researchers than any future financial gains to be reaped from licensing activity. The participants at LSI did not report any sort of recognition, including publicizing research commercial success via newsletters or blogging.

Using Lipsky's (2010) *street level bureaucrat* as a framework for comparison, I found differences in the patterns of practice between the technology transfer office at MSI when compared to those at LSI. Within the construct of *rationing services* (Lipsky, 2010, p. 87), the availability of the technology transfer officer to the MSI department was almost unlimited, which demonstrates institutional commitment to the importance of the technology transfer process. Conversely, the technology transfer officer at LSI offered

the department limited access to office resources by using the barriers of time and distance. The officer was rarely in the department, and if a meeting was needed between the officer and a researcher, the researcher needed to drive several miles off of the campus proper to meet at the technology transfer office.

When I undertook this study, I was curious if the federal rules governing technology transfer were uniformly enforced. Based upon Lipsky's (2010) pattern of practice in *inequality of administration* (p. 105), I expected to find that the over-arching rules for technology transfer promulgated under Byah-Dole ("The Patent and Trademark Law Amendments Act of 1980," 1980) to be enforced unevenly between the two institutions. While there were certainly differences in the relationships between researchers and the technology transfer officers, I did not find any substantial differences in the technology transfer process itself. However, there was a difference between institutions regarding the enforcement of conflict of interest rules for researchers who choose to self-commercialize, with MSI taking a much more relaxed stance towards conflicts while a faculty-based company is in the startup phase of operations.

Commercializing Researcher Environment Influenced by Both Culture and Policy

When comparing the departments at MSI and LSI, there were a number of differences that contained the frameworks of culture and policy. These topics include policy differences in physical proximity to peers, collaborators, and industry; and the departmental absorption of agenda setting by institutional administration.

Physical Proximity

I placed physical proximity in the category of analysis that overlaps both culture and policy because I could see where one factor directly influences the other. During my

data collection, I observed many differences between the institutions related to proximity, but I could not ascertain whether the physical spaces resulted from departmental culture or whether the physical spaces created departmental culture. Regardless, physical space within the department (and proximity to other research spaces for that matter) is ultimately a policy decision guided by resource allocation.

At the departmental level, the researchers at MSI were housed not only physically close to each other, but in such a manner to cause them to cross each other's path. This was evidenced by office suite layout and the sharing of resources such as printers, copiers, and a coffee pot. Beyond the department, researchers were physically proximate to potential collaborators within the college and the university overall. The compactness and terrain of the campus lent itself to short walks to all campus facilities and schools. Lastly, MSI is located in a relatively urban area, and thus, is proximate to industry. I could see the potential where a collaborative meeting of a research team involving many departments, the technology transfer office, and an industry partner would require no more than a 5 minute walk by any party.

In contrast, the infrastructure of LSI did not foster collaboration or proximity at the departmental level, the college level, the university level, or with industry. The department is housed in an architecturally featureless building, and designed in such a way that the individual researchers may not pass a peer while on the way to, or from, their office. This same building appeared to lack collaborative labs and meeting rooms to foster discussions. The college is located on the border of a sprawling suburban campus, and the terrain of the institution does not lend itself to walking conveniently to other offices across campus. Because the campus is located in a relatively suburban area, it is

not proximate to many substantial industries. The primary university collaborators for the department are physically located more than 30 miles away and the technology transfer office is more than 3 miles away. Collaboration is likely difficult because of space and proximity.

To its credit, the less successful school recognizes the lack of proper collaborative facilities for departments and collaborators on campus, and is making investments to correct the situation by building collaborative space. However, there is neither an initiative for closing the distance to primary collaborators located on another campus nor an effort to close distance to the technology transfer office.

Other departments within engineering, however, have made positive steps to close the proximity gap between their department and industry collaborators. During my visit to the institution, I did tour a facility built to attract industry to the campus with the expressed purpose of fostering industry – university researcher collaborations. This center is beginning to see some limited success with that model, with one announced industrial tenant to the facility and pending announcements for two more.

Administration Agenda Setting

When questioned about the importance of technology transfer in their institutions, the researchers in both institutions pointed to stated administrative practices that have shaped larger institutional attitudes about technology commercialization. Once campus leadership identified commercialization as important, the colleges began to see commercialization as important. Over time, this importance has reached the departmental level, however to a much lesser extent at LSI. This process of agenda setting is consistent with concepts in public policy agenda setting (Birkland, 2007). MSI began this path 8 or

9 years ago as the initiative of the then president. LSI began this path in earnest much more recently, at the urging of the provost 2 years ago. Both institutions indicated that the work in this area of commercial activities became more accepted after the administrative stamp of approval. It is important to note that once announced, the support for the initiative in technology transfer has been unwavering, and is mentioned in most all public appearances by the highest administrators of both institution. This stance is used by the entire institution to show relevance to stakeholders as a way to demonstrate the positive impact the local and state economy during a time of economic distress – a stance consistent with the concept of *academic capitalism* (Rhoades & Slaughter, 2004).

Recommendations for Practice

Drawing upon the conclusions I have reached through analysis, I believe that there are a number of recommendations that can be made to institutions that aspire to be more active in the commercialization of research into intellectual property that can be patented and licensed to commercial entities.

MSI viewed the process of converting funded research to commercial license as one of a natural outcome of good basic science. This concept permeated the department and was present in hiring considerations, merit pay decisions, and promotion and tenure process. I recommend that the adoption of this viewpoint – a continuum of innovation – be adopted in those institutions trying to improve their commercial success. MSI believes that good basic science yields, over time, good applied science with commercial impact. I also believe that this viewpoint is an outgrowth of a departmental culture that is *power-distributed, group-oriented, considerate*, and *holistic* (Dimmock & Walker, 2002) in

relationships. LSI tends to view the results of academic inquiry stopping at the level of basic science when a publication is made.

In addition to recognizing the value of commercialization out of basic science, MSI also maintains a culture where interdepartmental and intradepartmental collaboration is expected. I recommend that departments seeking to improve their commercial success work toward a spirit of collaboration within the department, within the college, across the campus and beyond. If desired, these activities could be incentivized through the allocation of internal research resources such as salary support or preferred lab spaces. The culture of the department should develop to include teaming as an expectation of the faculty. The benefits of this outlook will likely increase success in federal funding opportunities for basic research as well (Salter & Martin, 2001).

Turning to policies surrounding researcher motivation in the area of promotion and tenure, the difference in researcher outlook between the institution that gave promotion and tenure consideration to commercial work versus the institution that considered only publications or issued patents was breathtaking. I recommend that faculty who wish to become more successful in the commercial arena amend their promotion and tenure policies to include consideration of applied commercial research of all types. The relative weight of these contributions would likely still be judged through comparison to departmental culture, but at least the mechanism would be available for consideration.

The advantages of building mutually-beneficial, trusting relationships between technology transfer officers and researchers were quite evident at the more successful institution. I recommend that an institution seeking to improve its commercial success

invest the resources needed to build and maintain positive, collaborative relationships between technology transfer officers and researchers. Over time, the officers will transition from being seen as an adversary or nuisance to being one of the team in the development of discoveries.

Success in technology commercialization also tends to breed success (Santoro, 2000). Through public recognition in the form of galas, newsletters, blogs, and webpages, the technology transfer office can elevate the status of those who work in this arena. By including the most visible institutional administrators in these events, the visibility for all is raised. The very presence of the university president and others at events and in institutional communications also validates the realm of technology transfer as an accepted and appreciated use of researcher resources. This validation of activity may take time to be fully embraced the departmental level, but when integrated, further reinforces the institution's economic relevance to stakeholders.

I believe that physical proximity plays a strong role at the more successful institution, and recommend that changes in policy and resource allocation be allowed to close the proximity gap. According to the researchers at MSI, the "cross-pollination" of ideas is a huge source of innovation inspiration, a concept well known in the creative industries (Drake, 2003). However, changes to physical proximity will require transformation in both departmental culture and institutional policy. Researchers will need to be willing to work in collaborative labs outside their department, and administration will need to provide resources for collaborative lab space. Beyond these space challenges within the institution, proximity to industry contributes heavily to the success of MSI. Administrators will need to consider policies to allow industry partners

to be proximate to campus for expressed purposes. For example, an institution may consider the establishment of shared workspaces to facilitate interaction between institutional researchers and industrial researchers on the same topic. This collaborative research team arrangement would need to exist in a codified master research agreement and be managed for potential conflicts of interest, but the administrative framework could be established to allow such activity.

If a department seeks to be more successful in the realm of technology transfer, it has to be perceived by internal and external parties as something that is important. I recommend that the support of the technology transfer process come from the highest levels, be unambiguous, and be ongoing. Institutions do not move quickly in policy or culture, but the agenda setting by administration through the ongoing recognition of importance in the effort will eventually change attitudes and direction, as it appears to have done at MSI. Institutions that set this as a goal, and then are quick to publically recognize success will see faculty and departmental acceptance more quickly (Birkland, 2007).

Recommendations for Further Study

As I mentioned in the introduction to this study, there is a deficit in the literature offering insight into the social environment of the commercializing university researcher at the departmental level. This study was an initial foray on the topic, and was constrained by the lenses of culture and policy. I consider the findings in this study to be a survey of the environment, with the possibility of further study in each thematic area.

Of the thematic areas, the most striking to me was the willingness to collaborate which was related to physical proximity described in each quintain. I am curious if there

is a statistical relationship: Does physical proximity induce collaboration and a collaborative departmental culture, or does departmental culture cause physical proximity to change over time? I find these questions interesting and worthy of additional study, perhaps using network analysis techniques.

The mechanical engineering departments in this study were chosen by a nomination process that originated at MSI. The selection of the department was based upon the high degree of activity in technology transfer. It is likely that the profession of academic mechanical engineering may attract similar personality types (Erez & Shneorson, 1980), and therefore different personalities in other types of departments may present much different results than this study. Likewise, departments within institutions may tend to select certain personality types when selecting faculty members to fill vacancies. Therefore different intuitions or different departments may yield vastly different results. I find this an interesting question and worthy of additional study.

During this study, several participants mentioned that a primary motivation for participating in the arena of technology transfer was not financial or professional incentive; rather, it was simply that the researcher would like to see the invention have a positive impact on society. “I want to see my stuff used” became a common sentiment. This intrinsic reward for research performed and technology being transferred is beyond the scope of this study. However, I do believe that the sentiment and the underlying motivation could be a powerful phenomenon. A possible framework for examining this theme might be social entrepreneurship, where an entrepreneur is motivated more by social impact than financial reward (Dees, 1998; Mars & Garrison, 2009). I find this topic to be interesting and worthy of additional study.

In the larger phenomenon of technology transfer, the opportunities for research using other lenses at the departmental level exist as well. This study was constrained to culture and policy, but I am certain the allocation of resources, success in grant writing, post-doctoral persistence, and many other factors may influence departmental success in technology transfer. This study did not consider these factors beyond their influences on culture and policy as perceived by the participants, but I find these topics worthy of further research.

If a department and institution were to adopt my recommendations, it would be gratifying to know whether or not the changes in institutional policy or culture had any influence on the success of the institution in technology transfer. Therefore a comparative study showing significance in change would be welcomed and worthy of further research.

Summary

This chapter presented the synthesis of cultural and policy factors that influence the work environment of the commercializing university researcher and presented recommendations for institutions seeking to improve their commercial success from research. The discussion presented here illustrates the complex nature of the human experience in the environment surrounding this phenomenon. My attempt at analyzing the findings was intended to give the reader a sense of the interrelationships of culture and policy at the departmental level. Details were offered to inform the reader of conditions that exist within and surrounding the departments and offer potential solutions to those seeking change within their own organization.

As financial supporters of educational institutions and consumers of products, we all have a vested interest in the costs and the benefits of scientific research. The process

of transformation from basic science into technology and the transference of this technology to the commercial world where we can enjoy the fruits of this investment remain exceedingly difficult. By implementing the recommendations I have outlined above, an institution may improve the success of its technology transfer enterprise. By doing so, we, as consumers, would benefit from advances in science more often and more quickly.

Beyond personal gratification, increased success in this process holds many benefits for the commercializing researcher, the research institution, and the public in general. Many believe that the United States is in transition from a manufacturing economy to an economy based on knowledge and the creation of intellectual property (Longworth, 2008; McDowell, 2011; Pisano & Shih, 2009). Therefore, our next wave of economic prosperity may be on the shoulders of those who create and commercialize.

While the presentation of this analysis would be informative to those in a position to influence changes in policy and culture, it should be noted that the cases analyzed in this study represent only two institutions chosen specifically for their maximum variation in technology transfer success. Thus, the nature of the institutions should be considered when benchmarking findings. I also recognize that interpretation of the data is subjective on my part, and I do acknowledge my biases in the analysis of the findings; however, I have tried to minimize any bias through the use of member checking and ongoing internal critical reflection.

In the end, I realize that other participants on other days in different circumstances would have produced different results. Therefore, this chapter is a presentation of *my* perceptions of the data collected and the linkages, meanings, and themes therein. I hope

the rigor of my investigation resulted in a study other may find transferrable to their own unique contexts.

APPENDIX

Interview Protocol – Researcher

Project: "Cases for Efficiency"

Interview Information:

Date: _____
Time: _____
Place: _____
Participant: _____ Participant Code: _____
Position of Participant: _____
Institution: _____ Institution Code: _____

Interviewer Introduction

Description of Project

Discussion of Confidentiality

Approval to Continue

Questions:

1. What is your role here at the university?

2. How long have you been in this position?

3. From your vantage point, how would you describe the technology transfer process and ecosystem?

4. Within the TT ecosystem, who sets the agenda of the process? How do things actually get done?

5. In creating new innovations, do you consider your department to be team oriented or self-oriented? Why?

6. On those occasions when collaborations lead to innovation, how are disputes resolved within your department?

7. How would you describe the outlook on the future of innovation held by your department?

8. How do people within your department create new ideas? What helps this process? What hurts?

9. How would you describe the relationships you maintain with your peers?

10. What role does gender play when it comes to innovation within your department?

11. How would you describe your relationship with those offices that regulate research and technology transfer?

12. Is there anything else you would like to tell me about your role as a commercializing researcher?

Conclusion of Interview

Reminder of Confidentiality

Confirm Interviewer Contact Information

Thank Participant

Interview Protocol – Other Department Member, Chair

Project: "Cases for Efficiency"

Interview Information:

Date: _____
Time: _____
Place: _____
Participant: _____ Participant Code: _____
Position of Participant: _____
Institution: _____ Institution Code: _____

Interviewer Introduction

Description of Project

Discussion of Confidentiality

Approval to Continue

Questions:

1. What is your role here at the university?

2. How long have you been in this position?

3. From your vantage point, how would you describe the technology transfer process and ecosystem?

4. Within the TT ecosystem, who sets the agenda of the process? How do things actually get done?

5. In creating new innovations, do you consider your department to be team oriented or self-oriented? Why?

6. On those occasions when collaborations lead to innovation, how are disputes resolved within your department?

7. How would you describe the outlook on the future of innovation held by your department?

8. How do people within your department create new ideas? What helps this process? What hurts?

9. How would you describe the relationships you maintain with your peers?

10. What role does gender play when it comes to innovation within your department?

11. How would you describe your relationship with those offices that regulate research and technology transfer?

12. How would you describe the relationship between the researchers in your department and the regulatory offices?

13. Is there anything else you would like to tell me about your role working with commercializing researchers?

Conclusion of Interview

Reminder of Confidentiality

Confirm Interviewer Contact Information

Thank Participant

Interview Protocol – Technology Transfer Officer

Project: "Cases for Efficiency"

Interview Information:

Date: _____
Time: _____
Place: _____
Participant: _____ Participant Code: _____
Position of Participant: _____
Institution: _____ Institution Code: _____

Interviewer Introduction

Description of Project

Discussion of Confidentiality

Approval to Continue

Questions:

1. What is your role here at the university?

2. How long have you been in this position?

3. From your vantage point, how would you describe the technology transfer process and ecosystem?

4. Within the TT ecosystem, who sets the agenda of the process? How do things actually get done?

5. Do you consider the _____ department to be team oriented or self-oriented? Why?

6. When collaborations lead to innovation, how are disputes resolved within the _____ department?

7. How would you describe the outlook on the future of innovation held by the _____ department?

8. From your observations, how do people within the _____ department create new ideas? What helps this process? What hurts?

9. How would you describe the relationships amongst the peers in the _____ department?

10. From your observations, what role does gender play when it comes to innovation within the _____ department?

11. How would you describe your relationship with the _____ department?

12. Is there anything else you would like to tell me about your role working with commercializing researchers?

Conclusion of Interview

Reminder of Confidentiality

Confirm Interviewer Contact Information

Thank Participant

Interview Protocol – Dean/Associate Dean

Project: "Cases for Efficiency"

Interview Information:

Date: _____
Time: _____
Place: _____
Participant: _____ Participant Code: _____
Position of Participant: _____
Institution: _____ Institution Code: _____

Interviewer Introduction

Description of Project

Discussion of Confidentiality

Approval to Continue

Questions:

1. What is your role here at the university?

2. How long have you been in this position?

3. From your vantage point, how would you describe the technology transfer process and ecosystem?

4. Within the TT ecosystem, who sets the agenda of the process? How do things actually get done?

5. Do you consider the _____ department to be team oriented or self-oriented? Why?

6. When collaborations lead to innovation, how are disputes resolved within the _____ department?

7. How would you describe the outlook on the future of innovation held by the _____ department?

8. From your observations, how do people within the _____ department create new ideas? What helps this process? What hurts?

9. How would you describe the relationships amongst the peers in the _____ department?

10. From your observations, what role does gender play when it comes to innovation within the _____ department?

11. How would you describe your relationship with the _____ department?

12. How would you describe the relationship between the researchers in the _____ department and the regulatory offices?

13. Is there anything else you would like to tell me about your role working with commercializing researchers?

Conclusion of Interview

Reminder of Confidentiality

Confirm Interviewer Contact Information

Thank Participant

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VITA

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Jim comes from an entrepreneurial background, having owned and operated his own successful businesses in commercial printing, publishing, real estate management and property development. Additionally, he has held a number of elective and volunteer leadership positions in public service.

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