2013

Great Expectations: Twenty-First Century Public Institutions and the Promise of Technology Based Economic Development: A Case Study

Tara K. Baas
University of Kentucky, Tara.Baas@gmail.com

STUDENT AGREEMENT:

I represent that my thesis or dissertation and abstract are my original work. Proper attribution has been given to all outside sources. I understand that I am solely responsible for obtaining any needed copyright permissions. I have obtained and attached hereto needed written permission statements(s) from the owner(s) of each third-party copyrighted matter to be included in my work, allowing electronic distribution (if such use is not permitted by the fair use doctrine).

I hereby grant to The University of Kentucky and its agents the non-exclusive license to archive and make accessible my work in whole or in part in all forms of media, now or hereafter known. I agree that the document mentioned above may be made available immediately for worldwide access unless a preapproved embargo applies.

I retain all other ownership rights to the copyright of my work. I also retain the right to use in future works (such as articles or books) all or part of my work. I understand that I am free to register the copyright to my work.

REVIEW, APPROVAL AND ACCEPTANCE

The document mentioned above has been reviewed and accepted by the student's advisor, on behalf of the advisory committee, and by the Director of Graduate Studies (DGS), on behalf of the program; we verify that this is the final, approved version of the student's dissertation including all changes required by the advisory committee. The undersigned agree to abide by the statements above.

Tara K. Baas, Student

Dr. Alan J. DeYoung, Major Professor

Dr. Jeff P. Bieber, Director of Graduate Studies

GREAT EXPECTATIONS: TWENTY-FIRST CENTURY PUBLIC INSTITUTIONS AND THE PROMISE OF TECHNOLOGY BASED ECONOMIC DEVELOPMENT: A CASE STUDY

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Education at the University of Kentucky

By

Tara Kristen Baas

Lexington, KY

Co-Directors: Dr. Alan J. DeYoung, Professor of Education
and Dr. John R. Thelin, Professor of Education

Lexington, KY

ABSTRACT OF DISSERTATION

GREAT EXPECTATIONS: TWENTY-FIRST CENTURY PUBLIC INSTITUTIONS AND THE PROMISE OF TECHNOLOGY BASED ECONOMIC DEVELOPMENT: A CASE STUDY

American research universities, especially over the past 30 years, have increasingly become involved in technology transfer activities. For public land grant institutions, involvement is largely inspired by a desire to maximize revenue opportunities and demonstrate economic relevance. This intrinsic case study addresses the efforts of a public, land grant and flagship institution, the University of Kentucky, to augment its technology transfer activities, with a specific focus on its attempts to spin off university technology-based firms. The data were gathered primarily through oral history interviews with technology transfer personnel, entrepreneurs, and spinoff personnel. Its purpose is to understand better the structure of the university's technology transfer operations, the impact of changes in institutional administration and priorities on these efforts, and variables that challenge and accommodate accomplishment of organizational goals. The findings of this study indicate that the structure of technology transfer operations at the university is complex, and somewhat confounding. Administrative changes impact various groups differently than others, and a major challenge to the accomplishment of goals is funding. Moreover, distinct but related groups seem to lack consistent, overarching goals.

KEYWORDS: Higher Education, Public Universities, Technology Transfer, University Startups, Intrinsic Case Study

Tara Kristen Baas
Student's Signature
March 6, 2013
Date

GREAT EXPECTATIONS: TWENTY-FIRST CENTURY PUBLIC INSTITUTIONS AND THE PROMISE OF TECHNOLOGY BASED ECONOMIC DEVELOPMENT: A CASE STUDY

By

Tara Kristen Baas

Alan J. DeYoung, Ph.D.
Co-Director of Dissertation

John R. Thelin, Ph.D.
Co-Director of Dissertation

Jeff P. Bieber, Ph.D.
Director of Graduate Studies

March 6, 2013

ACKNOWLEDGEMENTS

To include all the individuals who have encouraged and influenced my academic career is a somewhat daunting task. I hope that these acknowledgements convey my appreciation of just a few of the people who have supported me along the way. First, I must acknowledge my family, the most important people in my life. My husband A.J. has been supportive of my efforts on many fronts. When we first moved to Lexington, I planned only to pursue a Master's degree. Yet when I wanted to continue my academic studies, A.J. immediately became our family's cheerleader and breadwinner; working to support our family emotionally and financially. He accepted the dual role of homemaker and provider, always ensuring that our house was in order and our bills were paid. While he has yet to understand definitively what I have been working on for so long, he has remained supportive and proud of my endeavors. I would also like to thank my immediate and extended family members who have supported me, particularly, my mom Mary, mother-in-law Cindy, dad Mike, and sister Chellie, for enduring the conversations about my scholarly work, and by understanding when I have been unable to attend gatherings due to academic obligations.

From an academic perspective, I must recognize the outstanding committee members who have agreed to mentor me throughout this process and who work so well together. Professor Joe Fink is responsible for inspiring me to pursue this area of research, and kindly invited me to classes and meetings outside of my department early in my studies. He also introduced me to a number of people I would not have had access to on my own, to facilitate my interests. Dr. Richard Angelo has been a treasure throughout my studies. Dr. Angelo has continually offered me intellectual feedback and supported

my interests and efforts. When considering my co-directors, Doctors John Thelin and Alan DeYoung, no words could express my gratitude for all they have offered me. Both of them have been ardent champions of my pursuits. Each, in his own way, has gratuitously given his time and talents to push me to be a better academician. I would be remiss not to thank them for the personal and professional advice, countless recommendation letters, and financial and scholarly support through research projects and assistantships. I could not wish for two people to have been better mentors and to have served, frankly, as surrogate family.

I must thank my scholastic and professional colleagues. The department does an exceptional job of hiring and admitting top-quality scholars and peers. The faculty, staff, and fellow students have provided me many opportunities for personal and professional growth. I would especially like to thank my friend and colleague, Becky Unites, with whom I worked, collaborated in several courses and projects, and largely spent the past five years studying and socializing. Finally, many thanks to Dr. Susan McDowell, Associate Dean in the College of Medicine, who recognizes the value of the skills attained studying educational policy, and has supported my efforts to pursue and complete my Ph.D. studies.

Table of Contents

ACKNOWLEDGEMENTS iii

Table of Contents v

CHAPTER ONE: INTRODUCTION 1

An Overview of Technology Transfer 1
The Complexity of Institutional Comparisons 7
Issues with Aggregate Measurements 8
Characteristics Attributable to Institutional Results 10
Economic Development Through University Technology Transfer Operations 13
Public Policy and Technology Based Economic Development (TBED) 15
Purpose of the Case Study 17
Research Questions 17
Definitions and Terminology 18
Additional terms utilized throughout the study 21
CHAPTER TWO: BACKGROUND 28
The University of Kentucky and TBED 28
Public Institutions: Unique Characteristics and Circumstances 29
The Kentucky Demographic 33
President Lee T. Todd and TBED 34
Establishing UKCED 37
CHAPTER THREE: METHODOLOGY 40
An Interpretivist Ontology 40
Intrinsic Case Study 41
Purposive Sampling & Sampling Frame 42
Gatekeepers and establishment of rapport. 43
The sample/participants. 44
Data collection. 46
Credibility through Crystallization 46
CHAPTER FOUR: THE CASE STUDY 49
The University of Kentucky and the TBED Enterprise 49
Personnel's Recollections of Organizational History 50
Organizational Structure of UKCED 53
The University of Kentucky Research Foundation. 54
Kentucky Technology, Incorporated. 54
Affiliated Organizations 57
Community entrepreneurial organizations. 60
Meeting the Expectations of UKCED 62
Challenges to the Mission 63
Benchmarks 63
Public Accountability 67
UKCED's Accomplishments to Date 71
The Impact of Administrative Change 73
The Bluegrass Angels 76

Angel membership. 76
Angel Recruitment. 78
Demographics. 79
Angel Funds. 80
The Angels' approach to investments. 81
Challenges to investment goals. 83
Angel accomplishments. 89
The impact of administrative change. 93
On the financial outlook for UKCED: 94
On Todd as an innovator and proponent of commercialization and economic development: 95
On the need for time to complete President Todd's mission: 96
On President Capilouto's focus: 96
On Vice President Tracy's responsibilities and priorities: 97
CHAPTER 5: AN EXPLORATION OF THREE UNIVERSITY OF KENTUCKY USOS 99
University Spinoff X: Engineering Technology Company 99
Technology X 100
Commercialization and Development 100
Education and Professional Background 101
The Road to Technology Company X 102
Finding the appropriate technology, environment, and ecosystem. 104
The University of Kentucky and its Technology Transfer Process 110
Company X and Funding 111
Growth and Economic Development 115
University Spinoff Y: Entertainment Media Company 117
Technology Y 118
Commercialization and Development 118
Education and Professional Background 119
The Road to Company Y 123
Finding the Appropriate Technology, Environment, and Ecosystem 126
UK and the Technology Transfer Process 130
Company Y and Funding 131
Growth and Economic Development 133
University Spinoff Z: Biotechnology Company 134
Technology Z 135
Commercialization and Development 135
Education and Professional Background 136
The Road to Company Z 138
Finding the Appropriate Technology, Environment, and Ecosystem 138
UK and the Technology Transfer Process 142
Company Z and Funding 142
Growth and Economic Development 143
CHAPTER 6: DISCUSSION AND CONCLUSION 145

Question 1: How can the organizational structure of the TBED enterprise at the University of Kentucky be described? 145
Question 2: From an organizational perspective, what are the goals of UK's TBED enterprise, as perceived by affiliated professionals? 146
Question 3: What are the challenges to the TBED enterprise's goals, as perceived by affiliated professionals? 148
Question 4: What goals have been achieved by the TBED enterprise, as perceived by affiliated professionals? 150
Question 5: What factors, as perceived by affiliated professionals, have influenced challenges and achievements to the TBED enterprises' goals? 150
Conclusion 151
Appendices 153
Appendix A: Legend for Oral History Interviews 153
Appendix B: Text of Introductory E-mails to Sampling Frame/ Invitations to Participate in the Study: Entrepreneurs/Investors 154
Appendix C: Text of Introductory E-mails to Sampling Frame/ Invitations to Participate in the Study: Technology Transfer Personnel 155
Appendix D: Text of Introductory E-mails to Sampling Frame/ Invitations to Participate in the Study: USO Officers 156
Appendix E: IRB Exemption Certification 157
Appendix F: Copy of Informed Consent Form 158
Appendix G: Basic Interview Script for Entrepreneurs/Investors 161
Appendix H: Basic Interview Script for Technology Transfer Personnel 163
Appendix I: Basic Interview Script for USO Personnel 164
References 165
VITA 170

CHAPTER ONE: INTRODUCTION

An Overview of Technology Transfer

Over the past three decades, much focus has been placed on university technology transfer (TT) efforts. Technology transfer is "university activities that are directly or indirectly linked with the private sector, like patenting and licensing, launching and nurturing new firms, conducting research for industry, and cultivating academic fields that contribute to technological advance" (Geiger & Sá, 2008, p, 1). One significant goal of institutional technology transfer operations, particularly among public institutions, is technology-based economic development (TBED) (Geiger & Sá, 2008). Overall, institutions concentrate on patenting and licensing for revenue generation (Mowery, Nelson, R., Nelson, B., & Ziedonis, 2004). Public institutions of higher education, in particular, have done so to compensate for a decline in state support, a central source of revenue (Slaughter & Leslie, 1997). Moreover, one rationale for TT from public institutions and federal and state policy makers is that early involvement by prestigious universities led to the development of *technopoles*, where university-industry collaborations have resulted in local economic development (Woodward, Figueiredo, and Guimarães, 2006). The Bayh-Dole Act of 1980, as part of a broad shift toward stronger intellectual property rights, is largely considered an enticement for reluctant institutions to enter into the field, as well (Yusuf & Nabeshima, 2007).

University newcomers have not generally seen comparable economic development outcomes. These newly participating institutions have been associated with a high volume of patents with low commercial value (Mowery, et al. 2004). In addition, many question the legitimacy of TBED efforts, noting that institutional revenues and economic

data are skewed by outliers. The bulk of revenue from patenting and licensing at Columbia, Stanford, and the University of California system (all historically dominant among commercially active institutions) is derived from a small number of *home run* patents, that have led to uncharacteristically large institutional royalties, as well as local development of associated firms (Yusuf & Nabeshima, 2007, p. 169). Overall, measurements of research and development investments of universities indicate that their strongest economic contribution remains in the development of human capital (Geiger & Sa, 2005).

Research and assessments of university TBED initiatives are often conducted in three manners. Outcomes assessments and rankings of university TBED are derived through data collected by the Association of University Technology Managers (AUTM). AUTM annually collects data based on fundamental metrics of the number of: invention disclosures to the technology transfer office, patents (applied for and granted), licenses procured, and revenue (from licensing agreements, investment liquidation, intellectual property sales, and legal settlements). AUTM data influence virtually all scholarly attempts to evaluate and compare outcomes of technology transfer execution at universities [National Research Council (NRC), 2010]. Others, examining the notable differences in outcomes between universities (based on AUTM measures), have generally sought out variables that could contribute to these differences. Results indicate factors such as governance (public or private status), institutional prestige, and presence of academic units are often correlated with performance outcomes (Geiger & Sá, 2008; Graham & Diamond, 1997; Lowen, 1997; NRC, 2010). A third group of scholars has approached research universities, and technology transfer (TT) operations, from the long

view. Framing their studies from a historical perspective, these researchers address the evolution of institutions' research enterprises. For example, Graham and Diamond (1997) and Geiger (2009), consider university research primarily from a historical perspective, studying the relationships between both manifest (conscious changes that, at the time, may have been unremarkable) and latent (shifts in structures, economic patterns, or culture) events. Their purposes include eliciting objective descriptions, measuring change, and analyzing consequences of circumstances (Kyvig & Marty, 2000). Each presents aggregate level themes of institutional research and policymaking over time, presenting brief case studies of institutional efforts to serve as examples of themes at a particular juncture. While others specifically address TBED at the aggregate level, providing brief case studies to demonstrate themes among institutions and policymakers (see Bok, 2003; Geiger & Sa, 2008; Mowery et al., 2004; Thorp & Goldstein, 2010; and Yusuf & Nabeshima, 2007). Lowen, alternatively, presents a detailed account of a single institution. Her work addresses Stanford's research enterprise, comprised of historical data from the early twentieth century to the early 1990s, as a close examination of an institution's increased involvement in research initiatives that has grown into one of the most successful and highly regarded examples of TBED (1997).

The literature also examines institutional attempts to replicate previous university success. Studies of specific areas and comparative analyses have outlined technopole development; combined areas of high-tech industry and business housed in centers purposely developed around renowned universities and research institutes, and suggest that economic development results are given (Woodward, Figueiredo, and Guimarães). In areas without well-established records in science and engineering research, and for

universities without medical research centers, economic growth is not a guarantee (2006; Geiger & Sá, 2008). Various empirical methods have been used to measure *local spillovers* (where exploitation of university research leads to local economic benefit), distinctive areas, and urban centers [Graham & Diamond, 1997; National Research Council (NRC), 2010]. The institutions that derive millions of dollars per year in revenue from commercial activities, note that, less operating costs, the revenue amounts to a small fraction of their annual research budgets (Mowery, et al 2004; Yusuf & Nabeshima, 2007). Therefore, the phenomena of economic growth related to technology transfer are approached from a number of perspectives.

Institutional characteristics, such as governance, prestige, and presence of specific academic units, are correlated with contemporary outcome variations among diverse institutions. Some of the variables found to contribute to performance differences across institutions include existence or lack of medical schools/clinical operations, public or private standing, and presence or absence of incentive pay for technology transfer personnel (NRC). Yet peer comparisons continue to demonstrate extensive variations in areas such as revenue, disclosure rates, active licenses, and university spinoff (USO) (new firms launched from institutional technology) activity (2012). Aspirational institutions that have enhanced their research programs demonstrate similarities through access to resources and targeted administrative direction (Geiger, 2009). These characteristics, however, do not appear to produce a consistent formula for TBED.

Geography, interpreted as "assets and resources already available in a geographic area" (Jackson & Audretsch, p. 119), is perhaps the most significant preliminary measure of available resources for technology transfer. The location of preeminent research

universities is a factor that lends itself to government investment in human capital development through technology transfer. Government initiatives include innovative funding and ownership opportunities that can promote development of area human capital. Two important byproducts of government investments are enhancement of institutional recognition by the business community and employment opportunities in the area through firm development (2004). In addition, successful TT operations are generally housed within top-ranked institutions. Top-ranked universities or clusters experience a *halo* effect, wherein their draw is greater than the quality of research can justify (Hedge, 2005, as cited by DeYoung & Baas, 2012). This can complicate examinations of TBED initiatives, because halo effects can be difficult to measure, but a significant factor in firm location and development, leading to economic growth.

Regarding targeted administrative goals, Geiger & Sá note that in a number of cases, university presidents or chancellors have significantly contributed to the success of TT at their institutions. Richard Levin effectually integrated Yale's portfolio with the pharmaceutical business in Connecticut. Martin Jischke, at Purdue, asserted the potential of his land grant university's innovations, and Steven Sample of the University of Southern California promoted a university-wide charge for innovation. Prior to his emphasis on public and economic welfare, Sample advanced undergraduate admissions and faculty prominence, i.e., academic quality, which is considered an antecedent of successful technology transfer. While several university presidents have embraced similar models to promote TBED through innovation, for the vast majority, their share in the possibility of new discoveries appears negligible (2008).

Technology transfer, moreover, is an enterprise. Geiger contends that the study of research institutions encompasses the relationships of contributing entities (2009). Studies of research universities frequently address the quintessential role of institutions in knowledge creation, as part of their complex missions (see Bok, 2003; Geiger, 2009; Geiger & Sa′, 2008; Graham & Diamond, 1997; Yusuf & Nabeshima, 2007). Researchers, such as Lowen (1997), have provided extensive studies of individual institutions' historical commitments to their research missions, including technology transfer. Others have examined, through social narratives, the evolution of American research universities over several decades, noting that the period subsequent to World War II, primarily due to expanded federal support, suggests the greatest accomplishments in knowledge expansion (see Geiger, 2009; Graham & Diamond, 1997). Research universities have significantly transformed, in terms of the intellectual and scientific areas practiced and taught, and their recognized societal roles during this time (Lowen, 1997). As research universities have evolved over the past century, a major aspect of their societal roles is now considered technology transfer; and particularly for public universities, technology based economic development.

Yet, the results of these studies do not consistently overarch. Successful TT operations are the exception, rather than the rule. Institutions traditionally benchmark their progress utilizing quantitative data that accommodate large and long-established research institutions. While over the past three decades, newly participating institutions have continued to emerge. Case studies can offer historical context to understand outcomes as part of a broader, continuous shift in higher education policy.

Three points are clear from the contemporary body of research. First, attempts to compare institutional outcomes by accepted quantitative standards (i.e., metrics derived from AUTM's principles) provide a snapshot of the results, without regard to other qualitative variables, such as historical involvement and unique institutional characteristics. Second, institutional characteristics, such as governance, prestige, and presence of specific academic units, are correlated with snapshot outcome variations among a broad range of institutions. Finally, the experiences of public institutions are distinct from those of private institutions, based upon their unique missions and influence by public policy.

The Complexity of Institutional Comparisons

Researchers have noted a general contrast between the results of technology transfer initiatives at publicly and privately funded universities (see Geiger & Sá, 2008; Graham & Diamond, 1997; Lowen, 1997; Marginson, 2007; NRC, 2010). The National Research Council has recently noted that comparisons of peer institutions continue to yield ambiguous results. Grouping institutions by similar characteristics consistently results in large variations in: the amount of patenting and licensing, spinoff corporations, and revenue. Examinations of *structural factors* (which are difficult or impossible to change), such as governance, prestige, and presence of specific academic units may account for differences in output *among* various institutions, but not *between* institutions with comparable characteristics (NRC, 2010). A university's potential for intellectual property generation is dependent upon the interaction of a few factors, but the size and effectiveness of the technology transfer office can have a substantial influence on outcomes (Jackson & Audretsch, 2004; Geiger & Sá, 2008). Along the same lines, the

NRC recently argued that it would be valuable to study the degree to which disparate results illustrate institutional differences in *non-structural factors* (which are in some ways controllable), hypothesizing that variables such as organizational structure, personnel, and funding sources of technology transfer offices may be associated with varied outcomes. "[A] more fine grain analysis could be revealing…but this work for the most part remains to be done" (2010, p.52). Moreover, because of the economic impact from development of regional technology clusters, in areas of the country such as California's Silicon Valley, North Carolina's Research Triangle, and Massachusetts' Route 128, technology based economic development has become an objective of technology transfer for public institutions (Hedge, 2005).

Issues with Aggregate Measurements

As the National Research Council suggests, the data concerning technology transfer initiatives at universities are complex. The exploitation of university intellectual property (IP) through licensing or development of USOs is more frequently "discussed, measured, quantified, and debated" (p. 17) than any other aspects of TT. While a large amount of research has been conducted concerning university patenting and licensing activities, there remains limited consistency among the results (2010).

The Association of University Technology Managers (AUTM) is a professional organization whose mission is to "support and advance academic technology transfer globally" (AUTM Board of Directors-Missions and Goals, 2012). Since 1991, AUTM has conducted a set of annual surveys to capture data, including, IP disclosed by faculty, patents awarded, licensing activity, and number of startups, i.e., USOs (NRC, 2010). While patenting and licensing are significant aspects of the technology transfer process,

summing the number of IP disclosures, patent applications and awards, and licensing agreements is not a robust measurement of the effectiveness of an institution's technology transfer enterprise. While the process of quantification is relatively clear-cut, its use as a measurement yields at least three significant issues.

First, data are voluntarily self-reported by institutions. Participation fluctuates each year. It is unclear whether some institutions purposely choose not to respond during periods of what could be considered low activity (NRC, 2010). Second, the volume of patents, licenses, and USOs is not necessarily indicative of technology performance. That is, the quality of patents (which could eventually be licensed or spun off) differs considerably. As Yusuf & Nabeshima contend, some of the motives for patenting and licensing activities range from regional/state economic development policy directives to retention of faculty who are interested in pursuing patents and licenses for their IP. A large number of patents awarded fail to be cited or actively applied as technology. Moreover, the value of patent portfolios typically comes from either a single, or a small number, of successful technologies (2007). Using technology transfer activities to satisfy parties, rather than pursuing strong intellectual property, devalues the portfolio; and muddies the waters.

Finally, interpreting financial returns from licensing activities, as reported to AUTM by institutions, can be problematic. Costs associated with areas, such as TT office operations and patent prosecution, detract from the bottom line. Concurrently, aggregate institutional revenue results are misleading. Higher licensing revenue from a minority of institutions inflates the incomes of the sample institutions, relative to research expenditures. Note that the AUTM survey reflects R&D budgets, but not total operating

budgets. In fiscal year 2007, the mean institutional licensing revenue, (represented as a percentage of research costs from the AUTM Licensing Activity Survey: FY 2007) was 4.1%, while the median was 0.9% (NRC). Three outlying institutions represented licensing income as 65%, 69%, and 266% of research expenditures (2012). Even among institutions with historically successful technology transfer operations, licensing revenue represents a small amount of capital, compared to total budgets. In 2007, Stanford University earned $50 million from 986 licenses (NRC). However, its research expenditures were $700 million. Excluding the capital and clinical operations budgets, Stanford's total budget for that year was $3.8 billion; indicating that licensing revenue amounted to a recovery of 1.3% of its operating costs. MIT and the University of Washington's licensing income for that period represent similar percentages of total budget recovery at 2.8% and 2.3%, respectively (2012). Further confounding analysis, as noted above, the bulk of monetary value in a portfolio is generally comprised of a small amount of strongly performing patents. Among Columbia University, Stanford University, and the University of California System, institutions with traditions of successful licensing operations, greater than sixty-five percent of their gross licensing revenues were procured from their top five performing patents for fiscal years 2001-2004 (Mowery et al., 2004; Yusuf & Nabeshima, 2007). As such, aggregated technology transfer data from the AUTM database of surveys can make interpretation of specific, goal-oriented results difficult.

Characteristics Attributable to Institutional Results

In an attempt to reconcile the data concerning institutions and technology transfer, Turk- Bicakci & Brint considered less successful institutions; noting that efforts to

understand growth and performance of top institutional performers in technology transfer is the focus of a large number of studies. Such works attempt to establish variables that contribute to success in technology transfer involvement. While studies have provided some characteristics that yield strong results, little focus has been granted to institutions considered mid or low level performers. Subsequently, it is unclear whether the same characteristics affect the majority of institutions involved in technology transfer (2005). That is, the body of research has largely established variables that may lead to successful TT operations, not whether the absence of such variables is strongly correlated with lower performance.

Turk-Bicakci & Brint's study of mid and low performing institutions, examining AUTM data from 1990-2000, uses three measures: industry research and development funding, number of licenses, and licensing income. Their findings suggest that factors such as prestige, private or public status, and characteristics of technology transfer offices affect the revenue earned by low and mid level institutional performers. They note that their analysis indicates, while many researchers assume that the same factors contribute to licensing volume and revenue, it is not the case. Their measurements suggest that emphasis on science and engineering technology transfer and economic strength are strongly correlated with corporate funding and licensing volume. However, only industry backing is strongly correlated with licensing revenue. Industry partnerships increase based on the presence of a medical school to generate research. Moreover, a large staff in technology transfer offices assists with generation of a large number of licenses and increased licensing revenues. A significant finding of the study is that, specifically, public land grant status is correlated with higher levels of industry R&D funding, but

yields no significant influence on licensing counts or income. The authors suggest that many land grant institutions may accommodate their historic commitment to conduct research for industry more easily than to produce intellectual property for commercial purposes. They also contend, based on the unique differences between public and private governance, that increased licensing revenue can be greatly attributed to a university's private operating status (2005).

Aside from Turk-Bicakci & Brint's findings specific to public land grant universities' (PLGUs) R&D funding, license volume and revenue, their results are comparable to others. For example, Woodward, et al. also suggest that well-established records in science and engineering research and medical research centers are correlated with successful technology transfer operations (2006). Geiger and Sá propose that institutional potential for generating IP (and subsequent licenses and revenues), is dependent upon four interacting variables:

1. The volume of research in patent-rich fields (including science and engineering);
2. The quality of academicians conducting research;
3. The degree of entrepreneurial encouragement within the faculty culture; and
4. The size and competence of the technology transfer office (which can serve as an independent factor) (2008).

Slaughter and Leslie have also addressed the governance status of institutions, indicating that the funding options of private institutions are not the same as public institutions. Therefore, their engagement in technology transfer is not driven by the same factors as public universities (1997) and cannot be compared symmetrically.

In terms of faculty entrepreneurism, collaborative efforts are challenged by contrasts between academic and corporate cultures. Role misconceptions, project timeframes, and research objectives can lead to conflict in sponsored project administration (Ford, Shino, Sander, & Harden, 2008). In addition, university and corporate missions are not reflective of each other (Martin, Gruetzmacher, Lanham & Brady). They embrace different success metrics, as well as values. While corporate agendas are quickly refocused, institutions are tethered to traditional commitments that are not easily transformed. There are also structural variants, such as staffing and organization. The core unit of the decentralized university is the academic department, which naturally embodies disciplinary similarities. Their focus, even formally organized across disciplines, is distinct from the market driven focus of large corporations (2004, Mendoza & Berger, 2005).

Economic Development Through University Technology Transfer Operations

Economic development has become a significant aspect of public institutions' service mission at the local and regional level (Geiger & Sá). The indication that local spillovers of university research can stimulate economic growth has pushed many public universities to encourage spinoff development: homegrown companies whose technology is derived from institutional intellectual property. Such endeavors are also increasingly promoted by public policymakers (2008; Jackson & Audretsch, 2004; Hedge, 2005; Geiger, 2006).

Research on technology transfer frequently addresses patenting, licensing of patent technology, and spinoff development as a continuum. All of these processes comprise the technology transfer process. However, a small number of patents are licensed or spun off

into new technology businesses (Mowery, et al., 2004; Yusuf & Nabeshima, 2007). While licensing agreements can bring in some revenue to institutions, university spinoffs are likely "the most distinctive net addition to economic activity by universities" (Geiger & Sá, p. 133), because successful spinoffs have the potential to create jobs within their firms. University spinoffs, though, are also burdened with finding a business need that must to be met, limited funding opportunities and lengthy development processes, and inventors with high expectations and limited managerial or marketing skills (2008; Martin, et al., 2004; NRC, 2010).

During the NRC's 2008 consensus study of university IP management, the committees involved heard oral presentations from a number of university officials and venture capitalists. Some of the investors argued that universities played no valuable part in spinoff development, other than providing and licensing any fundamental intellectual property. Nonetheless, university officers described a number of profoundly different programs to promote spinoffs as successful. A model befitting a technopole, with access to large amounts of venture capital, relies merely on networking between faculty inventors and early-stage investors. On the opposite end of the spectrum, are a number of institutional models that offer a single program or a number of collaborative services. Some provide a separate innovation center from the technology transfer office, where technology transfer personnel assist with financing IP until it is attractive to investors. Others employ graduate business students to develop business plans for faculty or student technologies. Some institutions manage alumni seed capital funds, while an additional model provides incubators or research parks where novice spinoffs can share economical space and services. Based on its study, the NRC concludes that while some operational

characteristics are common, there is little evidence to offer a standard model for technology transfer operations to initiate spinoff success. Moreover,

> Authors of literature surveys agree that empirical research has yet to produce consistent findings. DiGreggorio and Shane write: 'We find no effect of local venture capital activity and only limited support for an effect of the commercial orientation of university research on technology transfer office start up rates…the presence of a university-affiliated incubator and whether or not the university is permitted to actively make venture capital investments in licenses-do not appear to have an impact on start-up activity.' (p. 55, 2010)

At the same time, policymakers continue to promote university technology transfer for economic development purposes.

Public Policy and Technology Based Economic Development (TBED)

The federal government, as well as many state governments, establishes policies to try to encourage healthy economies (Geiger & Sá). Universities do not generally play a large role in these types of policies, but do expedite innovation through their research activities. Specific policies impacting research institutions are generally technology based economic development policies; directed at science or technology innovations. A primary difference between federal and state policies is the direction of innovation benefits. Whereas federal policies are targeted at collaboration between institutions and large firms for national economic growth, state policies address retention of any economic benefits through the work of small to mid-level technology businesses (2008).

In the post-World War II era, federal R&D funding for research universities has underscored an American position that the national government should maintain a significant commitment to advancement of scientific knowledge for public good (Geiger & Sá). For over 50 years, American institutions have conducted approximately half of the country's basic research (2008). Although its true impact on university engagement in

technology transfer is debated (see Mowery, et al., 2004), the Bayh-Dole Act of 1980 is largely cited as a catalyst for the emergence of TT operations among institutions for the past 30 years (see Bok, 2003; Yusuf & Nabeshima, 2007; Geiger & Sá, 2008; Thorp & Goldstein, 2010). Post Bayh-Dole, a number of federal initiatives, including legislation to provide funding for SBIR grants in 1982, and later STTR funding (1992), have aided universities in the technology transfer process (Geiger & Sá). Although, the grants are highly competitive and awards tend to be clustered among a small number of states, California and Massachusetts are frequent recipients (2008).

State policy makers have also increasingly supported technology based economic development efforts. Geiger & Sá argue that state policy makers take different approaches to TBED based on variables like the local economy, traditional investments in research universities, and the local or regional business environment. Part of the initial wave of TBED legislation arose from the states' negotiation of the Master Tobacco Settlement Agreement, where high taxes on tobacco products brought states extra funding. The strong economy of the late 1990s, coupled with the emergence of the biotechnology industry, led policy makers to invest portions of the funds into biotech research. The hope was to establish area technology clusters. This was particularly important for startup companies and spinoffs, because they were understood as the primary instruments for innovation and job growth. The other approach taken by state legislators was to exploit existing federal funding opportunities. In 2006, 21 states earmarked funds for investment in pre-seed or seed-stage startup companies. Twenty-seven states allocated funds for venture capital investments (2008).

Purpose of the Case Study

This is an intrinsic case study for descriptive and exploratory purposes. Its major objective is to provide a greater understanding of the factors that influence the spinoff aspect of technology based economic development activities at the University of Kentucky (UK). The study examines the perspectives of a purposive sample of technology transfer personnel, technology investors, and officers with three university-based technologies, through oral histories of their experiences. The study addresses the structure of the technology transfer organization, any influences a recent administrative change may have on pursuit of organizational goals, and participants' impressions of variables that challenge or enhance the realization of goals. The findings of this study could contribute to future research of TBED operations at public flagship and land grant universities. However, this study is interpretivist and inductive. It is not meant to be generalizable. Consistent with a qualitative approach (Glesne, 2006); this study is not a hypothesis test. The National Research Council's hypothesis that the existence of non-structural factors may contribute to varied outcomes, nonetheless, influences this attempt at greater understanding of the case site's attempts at pursuing a technology based economic development enterprise.

Research Questions

The objective of this study is operationalized by the following research questions:

1. How can the organizational structure of the TBED enterprise at the University of Kentucky be described?
2. From an organizational perspective, what are the goals of UK's TBED enterprise, as perceived by affiliated professionals?

3. What are the challenges to the TBED enterprise's goals, as perceived by affiliated professionals?
4. What goals have been achieved by the TBED enterprise, as perceived by affiliated professionals?
5. What factors, as perceived by affiliated professionals, have influenced challenges and achievements to the TBED enterprises' goals?

Definitions and Terminology

In practice and throughout the research literature, several terms are used interchangeably in reference to technology transfer operations. For the purpose of this study, the terms indicated throughout will refer to the following:

1. *Technology transfer* (TT) can be understood from two vantage points. First, is its literal definition "university activities that are directly or indirectly linked with the private sector, like patenting and licensing, launching and nurturing new firms, conducting research for industry, and cultivating academic fields that contribute to technological advance" (Geiger & Sá, 2008, p, 1). The second perspective is its relation to public benefits, wherein "moving advances in knowledge and technology into the commercial stream" (NRC, p. 16) allows universities to promote the public good. Under this guise, universities are considered accountable to the public, based on a sixty-year tradition of large government (tax) investitures into university research. That is, public institutions are expected to conduct basic and applied research that positively influences the community (2010).

2. *Technology based economic development (TBED)* relates to a specific economic development goal of technology transfer. Economic development has resulted from a number of university TT operations. Studies have correlated the development of specific urban, high-tech economies, with the TT efforts of renowned universities and research institutes (Woodward, Figueiredo, and Guimarães, 2006). Therefore, TBED has evolved into a goal of university technology transfer operations, rather than a derivative. Such a goal is understood as resultant of several contingencies: the comparative strength of the United States economy relies on innovation; this concept has been integrated into state and national public policy; and for universities, especially public land grant institutions, their missions have evolved to include demonstration of their economic relevance. Thus, institutions have modified their traditional research roles to encompass economic development goals (Geiger & Sá, 2008; Yusuf & Fink, 2007). For the purpose of this study, TBED will be used to refer exclusively to activities related to the university spinoff aspect of technology transfer for economic development.

3. *Spinoff* generally refers to a circumstance that meets three conditions, simultaneously (Pirnay, F., Surlemont, B., & Nlemvo, F.):
    1. It occurs within an existing parent organization.
    2. It involves one or more individuals, regardless of position or capacity within the organization.
    3. The individual(s) exit the parent organization to develop a new organization (2003).

As Pirnay, et al. suggest, the *university spinoff (USO), or university startup* is unique, though, in that it considers "many facets of a complex fuzzy reality" (p. 356). It is a specific type of spinoff, generated from the university as its parent organization (2003). However, ventures can be considered USOs even when researchers or students have spent an indeterminate period between exiting the university and forming the new firm. By Roberts, McMullan and Vesper's (1987, as cited by Pirnay, et al., 2003) logic, the idea leading to the new firm is derived from cumulative knowledge amassed while connected with the university, regardless of intermediate employment. In that respect, USOs can fall into one of four of the following broad categories based upon the "individual(s) status" (irrespective of current employment/enrollment at the university) and "nature of knowledge transferred" (Pirnay, et al, p. 361):

1. *Researcher/Codified*: a product-oriented spinoff utilizing an idea developed by a researcher(s);
2. *Researcher/Tacit*: a service-oriented spinoff utilizing an idea developed by a researcher(s);
3. *Student/Codified*: a product-oriented spinoff utilizing an idea developed by a student(s); and
4. *Student/Tacit*: a service-oriented spinoff utilizing an idea developed by a student(s) (2003).

This classification demonstrates the way in which outcomes measurement for spinoffs can be difficult. Such broad categorizations can blur the lines between what different institutions consider USO activities, particularly, those activities that involve students and researchers who have left institutions for lengths of time. There is not a clear

cutoff point, with which to determine if a venture is no longer university affiliated. In terms of measurement, affiliation is left up to an institution to resolve. This can lead to varying institutional interpretations of what does and does not constitute a USO.

Additional terms utilized throughout the study

Startup Financing: There are five *rounds* generally referenced in startup funding (Kelly). These include Seed Capital, Angel Investments, Venture Capital (also known as Alphabet Rounds), Mezzanine Financing and Bridge Loans, and Initial Public Offering (IPO) (2013). The classifications of startup financing referenced in this study include seed capital, Angel investments, and Venture Capital.

1. *Seed Capital*: Commonly, seed capital is the initial investment into a product or technology. Entrepreneurs often acquire seed capital from personal savings; personal credit cards, or approach friends and family for investments. At this stage, private individuals either loan the entrepreneur capital or provide financing in exchange for common stock in the company. Due to the low likelihood of a return, these individuals are colloquially called the "Triple Fs: friends, family, and fools" (Interview C, 2012).
2. *Angel Investors:* Wealthy individuals outside of friends and family are known as Angel investors. Investments from Angels are often loans that are convertible into preferred stock. Preferred stock (also known as preferred shares) differs from common stock, in that its owners have a greater claim to assets and earnings. In general, the dividend(s) must be paid prior to common stock payouts. Moreover, preferred stockholders rarely have voting rights in the company. With preferred

stock, there are both fixed dividends (debt) and potential appreciation (equity) (Investopedia, 2013).

The term Angel is derived from the theatre. Historically, when individuals attempted to present a show on stage, it required capital. Because of their ability to *save* a production, individuals or groups who invested in a show were known as Angels. The expectation was that a successful production would lead to a return on investments. Angel investments, however, did not require a great deal of ownership in the production. The term refers to both the ability to save a production and the role of Angel as a benefactor for the arts. Although contemporary Angel investors are not christened patrons of entrepreneurship, the term has carried over in reference to their early stage involvement in startup companies (Interview C, 2012).

Angel investors must be accredited. Essentially, Angels practice "self-accreditation" (Interview A, 2012). The Securities and Exchange Commission regulates Angel investing. In effect, companies seeking Angel funds are not required to disclose the same information as they would in later financing rounds. However, Angel investors accept this risk through their protected, accredited status. In order to obtain accredited status, individual investors must certify that they have $1,000,000 in assets, excluding their primary residence. An individual must have income exceeding $200,000 for each of the two most recent years. Alternatively, an individual and spouse may have joint income of $300,000 for those years and a reasonable expectation of the same income during the current

year [Interview A, 2012; Securities and Exchange Commission (SEC), 2012]. In general, Angel investors have high net income worth.

3. *Venture Capital Financing:* Venture Capital (VC), also known as Alphabet Round financing, is commonly provided to companies that have developed a product or service, and are distributing or selling it, but are not yet profitable. Venture capital is often used to counterbalance negative cash flow. Venture capital financing, like Angel financing, is frequently offered in exchange for preferred stock. Because there can be multiple rounds of venture capital financing, these rounds are often referred to by letters of the alphabet. Each letter indicates a *series* of VC financing, based on a valuation of the company. That is, VC financing generally begins with Series A, followed by Series B (if the company is performing well and has been assessed at a higher value than at the time of Series A financing), Series C, and so on. Alphabet rounds can also include strategic investors who provide value to the company in areas like technology or marketing (Kelly, 2012). Individuals or firms that provide venture capital are referred to as venture capitalists (VCs).

Moreover, several of the participants in this study reference federal grants known as Small Business Technology Transfer (STTR) and Small Business Innovation Research (SBIR) grants. These are administered by the Small Business Administration of the United States government. The grants are complementary in some ways, in that the research topics designated for the grants are offered by some overlapping federal agencies.

1. *STTR Grants:* The Small Business Technology Transfer program provides opportunities to expand funding in the federal research and development (R&D) arena. It provides joint venture opportunities for small businesses and nonprofit research institutions [U.S. Small Business Administration (USSBA)]. The STTR program requires small businesses to collaborate formally with a research institution during Phases I and II of development. The purpose is to link the results of innovations in basic science with commercialization. Federal agencies with extramural research budgets in excess of $1 million are required to allocate annually 0.3% of those budgets for small business awards. The federal agencies that currently participate in the STTR program are the:

    a. Department of Defense

    b. Department of Energy

    c. Department of Health and Human Services

    d. National Aeronautics and Space Administration

    e. National Science Foundation

Within its individual program, each agency administers STTR grants based upon Congressional guidelines. The grants are highly competitive and awarded after proposal evaluation.

2. *SBIR Grants:* The Small Business Innovation Research Program encourages small, domestic businesses to take part in federal R&D that has commercialization potential. Small businesses that earn the awards can explore the technological potential of an innovation and pursue its profitability, while concurrently addressing designated areas of U.S. R&D

needs. The purpose is to support scientific and technological innovation, by investing federal research funds into private sector commercialization activity, to strengthen the American economy. Federal agencies with extramural R&D budgets that exceed $1 million, annually allocate 2.5% of their R&D budgets to the program. Current agency participants include the:

a. Department of Agriculture

b. Department of Commerce-National Institute of Standards and Technology

c. Department of Commerce-National Oceanic and Atmospheric Administration

d. Department of Defense

e. Department of Education

f. Department of Energy

g. Department of Health and Human Services

h. Department of Homeland Security

i. Department of Transportation

j. Environmental Protection Agency

k. National Aeronautics and Space Administration

Within its individual program, each agency administers SBIR grants based upon Congressional guidelines. Like STTR, these grants are highly competitive and awarded after proposal evaluation. Each program is structured in 3 phases (below). The STTR and SBIR differ in terms of their requirements in a few ways. For SBIR, unless the agency has granted a

waiver, the principal investigator must be primarily employed by the for-profit business [referred to as the Small Business Concern (SBC)]. An STTR grant requires the SBC and research institution to establish an IP agreement that details: assignments of intellectual property rights, rights to execute follow-on research, and rights to exercise development or commercialization. In addition, STTR requires the SBC to perform a minimum of 40% of the R&D, while the single institutional partner performs at least 30%. Partnership with a research institution is required for an STTR grant, but only encouraged for an SBIR grant. (2012).

The Three Phases of SBIR and STTR awards are as follows:

a) *Phase I*: Phase I funding is to assist with establishing "the technical merit, feasibility, and commercial potential of the proposed R&D efforts and to determine the quality of performance of the small businesses prior to providing further Federal support in Phase II."

b) *Phase II*: "The objective of Phase II is to continue the R/R&D efforts initiated in Phase I. Funding is based on the results achieved in Phase I and the scientific and technical merit and commercial potential of the Phase II project proposed. Only Phase I awardees are eligible for a Phase II award."

c) *Phase III:* "The objective of Phase III, where appropriate, is for the small business to pursue commercialization objectives resulting from the Phase I/II R&D activities. STTR/SBIR does not fund

> Phase III. In some Federal agencies, Phase III may involve follow-on non-STTR funded R&D or production contracts for products, processes or services intended for use by the U.S. Government" (USSBA, 2012).

Funding levels and award periods for the phases of STTR & SBBR differ. For STTR awards, Phase I awards do not normally exceed $100,000 for 1 year. Phase II awards generally do not exceed $750,000 for 2 years. Alternatively, SBIR awards are normally not in excess of $150,000 for 6 months, and Phase II awards normally do not exceed $1 million for 2 years.

3. *Matching Funds:* In the Commonwealth of Kentucky, USOs or other startups that qualify for federal SBIR awards and STTR awards can augment their funding through the Kentucky Small Business Innovation Research and Small Business Technology Transfer Matching Funds program. State dollars are available to match all or part of the federal awards earned by Kentucky-based companies, or companies willing to relocate to Kentucky. The Matching Funds program is managed by Kentucky's Cabinet for Economic Development and contractually administered by the Kentucky Science and Technology Corporation (KSTC) (Kentucky Cabinet for Economic Development, 2012).

CHAPTER TWO: BACKGROUND

The University of Kentucky and TBED

The University of Kentucky, like many institutions, began its involvement in technology transfer later than universities often recognized for their successful technology transfer operations. The university constructed its research park, Coldstream, in 1992 (Coldstream, 2009). UK opened its Advanced Science and Technology Commercialization Center (ASTeCC) in 1994 (ASTeCC, 2012). In 1997, the Kentucky state legislature passed the Kentucky Postsecondary Education Improvement Act (also known as House Bill 1), realigning postsecondary education in the state to strengthen economic conditions for Kentucky's graduates (DeYoung & Baas). One objective of House Bill 1 was to establish the University of Kentucky as a highly ranked research university. This later became known and marketed as *The Top-20 Compact* (2012).

Retired University of Kentucky President Lee Todd served as president from 2001-2011. During his tenure, Dr. Todd initiated a number of efforts to enhance UK's status as a research institution. In 2006, as part of his *Top 20 Plan*, Todd created UK's Office for Commercialization and Economic Development. The office was overseen by a new Vice President for Commercialization and Economic Development, Dr. Leonard 'Len' Heller. By 2010, Todd announced his retirement from the University of Kentucky and a new university president, Dr. Eli Capilouto, was appointed. Capilouto was charged with responsibilities that included revising the university's financial model, enhancing student success, and improving campus safety (University of Kentucky, 2012 b). Vice President for UKCED, Len Heller, retired in March 2012. There are no plans to hire someone in that position (Interview I, 2012). Instead, UKCED was placed under the direction of

UK's Vice President for Research, Jim Tracy. This has left the future of UKCED uncertain. UKCED's indefinite future is not unusual, as Bok suggests that the presidential priorities affect the allocation of resources to specific units and services (2003).

Public Institutions: Unique Characteristics and Circumstances

As Geiger indicates, the examination of research institutions is difficult to aggregate; noting that it "address[es] a set of institutions whose central members are obvious, but whose peripheral members are never entirely clear." Moreover, "to address them from the perspective of their particular role of cultivating, interpreting, and extending knowledge" is difficult, because it includes "the interactions of participating and assisting institutions", as well as, "resources to support academic inquiry (2009, p. xix)." Public research universities are distinct in respect to more than governance.

Public institutions, greater in number of faculty and students, are much more complex organizations than private institutions. Their public affiliation exposes them to political influence and greater social accountability. These obligations have given rise to a considerable variety of classes of public research institutions (Graham & Diamond, 1997). Geiger utilizes case studies of both public and private research institutions to illustrate the diversity of their research enterprises (2009). Graham and Diamond, alternatively, separate the two. Moreover, they argue that the utility of the traditional Carnegie classifications by research levels is inappropriate. A three-tiered hierarchy, applicable to private research institutions, cannot be used constructively for public research universities, which are plentiful and diverse. Further complicating amalgamated comparisons, are traditional precedents, where state and local politics have emphasized the demarcation of public research universities' missions. Political auspices have further

characterized public research institutions by designations such as flagships, land-grant institutions, and regional universities (1997).

Comparisons of technology transfer operations at public and private universities are further complicated by institutional variables, as well as the various stages and resultant effects of the technology transfer process. The process, itself, consists of progressive stages. Outcomes are correlated with corresponding stages. For example, an intellectual property disclosure may or may not lead to a patent. A patent may or may not lead to a license. A license could or could not yield a spinoff or significant royalties. Finally, a spinoff could exit (either through acquisition or profitability) or fail, and so forth. Further complicating outcomes analyses; are the level of commercial research involvement, available resources at each stage, and the influence of institutional prestige. Objective measures tend to avoid variables of time, and emphasize quantity in relation to quality. This method frequently overlooks the significance of "pound for pound ratios of productive achievement" (Graham & Diamond, 1997, p. 3).

Moreover, research activity, particularly in southern regions of the United States, is comparatively weak in relation to leading public institutions. Since the American Civil War, several factors have contributed to economic instability in the south. Without a strong industrial foundation, southern institutions (including the University of Kentucky) have been excluded from the influence of commercial funding which has fostered research traditions at leading public institutions (Graham & Diamond). Land grant status, itself, has continued to encourage focused objectives related to practitioner, rather than basic science programs. That is, the academic missions of PLGUs encourage concentration in disciplines such as forestry, nursing, and military science, which are

historically weak in research productivity (1997). Although many land grant universities must compete for resources from rival flagship campuses, the mid-sized University of Kentucky is both land grant and state flagship (University of Kentucky, 2012 b). This leads to a further division of roles. State land grant institutions are recognized for their skewed emphasis on practitioner programs. Concurrently, flagship and medical status enhances the amount of per capita research and development funding, particularly from federal programs, but flagship missions also promote programs in the social sciences and humanities. Such programs traditionally produce less sponsored research (Graham & Diamond). Overall, undersized institutions have historically been impeded in their efforts to compete with mature research universities with specialized research institutes, hefty endowments, and reputations for strong research capabilities. As Graham and Diamond state, "Political and business leaders seeking economic development from their university campuses would in all likelihood prefer a Michigan State, winning $850 million a year in federal R&D funding" (pgs. 158-159) to an institution with lower total research funding, but higher per capita federal funding. In fiscal year 2009-2010, UK was among institutions awarded more than $40 million dollars for federal research, at roughly $145 million. Its national rank among institutions earning federal R&D funding was 68. In comparison, the top ranked institution in terms of federal R&D funding was Johns Hopkins University, with approximately $1.6 billion in funding (The Center for Measuring University Performance, 2011). Nevertheless, President Todd made the decision to engage the University of Kentucky in efforts for technology based economic development. Unless otherwise cited, the following information concerning the development of UK's TBED enterprise is derived from DeYoung and Baas's 2012 work,

Making the Case for a Strong Research University: The University of Kentucky Top-20 Business Plan, in Stanley, Bienkowsky, and Brada ‘s edited volume: The University in the Age of Globalization: Rankings, Resources, and Reforms.

In June 1997, the Kentucky State Legislature passed House Bill I, also referred to as The Kentucky Postsecondary Education Improvement Act. The bill set several goals for higher education in the state, including a mandate for the University of Kentucky to attain *Top 20* status, among national research institutions. The University of Kentucky was established in 1865 under the Morrill Act of 1863 with the use of federal land grants. As the dedicated state land-grant institution, UK has traditionally offered programs in agriculture and the mechanical arts, engineering and mining, in addition to a more general liberal arts education. UK is also the state’s designated flagship institution. According to Berdhal, public land grant institutions form the nuclei of the public education systems in their states and have a history of leadership, research, and graduate education (1998, as cited by DeYoung and Baas, 2012).

Because of its dual land grant and flagship status, the welfare of the university and the Commonwealth of Kentucky has been historically interconnected. The legislature’s charge stems from the institution’s land-grant designation, as well as an understanding of reciprocity between the university and the people of Kentucky. To demonstrate the connection between UK’s traditional mission and state welfare, DeYoung and Baas cite a 1917 report to UK’s Board of Trustees. The following excerpt summarizes the relationship, noting, “The possibilities and responsibilities of a state university are largely conditioned by the population, resources, industries, and public school system of the state which it serves.” The report advised early 20th-century trustees as to Kentucky’s

population, income levels, literacy rates and educational attainment, in addition to the potential for industrial development within six state regions. The report provided intervention plans, by college and department, for each region, indicating, "State University's particular function… [is] to serve widely and powerfully those practical needs of the state…for the investigation of problems bearing upon development of the State itself and upon the welfare of its citizens (University of Kentucky, 1917, as cited by DeYoung and Baas, 2012)." This part of the university's mission is widely understood by its administration and the people of Kentucky. Moreover, Kentucky has a large rural population in addition to its metropolitan areas. As such, university administrators are acutely aware of their role in assisting state development.

The Kentucky Demographic

Concerning educational attainment and income levels, Kentucky is below average among the 50 United States. The state ranks 46th in associate degrees, 47th in bachelor's degrees, and 37th in graduate or professional for population over 25 years of age, for highest level of educational attainment. Sixteen per cent of Kentucky's population falls at or below the poverty line. Median annual household incomes of $36,786, are approximately $10,000 below those of states with highly ranked universities. Kentucky residents are two percentage points above the national average for its population on Medicaid. Comparatively, the fifteen states with top-ranked institutions have populations that are slightly more than two percentage points below the national average for subsidized healthcare. Lung cancer mortality rates in the commonwealth, attributed to the 27% of Kentuckians reported as smokers, are also well above the national average. The amount of overweight or obese residents contributes to Kentucky's characterization as a

state with one of the highest rates of diabetes per capita (Kentucky State Data Center, 2000; Kentucky State Data Center and the Office of Workforce Research and Analysis; University of Kentucky, 2005, as cited by DeYoung and Baas, 2012).

President Lee T. Todd and TBED

As part of an effort to address the population's problematic characteristics, as well as the university's recent mandate to reach advanced status among its peers, the University of Kentucky's Board of Trustees launched a presidential search in 1999. The university's existing president, Dr. Charles T. Wethington, had announced his retirement, effective in June 2001 University of Kentucky Libraries, 2007, as cited by DeYoung & Baas, 2012). Dr. Lee T. Todd, a former UK faculty member, serving as senior vice president of an IBM subsidiary, was chosen out of three finalists for the position. Todd had successfully founded two technology companies based upon his faculty research in the UK in the College of Engineering. On July 1, 2001, Lee Todd became the 11th president of the University of Kentucky (Axelrod, 2001, as cited by DeYoung & Baas, 2012).

Todd earned his Bachelor of Science degree in electrical engineering from UK in 1968. He returned to Lexington in 1974, after completing his Ph.D. and a postdoctoral fellowship at MIT, to pursue a faculty career. Todd served as a faculty member at UK until 1983, when he founded two technology companies, Projectron, Inc. and DataBeam Corporation. Hughes Aircraft acquired Projectron in 1990, while IBM/Lotus purchased Databeam in 1998. Todd was also active in science and mathematics reform activities in Kentucky, as well as in economic development initiatives (University of Kentucky Office of the President, 2009, 2010, as cited by DeYoung and Baas, 2012). Todd was considered

by many to be a different breed of president, one with both academic and entrepreneurial experience.

After his presidential inauguration, Todd undertook an extensive marketing and public relations campaign to advance his plan for the university to obtain Top 20 status. President Todd met with the state's governor and over 100 state legislators to discuss ways that the university could work with communities to address what Todd coined the *Kentucky Uglies*: high statewide rates of diabetes, lung cancer, illiteracy and poverty (Todd, 2005, as cited by DeYoung & Baas). With advice from several appointed task forces, Todd initiated a strategic plan, and follow up business plan, to advance the university's prestige. The strategic plan revised the university's vision, mission and value statements, and argued for its critical role in the welfare of Kentucky's population. A key component of the plan was to "elevate the quality of life for all Kentuckians" by facilitating economic development (University of Kentucky, 2006, as cited by Baas & DeYoung, 2012). Some of the research goals established to accomplish the plan included increased federal research expenditures, construction of additional research facilities, and an increase in doctoral program enrollment. To enhance the lives of Kentuckians, a plan Todd implemented a plan to integrate service into the curriculum and recognize faculty service. Yet, in terms of economic growth, the most significant changes made concerned the university's technology transfer operations.

To establish growth in the local economy, Todd pushed research commercialization efforts. In fact, the number of patent applications increased by 10%, and the number of university-initiated start-up companies increased to two per year. Todd had some difficulty meeting his objective concerning industry-funded research expenditures.

Industry-funded research dropped during 2004 and 2005 and then returned to a baseline of $13.2 million in 2006 (University of Kentucky, 2006, as cited by DeYoung and Baas, 2012). Although state funding for university operations initially increased, Todd faced decreased state appropriations for the latter part of the 2000s. He continued his efforts, establishing a new strategic plan for the years 2006-2009. The plan accommodated the expansion of research and clinical operations, as well as the expansion of the faculty and student body, to account for a correlation between institutional rank and size. Narratives contained in Todd's business and strategic plans asserted that, in order to answer Kentucky's social, economic, and health issues, the size of the university and its operations must increase.

According to Todd, an increase in size and reach of university efforts would result from an increase in the number of Kentuckians with bachelor's degrees, leading to higher median household incomes. Expansion of faculty would also increase intellectual capital in the state. The 19% of the population with bachelor's degrees in 2005 was too much for Kentucky's unstable job market to employ. Todd argued that by engaging a creative class of faculty and entrepreneurs the university would collect talented people to create businesses and jobs, improve products and services, and battle diseases. These growth imperatives were articulated as investments in people. The proclamations conveyed UK as an engine for state economic development. Todd referred to growth as a moral imperative, based upon the university's land grant and flagship status (Todd, 2005, as cited by DeYoung & Baas, 2012).

Establishing UKCED

Key strategies of the Top 20 business and strategic plans included, increasing extramural research funding, enhancing the intellectual property development and technology transfer procedures, and increasing the number of start-up companies, royalty-bearing licenses, and patent licensing income. The implication was that investments in the university's intellectual property would create a knowledge spillover, specifically in terms of university spinoff companies. Todd claimed that USOs and state-based incentives would lead to more Kentucky-based businesses, jobs, and the development of a knowledge-based economy in the state.

In 2006, Todd created the university's Office for Commercialization and Economic Development. Dr. Leonard Heller was recruited as the Vice President of Commercialization and Economic Development. According to Heller, "Dr. Todd was very passionate about commercialization and economic development and I told him, 'I'll do this, as long as you are president' (L. Heller, personal communication, February 28, 2012)." Heller earned an Ed.D. in Organizational Development. He had been a faculty member at the University of Illinois, University of Michigan, Baylor College of Medicine, and the University of Kentucky College of Medicine. He worked as the CEO of WTT, Inc., which was one of the university's first spinoffs. WTT created thoroughbred drug screens for the horse racing industry. Neogen Corporation, an international animal and food safety corporation, acquired WTT in 1991. UK earned roughly $2 million in royalties from the technology (UKCED, 2012 d).

The number of technology transfer personnel increased under UKCED, but the reporting structure was streamlined and Heller reported directly to Todd, providing a

direct line from the Office for Commercialization and Economic Development to the president. The office was responsible for intellectual property development, commercialization and licensing of university-based intellectual properties and technologies, development of the UK Coldstream Research Campus, and business development for new and existing technology-based companies and small businesses at UK. The office's original slogan was *Research Means Business* (Highlights of Todd, 2010a; University of Kentucky, 2010d, as cited by DeYoung & Baas, 2012).

The economic development strategy was marketed as crucial to improving the quality of life in Kentucky. It would not only benefit the economy, but also offer targeted research and assistance to tackle some of Kentucky's leading healthcare problems: diabetes and lung cancer. The research initiative was modeled after those in areas with high-technology clusters, such as the Research Triangle Park in North Carolina, Route 128 in Massachusetts, and Silicon Valley in California. Universities in these areas are recognized for conveying knowledge to local industries, operating in-house business incubators, and operating scientific research parks in their areas. Some firms establish themselves near prominent universities to accommodate interaction between their research and development (R&D) teams and distinguished scientists (Hedge, 2005).

Based on case studies of successful ventures, a widely assumed notion among public university administrators is that university R&D leads to economic development. Results indicating a direct link between flagship university R&D and new state businesses and industries, however, are weak. Other considerations include markets, environmental factors, access to qualified labor, and presence of existing high-technology clusters. Concerning patent citations and their impact on local economies, private

universities outperform publics in local research spillover. The influence of high-tech clusters and private universities brings to light a disadvantage of modeling; that is, metropolitan prestige and geographic location often plays a substantial role in where high technology and knowledge-based businesses choose to locate and form partnerships with nearby universities. Central Kentucky, plagued with many of the 'Kentucky Uglies', is at a disadvantage in such considerations (Hedge, 2005; Woodward et al., 2006, as cited by DeYoung & Baas, 2012).

Private research universities dominate the *U.S. News and World Report's* "Best Colleges and Universities Top 25". Triangle Park, Route 128 and Silicon Valley are heralded as university-industry collaboration success stories. Top-ranked universities or clusters experience a "halo" (p. 383) effect, wherein their draw is greater than the quality of research can justify (Hedge, 2005). There are over 1,000 centers similar to UK's Office of Economic Development in the country. Although these centers contend that they are innovative, in fact, they are replications of previously successful ventures. The relatively small number of institutions with successful programs has collaborated with industry since the early 20th century. The evidence suggests that the research expansion strategy for Kentucky was an effort to create an image of prominence for future possibilities rather than a strategy that would have any immediate impact (Mowery et al., 2004; Yusuf and Nabeshima, 2007, as cited by DeYoung & Baas, 2012).

CHAPTER THREE: METHODOLOGY

The research presented here is a qualitative, single, intrinsic case study of the University of Kentucky's technology transfer enterprise, formally known as the University of Kentucky Office for Commercialization and Economic Development (UKCED). The approach is also referred to as a Constructivist perspective. Utilizing a purposive sample, its design is intended to serve as what Stake has termed an *intrinsic case study*.

An Interpretivist Ontology

The qualitative approach to this study stems from an interpretivist paradigm. Yates argues that qualitative methodologists stress the significance of context in appreciating different interpretations and that the data are comprised of entities found in the environment that hold meaning for individuals and groups. As such, qualitative study often ventures to carry out one or more of the following:

> Achieve an in-depth understanding and detailed description of a particular aspect of an individual, a case history or a group's experience(s); explore how individuals or group members give meaning to and express their understanding of themselves, their experiences, and/or their worlds; find out and describe in detail social events and explore *why* they are happening, rather than how often; (and) explore the complexity, ambiguity and specific detailed processes taking place in a social context (2004).

Rather than control, qualitative researchers seek greater understanding (Hesse-Biber & Leavy, 2006).

Denzin and Lincoln, moreover, argue that "all research is interpretive" (p. 31), in that any attempts to answer research questions are essentially framed by the researcher's belief system. Many premises are assumed and undisclosed; even the questions posed by the researcher are subject to the interpretations s/he implicitly draws upon while

constructing the study (2008). Interpretivist assumptions consider how participants in a social setting conceive their situations. These socially constructed realities are numerous, complex and cannot be separated into "discrete variables" (Glesne, p. 5). The researcher serves as the primary research instrument by observing, interacting with, and interviewing participants. The role of subjectivity in the research process supplants concerns over objectivity. Findings are communicated through descriptive narratives, with limited use of quantitative data. Moreover, the approach is inductive and searches for patterns within the results, rather than attempting to reduce findings to numerical indices or seek norms (1999). This particular qualitative work utilizes an intrinsic case study method to address its research questions.

Intrinsic Case Study

Intrinsic case studies, as opposed to *instrumental* or *collective case studies*, are undertaken in consideration of not only what they do represent, but also what they do not. Intrinsic case studies are conducted "because, first and last, one wants better understanding of this particular case" (p. 121). Intrinsic studies of cases are not undertaken because they illustrate specific traits or issues, but because their characteristics and, even commonness, are of interest. Although there are some similarities in terms of examination it is unlike instrumental case studies, in that the case is not secondary to the issue it addresses. It is further separated from collective case studies, which like instrumental case studies, are used to draw generalizations, examine populations, or general phenomena. Intrinsic case studies are not meant to build upon theories. When a researcher commits too strongly to generalization or theory construction, s/he runs the risk of pulling attention away from the qualities that are

critical to understanding the case. Generalizations, however, are not avoided. They are still made concerning the case, itself, and at future points in time, and drawn upon in other contexts. The primary purpose of intrinsic case study is to provide readers with interpretations, but also allow them the freedom to draw their own conclusions (2008).

Purposive Sampling & Sampling Frame

The sampling technique for this study was purposive (also referred to as judgmental), in that it is based on knowledge of the population that is meaningful for its purpose (Babbie): UK's Office of Commercialization and Economic Development and other entities comprising UK's TBED enterprise (2008). When generalizability is a fundamental goal, random sampling is more appropriate. In this case, random sampling was inadequate, due to the case study's focus. In small cases, purposeful selection is favorable, in order to establish specific comparisons. Purposive sampling allows the research to highlight rationales or variables that contribute to differences between individuals and environments (Maxwell). A small, purposive sample yields greater confidence that data and results sufficiently provide a balanced representation of the target population, than a similar sample utilizing random variation (1996).

The approach to sampling was purposive, in that individuals were sought out who were either UKCED personnel, members of the Bluegrass Angels (a venture club established by UKCED to finance promising technology for commercialization), or UK spinoff personnel. The expectation of this type of sample was that information from TT personnel and investors would provide a historical background for UK's commercialization efforts, as well as contemporary issues, from an organizational perspective. Moreover, USO personnel's experiences could presumably connect

organizational goals to outcomes and provide further insight into the nature of university spinoff development at UK. Finally, sampling three related but disparate groups provides crystallization and credibility for interpretation.

Gatekeepers and establishment of rapport.

The sample was based upon my previous knowledge of UKCED's organization, as well as information from a gatekeeper and an intermediary. The intermediary, "whom the gatekeepers or potential participants know and respect" (Glesne, 2006, p. 45), is a member of my advisory committee, Joseph L. Fink, III. Professor Fink previously served as the Vice President for Research and Economic Development and Vice President for Corporate Relations and Economic Outreach, as well as Executive Director of UK Coldstream Research Campus from 2002 to 2004 (Pharmacy Faculty-Joseph Fink - B.S.Pharm., J.D., F.A.Ph.A., 2012 c). Over the course of approximately two years, Professor Fink contacted a number of individuals on my behalf. Professor Fink and I met with UK's (now retired) Vice President of Commercialization and Economic Development to discuss my emerging research interests. Moreover, Professor Fink introduced several personnel from UKCED to my research interests and requested that, as a member of my advisory committee, they assist me as I further developed my dissertation study. This gave me the opportunity to meet with some staff members prior to beginning this study. As Glesne suggests, a certain rapport is imperative in qualitative research to reduce distance, calm the anxiety of the participants, and build trust, so that insiders have confidence in the researcher and his/her work (2006). These early interactions established the rapport necessary to utilize a gatekeeper to pursue the sample. The gatekeeper, a technology transfer officer with UKCED, provided the necessary

consent to enter the research setting and offered referrals and contact information in order to develop the sampling frame (for additional information on the role of gatekeepers, see Glesne, 2006, pp. 44-45).

The sample/participants.

My gatekeeper provided a preliminary list of technology transfer personnel, investors/entrepreneurs, and USO personnel, which included e-mail addresses and phone numbers. The individuals within the sampling frame were sent introductory e-mails with invitations to participate (See Appendices B-D). Introductory e-mails contained general information. Once prospective participants responded, correspondence commenced. Individuals were given the opportunity to ask questions, provided with more detail about the study, including information concerning Institutional Review Board (IRB) exemption (see Appendix E) for the study, and asked for permission to record the interviews. Those in the sampling frame who agreed to participate were given additional details concerning the study's objectives, the opportunity to review the exemption certification from the IRB, and asked to provide Informed Consent prior to their interviews (See Appendix F). As I met with participants, as part of the interview scripts (see Appendices G-I), I asked if they could think of any additional professionals I should speak with or documents I could access, executing a snowball technique. Snowball sampling is warranted when "members of a special population are difficult to locate" (Babbie, p. 205), so the researcher collects data on members of the targeted population and asks them for additional information, to locate other members of the population that they know. Accumulating participants using the snowball technique can occasionally result in questionable representativeness, which is why it is predominantly used for exploratory purposes, such as this study (2008). The

majority of referrals were interviewed, although some fell outside the scope of this study, while others either did not respond to multiple requests or declined to participate.

All of the technology transfer personnel, except for one, participated. The TT representative who declined initially agreed to participate, but soon changed positions within the university and indicated that the new position required a great deal of time and attention, and could no longer afford to participate. Three out of six USO officers participated in the interviews. Two USO officers (one a representative of UK's medical technology incubator and spinoffs, and the other, affiliated with a spinoff of a biomedical parent company that was recruited to relocate to Lexington, KY) did not respond to repeated requests for interviews. The third USO officer, currently located in California, indicated that there was not time in her schedule to participate-particularly given the difference in time zones. Alternatively, I contacted an officer of that USO who works locally who agreed to participate. I also contacted Lee Todd, UK's retired president who championed technology transfer for economic development purposes and established UK's Office for Economic Development in 2006 (DeYoung & Baas, 2012). Like the two USO officers, he did not respond to me. Finally, after alleviating some initial concerns over proprietary information from investors, all three agreed to participate. The total number of oral history interviews conducted for this study came to ten (see Appendix A-Legend for Oral History Interviews). This is consistent with Glesne's contention that data collection often concludes under less than perfect conditions, due to limited time or resources (1999).

Data collection.

The data collection process consisted primarily of oral history interviews concerning affiliated professionals' experiences and impressions/interpretations. In general, interviews lasted between an hour and ninety minutes. The briefest interview was approximately fifty-five minutes, with the longest lasting over two hours. The group of interviewees consisted of officers within UKCED, with distinct roles and responsibilities, members of the group of investors/entrepreneurs that often provides start-up financing for UK associated technology, and entrepreneurs/officers of three of the university spinoffs that are currently active. A limited amount of documentation was used in an attempt to triangulate data derived from interviews. Thus, the majority of the analysis presented is based on data gathered through personal communications. The interviews were transcribed and examined, using an open coding technique, wherein codes (or themes) were generated by inspection of the transcripts (Babbie, 2008). Per the IRB exemption certification for the study, digital recordings and transcripts will be kept for 6 years after completion of the work on a password-protected computer and then erased/destroyed.

Credibility through Crystallization

A foundation of case study is "description of persons, places, and events" (Janesick, p. 69). "The trinity of validity, reliability, and generalizability" (pp. 68-69) is not always applicable to qualitative questions. Discussions of qualitative methods and design have periodically taken place to address the suitability of these terms outside of psychometric study. While the term *validity*, explicitly defined, is a cornerstone of quantitative research, alternate paradigms for descriptive validity and case study deal with illumination and interpretation-considerations of the *credibility* of explanation. Whereas

quantitative validity holds a particular set of restricted definitions, qualitative credibility acknowledges that there may be multiple legitimate interpretations. The essential question for qualitative case study, is not 'Are you measuring what you propose to measure?', but "Is the explanation credible? (p. 69)" In terms of a study's appropriateness, Janesick contends that researchers have become preoccupied with "methodolatry, a combination of *method* and *idolatry*,…[by] defending methods to the exclusion of the actual story being told…that often overtakes the discourse in the education and human services fields (p. 64)." Because an objective of case study is to find "categories and the relationship and patterns between and among categories [leading to]… completeness in the narrative" (p. 64), she argues that credibility should replace *the trinity*. As an umbrella term, credibility encompasses strategies such as member-checks, journaling, and participant crystallization. These strategies are better suited to qualitative study than narrowly defined conceptions of validity, reliability, and generalizability borrowed from quantitative methods (2003).

Moreover, for research in areas like education and human services, the conventional consideration of generalizability weakens its purpose (Janesick). Case studies are organized to explore unique attributes. Inasmuch, a technical approach to reliability is irrelevant because there is no acute need for replication (2003). As previously indicated, the purpose of this study is not to provide generalizable findings, but to offer a detailed examination of its specific case. Therefore, credibility is approached through crystallization.

Janesick uses the metaphor of the qualitative researcher as choreographer to demonstrate this point.

> The design of the study begins with some fixed movements: precise interviews are planned, observations are scheduled, documents reviewed and analyzed…At the same time, within the parameters of the interviews, information is disclosed that allows the researcher to improvise, find out more about some critical event or moment in the lives of the participants…Even the act of charting observations and interviews is sometimes improvisational…All choreographers make a statement and begin, explicitly or implicitly, with the question, 'What do I want to say in this dance?' In much the same way, the qualitative researcher begins with a similar question: 'What do I want to know in this study?' This is a critical beginning point (pp. 50-51).

She argues that questions best suited for qualitative inquiry are generally the questions approached by many "educational researchers and theorists, sociologists, anthropologists…and historians (p. 51)." Such questions concern areas including: quality of innovations or programs, meaning or interpretations of components of subject matter, and whole systems at micro and macro levels.

Janesick cites Richardson's (1994) discussion of crystallization and contends that it is a more appropriate lens with which to view designs and components of qualitative research than triangulation. She recommends crystallization as the proper context to incorporate the multiple disciplines that influence the character of qualitative study design. Richardson's (1994 p. 522, as cited by Janesick) depiction suggests that the crystal:

> Combines symmetry and substance with an infinite variety of shapes, substances, transmutations, multidimensionalities, and angles of approach. Crystals grow, change, and alter, but are not amorphous…crystallization provides us with a deepened, complex, thoroughly partial, understanding of the topic. (2003)

To provide credibility through crystallization, this study incorporates both internal and public documents concerning TBED initiatives at the University of Kentucky, as well as oral histories of active USOs, technology transfer personnel, and Angel investors, in order to approach the of the organization from multiple perspectives.

CHAPTER FOUR: THE CASE STUDY

The University of Kentucky and the TBED Enterprise

"Unless you live it, there aren't many people that could talk this stuff" (Interview J, 2012). This statement, from a technology transfer officer at the University of Kentucky, provides insight into the complex and interwoven network of relationships that comprise the TBED enterprise. Personnel have a mix of educational and professional experiences. A broad network of formal and informal partnerships has formed to promote technology transfer at the institutional and community levels. Some individuals have seen their positions evolve over decades, while others have worked within the general area of innovation or small business policy in a variety of positions.

Several studies have quantitatively addressed some angle of the question, 'Does the structure and organization of TT offices facilitate universities' contributions to economic development effectively?' An answer that addresses the diverse range of research institutions over time has been elusive. What is clear is that the rationale for the TT office's existence generally relates to the public benefit of university discoveries or the economic benefit to either the community or institution (Geiger & Sá, 2008). One expectation of this study is to investigate the perceptions of TT personnel, in the hope of illuminating multiple areas related to their positions. Participants were asked to discuss the organizational history and structure of the technology transfer office, their backgrounds, the expectations of their positions, what they perceived as major challenges and accomplishments of the organization, and any impact administrative changes have had on their work.

Personnel's Recollections of Organizational History

The technology transfer officers who participated in this study have diverse backgrounds. Direct experience with UKCED (and its previous interpretations) ranges from two years to twenty-eight years. Their formal educations include, law, zoology, and statistics. Professionally, their experiences include work in scientific research, government, and telecommunications. They relay both common and unique understandings of their roles in technology transfer and economic development.

Ten years ago, when *Roger Kemp* (pseudonym, Interview I, 2012) joined the university, UK had already built the ASTeCC campus incubator facility, as well as Coldstream. Kemp knew Lee Todd through his company, Databeam. Kemp was hired roughly a year after Todd took office as President of UK. When Kemp began his tenure at UK, he had an interest in ideas about a new, technology-driven economy and became acquainted with the Dean of the College of Business and Economics. His position was housed in the Von Allmen Center for Entrepreneurship in the college.

Kemp's contention is that initiating an infrastructure to facilitate commercialization consisted primarily of networking. At the time, the state of Kentucky was beginning to establish several programs in the area of innovation and commercialization. Kemp notes that commercialization was drawing a great deal of attention, largely because Todd "likes that kind of stuff." At the time, there were a small number of local investors.

> There were investors, there's always investors, but there were no organized Angel groups…There were groups of 2 or 3 who invested together, another group of 2 or 3 here and in Louisville. There's money in Kentucky, but there wasn't any way for entrepreneurs to reach those people. It's like, 'who are they?' Because they're all private out there and unless you had some personal connection you couldn't get to them even when you had to. Then some of them, their wealth is built on real estate or fast food, right? So that was scary. [It] is scary to investors,

> but when you get an Angel group together, you can work through some of that. So we worked very hard on that and we've been very active with that.

Kemp worked with the Dean of the Gatton College of Business and Economics, Dick Furst, President Todd, and an investor to organize the Bluegrass Angels in 2004, to assist with UK's commercialization efforts. He argues that the group he helped to establish is currently the most active Angel group in the state.

To promote interest in IP disclosures and spinoff development, Kemp, Todd and Furst "put a lot of word out there" to encourage faculty to "do research, start companies, [and] create jobs." At the time, securing space in ASTeCC and starting a company was relatively straightforward, but there was "not much of a support structure here" to go beyond that point. Part of developing the structure was meeting with faculty to convince them that "starting a company…doesn't have to be scary." He provided faculty with information about SBIR and STTR grants, stating, "Kentucky at that time was not getting its fair share of that at all." The timing was right; however, as Kentucky was developing its aggressive matching funds program, which he claims is unique, nationwide. "That's why I came here. I saw the state was doing some interesting things. Dr. Todd certainly lived this kind of stuff and was very supportive of it."

In 2000, Kentucky's General Assembly also enacted the Kentucky Innovation Act (Interview C, 2012). The legislation created structures and funding opportunities to enhance innovation in the state under the Cabinet for Economic Development (CED). The Office of Commercialization and Innovation was created to:

> Lead the state's technology-based economic development efforts by developing and implementing a strategy to build and promote technology-driven and research-intensive industries with the goal of creating high-tech job opportunities and developing clusters of innovation throughout the state. [The Office] administers and recommends funding to facilitate recruiting,

> creating, and retaining innovation-driven companies and jobs, producing new products and services, and developing new and improved processes (Who We Are, 2012).

Part of the structural enhancements was the Kentucky Innovation Network, which began with six, and currently consists of ten, Kentucky Innovation and Commercialization Centers (ICCs) across the Commonwealth. The ICCs are located in areas ranging from Louisville, KY, to Ashland, KY. ICCs are designated as part of the Kentucky Innovation Network. Each center provides consultation services for areas including business development, marketing, and funding sources (About Us, 2012).

The state's Office of Commercialization and Innovation funds 50% of the operations and salaries of the ICCs, and strategic partners, including the CED and Kentucky Technology, Incorporated, (Interview C, 2012), fund the remainder. Some of the ICCs are affiliated with local universities, while others like Louisville's-affiliated with Greater Louisville, Incorporated- are affiliated with private entities for funding purposes.

When the Kentucky Innovation Act was passed, the Von Allmen Center for Entrepreneurship was within the organizational hierarchy of the ICCs. Essentially, it was the Lexington ICC (Interview I, 2012). It is now part of the University of Kentucky's Office for Commercialization and Economic Development (UKCED), established in 2006. Currently, the Lexington ICC is located in downtown Lexington in the same facility as the Chamber of Commerce (commonly referred to as Commerce Lexington) and partially funded by the Von Allmen Center. Because of their close relationship, the Von Allmen Center provides initial services to faculty researchers to assist with the IP disclosure process through UK's Intellectual Property Committee. The Lexington ICC also becomes involved early in the disclosure process, to assist faculty with state funding

opportunities that are available. “One thing that Kentucky does not really lack is the number of opportunities that are out there (Interview C, 2012).”

In conjunction with the establishment of the Bluegrass Angels, Kemp believed he and his colleagues were setting the groundwork to effectively venture into commercialization of UK intellectual property for economic development. By 2006, the university formally established its Office for Commercialization and Economic Development, with Len Heller at the helm. Kemp remains unclear as to how the office was funded, “I don’t know how all that budget came together – or where it came from. I just don’t know.” His only recollection is that President Todd somehow organized funding.

The combination of the new Angel group, government incentives, and faculty outreach, were considered essential because, “Without that, what you end up with is a bunch of faculty-run companies that really don’t create many jobs.” The support structure had to be local, considering that venture capital is found at the national level. The structure could not be present only at UK, but also in the community (Interview J, 2012).

Organizational Structure of UKCED

Under the initial organization, the ICC and Von Allmen Center for Entrepreneurship were structured in UK’s Gatton College of Business and Economics. When the Office for Commercialization and Economic Development was created, the Von Allmen Center was shifted under the Vice President of UKCED, Dr. Len Heller’s charge. When Heller retired in 2012, UKCED was placed under the direction of the Vice President for Research. That position is currently held by Dr. Jim Tracy. Both Heller (previously) and Tracy report directly to the university president. Tracy has several departments and offices under his command, whereas Heller was solely responsible for UKCED. UKCED

serves as the umbrella organization for the Von Allmen Center, Technology Transfer, the Kentucky Small Business Development Center (KSBDC), Coldstream Research Campus (which includes ASTeCC), and Kentucky Technology, Incorporated (KTI). The University of Kentucky Research Foundation (UKRF) is also affiliated with Technology Transfer (Interview B, 2012).

The University of Kentucky Research Foundation.

The University of Kentucky's Technology Transfer and Intellectual Property Development offices are owned by UKRF, which is a non-profit branch of the university. All financial resources for research that come to the University are the property of the University of Kentucky Research Foundation. However, UKRF does not have a physical department with paid employees. Employees can *represent* UKRF's interests, but representing UK's Research Foundation means, for example, "I represent UKRF for patents. I spend UKRF money (Interview B, 2012)." The majority of UKRF funds come from the university's share of grant money earned by faculty. In order to facilitate revenue generation, Kentucky Technology Inc. (KTI) was established in 1988 as UK's for-profit corporation, owned by the University of Kentucky Research Foundation.

Kentucky Technology, Incorporated.

KTI is somewhat exclusive from other entities associated with TT at UK, in that it is for-profit. KTI's mission is to earn revenue from licenses, equity investments, and leases from the Coldstream Center at the UK research campus, and the ASTeCC campus incubator. KTI also invests in university-based technologies and technology-based businesses. KTI is also an investor in the Bluegrass Angels' venture funds (Interview J, 2012; UKCED, 2012 c). UK's Administrative Regulations provide KTI with two

objectives. KTI's primary role is to administer a master lease for ASTeCC and Coldstream. Business occupants of ASTeCC lease subsidized space. Coldstream space is unsubsidized. Rent is paid directly to KTI. Second, it has first rights to commercialize university intellectual property. In terms of commercialization, although first rights are granted in the university's regulations, KTI has rarely exercised those rights. The rationale for the second objective was to facilitate arm's length's transactions from the University so that "you could have a company that could own parts of companies that they started" (Interview B, 2012). The one exception that Kemp is aware of is with the medical technology company, Therix Medical. He explains it as:

> Now the one I know where they have [exercised first rights] is Therix Medical. It is hard. Therix is a private company. KTI was the founder. KTI did put some investment money in it- small amounts. But the primary funding for Therix Medical is private. People like the Bluegrass Angels are their investors. So KTI's relationship with Therix is – This is gonna get complicated. KTI's relationship with Therix is they're a founder *and* an investor, so they have equity in the company. Now – but then Therix still needs access to intellectual property at UK. So there's two ways they can … when it came time to how are we going to handle Therix – how are we going to handle the intellectual property – there was two ways it could have happened. They could have either got it through KTI, but then KTI would have had to exercise its rights with UKRF. Instead – and I don't exactly know why it ended up this way, but instead Therix has a master license with UKRF. So, they have access to the intellectual properties through UKRF, not through KTI. So, like any royalties that come out of sales and stuff from Therix, the royalties go to UKRF. But if Therix ever sells for a billion dollars, you know – then the equity in it would come back to KTI. It's complicated. It was. (Interview J, 2012)

In terms of equity purposes, KTI has executed agreements in the past. *Dave Richardson* (pseudonym, Interview B, 2012) has worked for the various incarnations of UKCED for almost three decades and recalls that equity is not exercised as frequently as it had been.

> We have a number of equity agreements. Now, we haven't done as much equity, at one point we were doing quite a bit of equity startups, but we haven't been

> doing it lately. Len [Heller] didn't really push equity. I don't know [why]… most of the time you want to take equity *and* [emphasis added] royalty. So you want some combination of equity and royalty.

Richardson explains that equity investments can be risky.

> Well, the trouble with equity is, if you're a minority holder of equity there's a thousand ways for them to screw you. Right, you don't control the company. Every time they raise money you get diluted, so your share gets smaller and smaller. We've never been in the position where we would put money into the company to keep it.

He continues that generally, the university did not put up any capital for equity. Instead, it was part of a licensing deal. In those cases, companies were seeking to pay lower royalties, so the trade off for lower payments was equity.

Unlike equity agreements, KTI's leasing function has continued, and will likely continue, as long as there are companies leasing space on university properties (Interview J, 2012). Coldstream has had a few companies, like Tempur-Pedic Corporation, A&W (fast food restaurateurs), and an international law firm choose to locate there over the past two years, but is not considered near capacity. ASTeCC, however, has 19 companies leasing space and is "almost always full" (Interview I, 2012). KTI's investment priority, a significant goal of President Todd, however, is not currently active.

During Lee Todd's tenure, KTI was able to make small investments into the Bluegrass Angels' venture fund, as well as directly into companies. Richardson surmises that *investor* was not a role that the university could play very effectively. Kemp states that KTI will abstain from investing, at least for a while, while the new administration addresses budgeting issues. He remains unclear as to how KTI carried out that function, noting that part of the funds came from rental revenue "and through some other ways", but is unsure, specifically, what those were. Regarding KTI's dormant status, Richardson

indicates, “I don’t know how that [investing] went…I think KTI ran out of money-and I was never one of Len’s favorites, so he didn’t talk to me. And that’s just as well.” He recalls an exceptional circumstance when KTI may have been used to back patenting costs during Heller’s tenure:

> We had a startup and the startup didn’t have [capital for patenting costs]. Usually, once we sign a license with the startup, they are responsible for the patent expenses. So we had one situation where Len paid patent expenses in return for some equity in the company…[that funding] came out of KTI- or out of his (Heller’s) budget.

Kemp suggests that KTI was set up with expectations it has not been able to meet, concluding, “It’s never been a moneymaker [and] it’s been around a long time.” There appears to be no clear-cut answer as to Kentucky Technology Inc.’s future, other than leasing, and none of the technology transfer personnel in this study is completely clear about how KTI functioned in the past. What is clear is that what is now the UKCED has evolved over the past decade and currently functions as part of a complex and loosely affiliated structure of organizations and relationships.

Affiliated Organizations

The current network of organizations affiliated with UKCED stems from the work of Kemp and others approximately a decade ago. In 2004, the same year the Bluegrass Angels was established, the Greater Lexington Chamber of Commerce, Lexington United, and the Lexington Partnership for Workforce Development (LPWD) merged to create Commerce Lexington, Incorporated (Greater Lexington Chamber of Commerce, 2012; Interview I, 2012). During that period, the ICC was located in the Von Allmen Center within UK’s Gatton College of Business and Economics on campus. As Kemp and his colleagues worked to establish the Bluegrass Angels, they found themselves

interacting frequently with similar groups working toward economic development at the local level. Personnel from a handful of organizations continued to meet regularly on common issues, and found that board membership often overlapped. Over time, the decision was made to merge the organizations and create the entity commonly referred to as *CommerceLex*.

Shortly thereafter, Jim Newberry was elected mayor of Lexington. He was a Bluegrass Angel, and had a long-term relationship with Dr. Todd. He had also worked as the attorney for an officer in a UK spinoff software company that had recently been acquired by a large corporation. Because of Newberry's support of the university's TBED enterprise, his ties to Todd, and frequent interactions between the Lexington ICC and the newly formed CommerceLex, the ICC was relocated from campus to downtown Lexington. The Von Allmen Center had earned a grant from the federal government's Economic Development Administration, and the funds were available to move downtown. Some office space in the new CommerceLex location had historically been rented to a third party business and was being vacated. Although the ICC/Von Allmen Center was not formally affiliated with CommerceLex, the space became the new location for the ICC/Von Allmen Center for Entrepreneurship. The rationale was to create a "tighter partnership" with the economic development staff inside of Commerce Lexington (Interview I, 2012). Although it was not legally organized, the association was named the Bluegrass Business Development Partnership (BBDP) (Interview C, Interview I, 2012).

The BBDP is a collaboration of the business development specialists from the University of Kentucky, Lexington-Fayette Urban County Government (LFUCG), and

Commerce Lexington. The BBDP is considered a project of the three organizations. All housed in the same building in downtown Lexington, some are employed by the university and some work for the other two organizations. The Bluegrass Business Development Partnership advertises itself as "a one-stop, super-service provider" (Bluegrass Business Development Partnership, 2012). Another justification for the location of the ICC and the BBDP was so that representatives could be "the face of UK on Main Street" (Interview C, 2012). In addition to its close proximity to campus, the location allowed community entrepreneurs to work with the BBDP, and by association, UK employees. Under the circumstances, UK employees could assist with multiple types of small businesses, not just university technology businesses. The logic was that if university employees could facilitate the expansion of community-centered businesses like restaurants or bicycle shops, they could help to build wealth in the community and possibly gain access to any technologies that local small business owners might be developing. In 2006, when President Todd created UK's Office for Commercialization and Economic Development, the ICC remained downtown, but the Von Allmen Center for Entrepreneurship was moved under UKCED on campus (Interview C, 2012).

Today, the ICC remains involved in Von Allmen Center work, however; ICC employees travel to campus for budget meetings, or Von Allmen Center representatives come downtown to for meetings. The partnership through the BBDP facilitates such activities.

> Sometimes it's a test. 'Why don't the next one [meeting] come to my office?' It's good for faculty to find their way off campus. I kind of wonder if they can even do it…if you're gonna be in business, it doesn't happen…on campus. It's gonna be out here. (Interview C. 2012)

The funding available through the city and state, as part of the partnership, has been a "Godsend" (Interview C, 2012) for the university. The structures in place also provide significant funding opportunities through the government portion and assistance finding a location for a small business in ASTeCC or Coldstream, through UK. However, the partnership does have some drawbacks. Entrepreneurs think and act quickly, which is antithetical to the bureaucratic cultures of local government and the university. Inventors are often unsure if important tasks can be accomplished in a reasonable timeframe. Nonetheless, the organizations "do a lot of working together" (Interview C, 2012) and believe it is a mutually beneficial relationship. As for the evolutionary nature of organizational alliances, Kemp argues that,

> [The missions] are all related. There's continual change, you know? I don't know. I've lived in big organizations, you know. This is my first university job, but you live in a big company [the] same stuff happens. Right? And it changes because of financial needs or it changes because of a shift in priorities or a new manager comes in with different ideas, and then that happens when you're a company or at a university.

It is all part of working for a large institution.

Community entrepreneurial organizations.

Two additional entrepreneurial assistance organizations are loosely affiliated with UKCED and its partners, Awesome, Inc. and Base 163. Awesome, Inc. was founded in 2009 by a number of University of Kentucky graduates who had started their own small businesses. Based on their experiences, the group established a non-profit, community incubator for entrepreneurs. One way to think about Awesome's organization is as entrepreneurial "hipsters" (Interview J, 2012). There is no age limit, but the entrepreneurs are often younger than typical university faculty and working with mobile applications (apps), internet technology, or gaming. In a way, the approach is similar to ASTeCC. At

Awesome, inventors "hang out…learn from each other, and work with each other" (Interview J, 2012). For a nominal fee, entrepreneurs can rent a desk in the space and interact with other inventors. Awesome Inc.'s focus is high tech, creative companies. They advertise that:

> By day, Awesome Inc serves as a coworking space for creative and technical professionals. We currently have 15 early-stage companies who utilize this shared open collaborative office space. By night, the space is transformed into a dance studio, art gallery, event venue, and creative laboratory. (Awesome, Inc., 2012 a)

Awesome, Inc. is linked to UKCED in a couple of ways. The company leases space below the ICC, in the Commerce Lexington building and frequently interacts with representatives from the ICC and Bluegrass Business Development Partnership. The company's principal is also well connected with the Bluegrass Angels, although Awesome, Inc. is focused on "the bottom up instead of the top down (Interview A, 2012)." Awesome works with individuals seeking seed capital, to try to create their own funding network. Although at this stage, the entrepreneurs at Awesome, Inc. need support from the Bluegrass Angels, "They aren't really wild about needing us because we're a bunch of old guys…sitting around making life-changing decisions affecting their entrepreneurs (Interview A, 2012)." Awesome, Inc. generates rental revenues and receives funding from wealthy sponsors who support entrepreneurialism. Although they collaborate with UKCED, BBDP and CommerceLex, they are not government or university-affiliated (Interview J, 2012).

Base 163 is another entrepreneurial organization in the community with connections to UKCED. It is owned by an entrepreneur who is "at least on his third company", who was able to purchase a building in downtown Lexington (Interview J, 2012). Entrepreneurs are located on the third floor and the elevators open directly into a large,

open space. There is a shared conference room for meetings and individual workspaces, but the space, itself, is completely open. In addition to one of the entrepreneur's companies, other inventors lease space. They use it in a similar, shared and collaborative manner as the entrepreneurs at Awesome, Inc. The UKCED connection is that two of its current spinoffs are located in the building, as opposed to ASTeCC or Coldstream Research Campus. One is Therix Medical, the company where KTI serves as founder and investor. In laymen's terms, Therix is the parent company of UKCED's clinical technology spinoffs. The other UK spinoff located in Base 163 is Spinoff Y (featured later in this study). Spinoff Y is essentially an online gaming company, in which the Bluegrass Angels have made a significant investment (Interview I, 2012). Like Awesome, Inc. Base 163 hosts events like art shows in the evenings, as well as *meet ups* for individuals interested in technology such as mobile applications (Awesome, Inc., 2012 b). Awesome, Inc. and Base 163 interact with UKCED and its partners and share some common goals. UKCED is unique, however, in that it is institutionally affiliated. As part of its public, land grant mission, the University of Kentucky is charged with serving the public good. UKCED's role is not strictly to encourage entrepreneurism, but to enhance economic development.

Meeting the Expectations of UKCED

A significant aspect of President Todd's Top 20 Plan was marketed as a means to enhance the state's economy (DeYoung & Baas, 2012). The expectation for UKCED was that by patenting more university-based technologies, UK would be able to spinoff companies and create greater job opportunities. As Kemp indicates, Todd's Top 20 Plan was the impetus for increased focus on technology transfer. The expectation was that

increased IP disclosures, coupled with aggressive state programs would lead to a stronger economy. “It was all jobs. I mean, it was all jobs. It was taking the good things…at UK in terms of teaching and research, but also creating jobs.”

Challenges to the Mission

UKCED has not seen a large increase in jobs available in the state, based on its efforts. In part, that is because there has not been a detailed effort to track or measure workforce changes related to university spinoffs. Additionally, TT personnel cite unrealistic expectations, timing, and funding issues. Technology transfer personnel indicate that UKCED is not modeled after a specific set of institutions (Interview B, Interview C, Interview I; 2012). Instead, the operations and subsequent results are considered in relation to the unique resources available.

Benchmarks

None of the participants suggested that UKCED attempts to replicate the results of other institutions. Instead, they indicated that stakeholders seemed to expect expedited economic development similar to that seen in technopoles such as Silicon Valley or Route 128. TT personnel were acutely aware of comparisons to technopoles; and clear about the length of time and resources necessary to develop a technology cluster.

Recently, Lexington has been compared to Austin, TX, for its growing community of entrepreneurs working with online, big box, and independent game development. The gaming community in Lexington is comparatively small, but continuing to grow (Interview C, 2012). Although Technology transfer officers look for growth in that area, they are in the early stages of developing it. They note that looking to communities, such as Austin, is significant in terms of learning best practices, but what works in one area

may not be applicable to Lexington or the state of Kentucky (Interview C, Interview I; 2012). Citing that areas like Silicon Valley have been engaged in TBED for almost a century, one individual working with UKCED acknowledges, "I don't care to be Silicon Valley, to be quite honest. There are uniquenesses [sic] about this place that we all love, and that's why we want it [economic development] to happen here. We don't need to be Silicon Valley (Interview C, 2012)."

Results of economic development are also difficult to measure. Because of cultural differences between academic and corporate environments, USOs are often leery of disclosing proprietary details. UKCED makes some effort to measure its impacts, but the results are not detailed. The results include funding and employment data. Employment data are collected through an annual survey. Spinoffs are asked to indicate the number of current employees, in addition to new hires. Because the data are self-reported and aggregated, analysis is difficult. From 2006-2010, UKCED's indicates that new hires increased spinoff employment by 161% (UKCED internal tracking document). New hires from 2010-2011 indicate a 16% increase. The average employee salary for 2011 was $65,561.00 annually. Superficially, this seems strong. Yet, these include full and part-time positions and UKCED does not triangulate the results. The results also include *UK affiliated* companies. Affiliated companies "is not well-defined either" (Interview J, 2012). That is, an affiliated company is not necessarily a USO. It may be a company, not based on a university technology, which has some other connection with UKCED. For example, the ICC, in partnership with the BBDP, has a "bigger charge than UK. Their charge is to help anyone out there" (Interview B, 2012). However, community companies who have worked with the ICC are included among UK affiliated companies.

Concerning financial data, projects that are funded from outside UK (for instance, by a large pharmaceutical company) for a UK project are included in the results. For example, for fiscal year 2011, UKCED and Commerce Lexington distributed a report, authored by the Lexington Venture Club that indicates "over $69 million in funding" from a variety of aggregated sources for startups. What is unclear is where the funding was directed. It may have gone to a large number of affiliated companies, or largely to a handful. The term startup can also be misleading. University spinoffs are derived from UK research. Startups can include USOs, as well as community companies. The report provides the brief descriptions of 79 active startups, including contact information for the startups' principals (Lexington Venture Club, 2012). In a number of cases, however, the principal is the only employee (Interview J, 2012).

Intellectual property transfer processes are separate from economic development, however, in that the University of Kentucky utilizes a set of benchmark institutions. UK's technology transfer personnel look to other institutions, largely for process influences, but caution against outcome-related comparisons. Using institutions as models is dependent on the task. For instance, UK looks to the Massachusetts Institute of Technology and the National Institutes of Health (NIH) for templates. Many of the agreements in use today were developed years ago by some of technology transfer's most influential institutions. MIT provided the template that UK uses for licensing agreements. The NIH has developed some of the Material Transfer Agreement templates that UK uses. Overall, MIT and the Wisconsin Alumni Research Fund (WARF) are considered "long time leaders" in the transfer process (Interview B, 2012). Richardson suggests,

"Probably for people with no resources, we've done better than anyone." He contends that,

> There are institutions that are not traditionally considered models, but have done well because they had resources…The general guideline is that one out of a hundred inventions will ever make money. And out of the hundred that makes money, only one out of that hundred will make enough to cover patent expenses, and then one out of that, will make significant money. So downstream, the chances are extremely small. Most university tech transfer offices that make money-make money on one big hit and the size of the hit is what determines [the return]. But we had some medium, nothing huge, but we have enough to make a couple million a year on average over time.

He continues that for many years, the University of Notre Dame had few resources, but they have been able to pull ahead of the pack recently. In comparison, however, "The ones that have just amazing-like WARF…that was from Vitamin D and Warfarin." Intermittently, institutions, such as Florida State University will "have a hit… [like] Taxol." The chemotherapy drug brought in "$20 million a year…with one person in the office." Yet, when a "hit" results in a single license, increasing the number of personnel is risky. Human resources tend to remain constant (Interview B, 2012). Outcome related comparisons are less reliable than sharing processes across institutions.

"We wanna benchmark against those [institutions] that everybody else in the university is benchmarking, even though we don't fit" (Interview B, 2012). Among UK's benchmarks, the university has the least amount of federal funding. Although UK ranks low on a number of comparative measures, its technology transfer results places the institution "mid pack" (Interview B, 2012). Technology transfer personnel argue that with fewer resources than benchmarks, mid-level performance should be considered strong, but there is constant pressure to be in the top. Although UK has a strong faculty, it is limited by its size and funding, compared to a benchmark like The Ohio State

University, for example. UK's budget cuts in recent years have led several faculty inventors to transfer to other institutions. When one strong faculty inventor leaves, it can have a large impact. The recent loss of one pharmacy professor has reduced annual IP disclosures by ten. By Dave Richardson's estimate, approximately 20% of university faculty disclose 50% of UK's intellectual property. Richardson also contends that tracking data, such as AUTM measures, does not reveal much about the effectiveness of the technology transfer operation, although AUTM data are frequently cited on institutional technology transfer websites.

"I've never met anybody that marketed at any university that's ever done a [technology] license based on someone finding it on the internet. It's [institutional TT websites] internal PR. You don't get licenses from that." License counts are also not a robust indication of effectiveness or possible economic development. Richardson suggests than an "infinite number of licenses" could be "worthless." He notes that some institutions have developed reputations for compiling license counts. "Like Utah, they have a ton of licenses to look at, but the guy that ran the office was setting up companies and licensing to companies that weren't even real." Moreover, "We have 47 companies this year. How many of these companies have employees? (indicating very few)." He argues that there are several ways to "game this system if that's what you want to do… For a while, we were number one in startups. [It] didn't mean a whole lot."

Public Accountability

Unlike public institutions, TT dominant universities, such as Stanford, are not held to the same standards for economic development. Their efforts have led to economic growth, but "that's not their emphasis" (Interview B, 2012). The public, however, is

aware of the promise of technology clusters and "is not patient about this" (Interview C, 2012). Institutional research strengths, commercialization models, and job classifications can all influence the perception of spinoffs' economic influence on the community.

In terms of commercial research disclosures and products, UK's highly ranked College of Pharmacy is likely the strongest contributor (Interview B, Interview E, Interview F Interview I; 2012). The pharmaceutical market, however, poses a problem for USO development. "It is probably the least sure area" (Interview B, 2012). In order to confront the issue, UKCED has devised a licensing and acquisition strategy for pharmaceutical technology. While that model is more cost effective, it interferes with the economic development objective.

Several investors from the area earned their wealth in the food, equine, or coal industries. There is often a disconnect, in terms of how to develop a drug company, because there is not a concentration of pharmaceutical industry veterans in Kentucky. Developing a spinoff related to animal drugs, through the College of Agriculture, or even pharmaceutical related manufacturing, are often easier to accommodate (Interview B, Interview I; 2012). As far as disclosures, UK's medical school and pharmacy school projects occasionally overlap, in that pharmacists can assist with issues of drug delivery. The issue of commercializing pharmaceuticals is much more complicated (Interview B, 2012).

Pharmaceuticals often demonstrate great potential in animal research that does not translate to humans (Interview B, Interview F; 2012). Moreover, pharmaceuticals that test well are difficult to launch anywhere in the nation, not strictly Kentucky (Interview I, 2012). Because of stringent federal guidelines for clinical trials, the investment horizon

for pharmaceutical technologies is lengthy and riddled with opportunities for a project to "die" (Interview B, Interview E, Interview F; 2012). Drug development can take "probably close to a million dollars, seven-plus years, and you still may not have anything at the end…typically there' s nothing left" (Interview F, 2012). Rather than strictly seeking capital locally, pharmaceutical spinoffs can often license their work to a subsidiary of a large drug manufacturer. Even that route can lead to termination of research and development, though. In the past, UK projects that were going well were terminated when the subsidiary or parent company was acquired by or merged with another company. When new management comes in, projects are placed under review. For a variety of reasons, pharmaceutical manufacturers can choose to terminate a strong project. One way that UK has attempted to recover from these losses is to implement milestone fees. As a product passes specific milestones in clinical trials, licensees remit large fees to the university, to accommodate for the lengthy development phase (Interview B, 2012). In addition, the university employs an acquisition model.

Economic development is less likely to occur with an acquisition model in place, but UK has found it difficult to amass the large amounts of money required for multiple patents and to finance lengthy development phases that are high risk. While there is no *average* patent cost, the minimum is approximately $10,000 and can range up to $30,000 per patent. The examiner who prosecutes the patent controls the timeframe and cost. "It's an adversarial process…The examiner is not there to work with you" (Interview B, 2012). The appeals process is also lengthy, costly and not a guarantee. The institution must pay $5,000 to file a brief. The chances of winning an appeal are about 50%. If that occurs, the judgment is based on procedural issues, not the novelty of the invention.

Appeals are returned to the initial examiner and "that makes them mad, and so they find another citation [to use to reject the patent application]" (Interview B, 2012). Licensing technologies is often the "easiest way" (Interview C, 2012) to approach technology transfer. Selling a USO to a larger corporation provides an alternative that can recover investment costs. It may generate less significant revenue than a homerun technology, but it is well understood that large pharmaceutical corporations would not thrive in Kentucky (Interview B, 2012).

Technology transfer officers are highly aware of the economic development objectives of their operations. They argue, however, that it is not as simple as conducting more research and creating jobs, particularly at a publicly supported institution.

> Well, and there's this theory of clusters and successes. Great success-Silicon Valley. You can walk out of your door and talk to 20 other people that know what you're doing and have done it before. San Francisco-the same. Boston-the same. There's just certain areas of the country where you have more expertise. That have done it-these clusters, Research Triangle. Unfortunately, we looked at Research Triangle and go, 'Oh, that's a great model. Let's do that.' 20 years late and a billion [dollars] short. So, you're always trying to do what everybody else tried to do on the cheap. (Interview B, 2012)

An alternative perspective to the economic development objective is that "any time you've got public dollars going in [to a program], it's going to impact the public…You've gotta tell me hopefully people understand how important this is(Interview C, 2012)." *Terry Atkinson* (pseudonym, Interview C, 2012) argues that most people understand that significant job growth in the U.S. is a result of small business creation. He argues that it is not something that can happen overnight. It requires building and fostering an entrepreneurial community, which requires a public investment. Moreover, although technology transfer has not facilitated extensive job growth, it has brought about a number of high paying jobs. His contention is that individuals with those

positions develop the local economy through the money they spend frequenting local establishments-a trickledown effect.

Dave Richardson remains skeptical. In relation to the impact on the Lexington economy, he argues that,

> You're not really making that big of a ripple [considering the Lexington population of approximately] 250,000. It's kind of like that 'small business is the backbone' [of the economy], or whatever…You can have a little bit of effect, but we haven't had a Google. We haven't had something that's going to build hundreds of jobs. Only Republicans will believe that….and unfortunately it takes an investment, so you're only making the rich richer.

Atkinson believes that the Lexington economy can be affected, but the approach must be adjusted. Noting that the types of jobs created thus far are "manufacturing, distribution, they're service-related great paying jobs. But they're not producing the product." He argues that the appropriate method for economic development is to utilize institutional intellectual property to create "the next big widget", develop, and manage it locally.

UKCED's Accomplishments to Date

Technology Transfer personnel indicate several challenges to their mission, but also cite a number of accomplishments. They include office technology advancements to streamline processes, establishment of procedures within the organization, and outreach efforts. The challenges of UK's TBED enterprise are largely related to its economic development mission. At this stage in its growth, most of the accomplishments are related to establishing a foundation for effective processes and building community support.

Two major accomplishments were cited in relation to efficiency. First, the technology transfer office created a relational database that assigns a case number to every intellectual property disclosure. Still early in the process, the office currently has 1,900

cases entered. This allows a user to extract all of the traditional paperwork that accompanies the patenting process: the application, patentability opinion, prosecution history, and licensing information. In a small office, the integration of the database has provided more space, although physical files are still kept for a time, and streamlined processes. In addition, UK's TBED enterprise has instituted an Intellectual Property Committee (IPC) to facilitate IP disclosures. It is a standing committee consisting of diverse faculty with technological expertise. Faculty, staff, or student inventors meet with the IPC to discuss their discoveries and the committee determines whether UK has an interest in pursuing it (for patenting or copyrighting). If not, the IP is released back to the inventor. Disclosures are facilitated through an online submission portal to streamline the process (Interview B, 2012).

UKCED has also made a concerted effort at outreach. The intellectual property division currently conducts campus seminars to reach faculty, staff, and funded graduate students. Personnel also cite collaboration with partner agencies, the establishment of the Bluegrass Angels, and work to recognize and support emerging areas of entrepreneurial interest. This includes attendance at conventions for game developers, as well as significant investments by the Angels in gaming technology ventures. Finally, they point to strengthening community relationships and teams. They agree that it will be a long process, but personnel have seen some changes in the Lexington community, in terms of embracing entrepreneurialism. Atkinson suggests that some of the change within the community results from increased efforts to disseminate progress toward economic development as part of a commitment to public accountability (Interview B, Interview C, Interview I, Interview J; 2012).

The Impact of Administrative Change

Of the participants in this study, technology transfer personnel were the most impacted by administrative changes at UK. They indicate that job duties and processes have remained relatively stable, but that the changes have influenced the structure of their organization in terms of financing and security, as well as the morale. For the time being, technology transfer personnel carry on with their responsibilities in a standard fashion. However, the university administration has stated that UKCED will not exist in the same format as it did under Len Heller, who retired in 2012. President Capilouto has directed some committees to determine the most effective organizational structure for the University of Kentucky. The committees are currently examining the best organizational fit for the various divisions of UKCED (Interview A, Interview I; 2012).

Over time, the divisions of UKCED may be shifted into centers, institutes, or individual colleges. "Dr. Tracy [UK's Vice President for Research] has a lot more on his plate [than Heller]" (Interview J; 2012). The assumption is that, with so many departments, Tracy will remain VP of Research, but the individual pieces of UKCED will be spread out and report to a variety of upper of level administrators. Kemp argues that the work of UKCED will remain the same. Only the organizational model will change. As he notes, the Von Allmen Center was initially housed in the Gatton College. President Todd made the decision to create a separate office under a Vice President for Commercialization and Economic Development. He suggests it is simply a shift in priorities, stating that President Capilouto is "very supportive of this, but it's not his passion. It is different than Dr. Todd's. Dr. Capilouto's passion is undergraduate education [and] infrastructure". Kemp and Richardson agree that job duties evolve over

time, but the disclosure, patenting and licensing processes generally remain the same. When the Von Allmen Center was located in the College of Business and Economics, MBA students assisted with business plans for USOs. Kemp notes that he enjoyed working with students and looks forward to the possibility of returning under the Gatton College and working with them again. "It can work either way, but it does matter a little bit where the university wants to put its priorities."

The change has influenced UKCED's budget and personnel over the past year. While the UKCED employees did not speak to it, one of the Angel investors indicates, "It's been very much downsized here" (Interview A, 2012). Kemp advises that UKCED has made some "voluntary budget cuts" in anticipation of organizational change "because there's some uncertainty…but it happens everywhere." In addition to budget cuts, UKCED has also secured grant funding to assist with its operations. UKCED has historically utilized grant funding. The two grants are not a new addition to the UKCED budget, but do provide some sense of security.

The Von Allmen Center has secured two grants. One from the state's Cabinet for Economic Development, was initially earned in 2002. Kemp's salary is paid out of that funding. The grant has a matching requirement of one-for-one that comes out of a separate piece of the university's budget. Although the amounts have changed over the years, the funding has ranged from $150,000-$175,000, annually, which is matched by UK. The current amount is $175,000. The Von Allmen Center has also earned a federal grant, in its seventh year, from the Economic Development Administration (EDA) for the University Center Program, which provides funding to university innovation centers. Each state is awarded one grant and they are generally furnished to public land grant

institutions. The EDA grant has traditionally been awarded in 3-year blocks, but funding is prorated (ranging from $130,000-$145,000) annually. The EDA grant must also be matched by the university. The Von Allmen Center has re-competed for the grant twice; and was recently re-approved, now for a five-year block of time. (The EDA grant structure has been adjusted). Grant applications require match commitment letters from upper level administrators. Previously, Dr. Todd or the Vice President for Budget and Planning submitted the letters, because it strengthened the application. However, the last match letter was submitted by the Vice President for Research. The applications also require letters of support from the community; Commerce Lexington, the Bluegrass Angels, and the state government, because the grant is intended to enhance job creation. State applications are much easier to submit. "As long as they're happy with what you're doing, you get it…you don't really have to apply" (Interview J, 2012).

Aside from budgetary and reorganizational concerns, TT personnel admit that there is currently a difference in their perceptions of administrative priorities. The effect of different administrative priorities and organizational changes, however, is not the same for each individual. Terry Atkinson agreed to speak to the changes but requested that his comments not be recorded. Roger Kemp addresses the changes pragmatically, citing that change is continuous. Dave Richardson seems unconcerned about recent reorganizations. "Lee Todd was, at least he said, he was extraordinarily interested in economic development. That was his thing." As for Dr. Capilouto, "I think that he's a little overwhelmed with building dorm rooms and enlarging freshmen classes. I haven't seen that he's turned his attention to this so far." Concerning Dr. Heller's retirement and any influence Dr. Tracy's considerable responsibilities have on UKCED's direction,

Richardson says, "Oh, I think he's [Heller] an idiot and he had his hands on everything. I don't know if that [Tracy's responsibilities] affects anything." Richardson argues that the researchers are the most important contributors to technology transfer and upper level administrators are secondary. Richardson notes,

> I think if someone in that position could obtain resources, that would've been a great thing. But it didn't really happen. The people that were hired weren't hired to do really tech transfer. They were hired to do publicity…and it was more PR for upper people as opposed to the program itself, my people. You know [Dr. Todd's declared passion], just buzz words for investors who knew nothing.

In addition to technology transfer personnel and their operations, the Bluegrass Angels play a large role in UK's TBED enterprise. Angel investors were also asked to reflect upon their organization, challenges to and accomplishments toward their goals, and any influence administrative changes have had on their organization. *See author's note.*[1]

The Bluegrass Angels

As part of Kemp's initial efforts to enhance technology transfer operations at the University of Kentucky, he collaborated with President Lee Todd, former Gatton College Dean Dick Furst, and an investor, to establish the Bluegrass Angels, Incorporated (BGA) in 2004. Currently, the Angels is a group of approximately 40 accredited investors who provide seed capital to university and community entrepreneurs.

Angel membership.

The Angel investors who participated in this study are all heavily involved in the organization. They are highly educated and wealthy individuals. Their educational backgrounds include electrical and software engineering degrees, two Masters of

[1] *References to "venture capital" have been left in parts of this section in order to remain true to the original responses. Atkinson (Interview C) provides an explanation. "People will always call everything venture capital [but they are] two different kettles of fish." Angel investments are considered seed capital. Seed capital is the round after friends and family.*

Business Administration, and one ABD (All But Dissertation) towards a Ph.D. in Political Science prior to entering the business world. They all attended Ivy League or highly ranked public institutions. Two of the Angels have served as President or CEO of their companies. The other's experience is as an entrepreneur with startup companies in Atlanta and California, and now oversees his family's large investment portfolio.

Kemp refers to the networking process that takes place to build an investor group. The Angel investors who participated in this study were either invited by an acquaintance or sought out membership in the BGA. None is an original member. For narrative purposes, they are referred to by the following pseudonyms: *Randall Booker* (Interview A, 2012), *Gary Chiles* (Interview E, 2012), and *Rob Ellison* (Interview F, 2012). For Rob Ellison, his interest stemmed from his experience as an entrepreneur, as well as his difficulty finding solid investment opportunities on his own.

> It's [BGA] something I found. My dad and I, we get business plans and people coming in to pitch ideas on a fairly regular basis, so we would evaluate those…and decided that usually, when somebody's making an outbound call to us, they've exhausted the other areas. Because…we don't have a little sign hanging out front saying 'we invest in young companies'. So typically, by the time they were calling us, they'd already kind of gone through their traditional, local sources of capital, or whatever, and were unable to get funded.

Ellison opted proactively to join BGA for access to a larger number of presentations, before they had been turned down by a number of groups.

Gary Chiles was invited to join BGA because he is an acquaintance of Randall Booker, and saw the opportunity as a way to diversify his interests. The meetings provide an opportunity to participate in something he would not normally do. As for Booker, his affiliation was "really sort of happenstance." He ran into Dick Furst (former Dean of the Gatton College of Business and Economics) at a meeting. Furst suggested that he meet

Roger Kemp. Kemp got Booker involved about six months after establishing the BGA, which was then referred to as an entrepreneur's club, sponsored by Gatton College. He recalls it was a small group, "not really much of anybody" and he became involved with its advisory board.

> I was looking for something to do. The whole idea of tech transfer, commercialization. Our kids had gone to Stanford. I went to Harvard Business School. I'd seen in Boston and in Silicon Valley, I'd seen how this could work, you know… And there was a meeting at Harvard Business School, where they just were trying to link Harvard alumni in the Boston area with the office of Tech Transfer at Harvard, and they filled it. They filled the classroom with 100-and-something people…and had a bunch of students present. And it was the first time that I'd really had a chance … to sort of listen to the students talk, and to realize that in many cases, the students of today who were doing this research, are much more interested in trying to start a business…[than they] might have been back when I was in college.

Booker believes that as the economy has changed, students have become more concerned about how they will pay off debt and whether they will be able to find employment. He was beginning to feel that there was a considerable amount of interest in technology transfer for economic development, and had just completed reading Derek Bok's, Universities in the Marketplace. Booker thought Bok told an interesting story and, although he disagreed with some of Bok's assertions, felt passionate about becoming involved in helping early stage companies. Around the same time, Furst was serving as an advisor to President Todd, and asked Booker to help establish the BGA's "two very small venture funds to help these companies, one of which is fully vested and the other is about two-thirds vested."

Angel Recruitment.

Angel recruitment is not a formal process. Members frequently bring one or two guests who observe the process and determine whether they would like to join.

Additional recruitment occurs through networking with friends and colleagues who are "sort of like-minded or might be interested" (Interview E, 2012). Some aspects of membership are inherently prohibitive. The membership fee is $1,000, which covers the cost of beer or wine and appetizers after the meetings (Interview F, 2012). The group's standing meeting time is 4:00 pm and "some professionals that would have the wherewithal to do this investing are just unable to come to a meeting that starts at 4:00 in the afternoon" (Interview E, 2012). As addressed in the *definitions* section of the study, BGA members must also be accredited investors.

Demographics.

The Angel investor group is generally retired or semi-retired professionals (Interview F, 2012). "The age cohort tends to be a little on the older side, but there's a smattering of younger people as well" (Interview E, 2012). Recruiting diverse membership can be difficult. Booker notes,

> We can't [recruit] by putting an ad in the paper…we can't accept a lot of people… And I mean in today's world, unfortunately, you know, with the class divisions. I don't want to make a political statement, but it's an unfortunate by-product. A lot of people are kind of– they're just not really wanting to make a big deal of the fact that they're in that room. I mean they don't want – they're not interested in a lot of publicity. We'll talk about the group as a group, but we don't like to talk about the individuals as individuals. I mean that's – we're really sensitive about that.

He also concedes,

> We could do better, you know, the Angels. If you look at our membership list, it's primarily a bunch of old white guys, and we don't have that many younger people. And by younger, I mean like 30s and 40s. I don't really mean 20s because those – They don't have any money, but 30s or 40s, you know, people that have made some money who are younger. We don't have a lot of women, a lot of people of color. Of course, the community doesn't have a lot of people with color, so I don't feel all that badly about it, but we don't. And I mean that's just reality. It's an issue that we have to deal with.

Angel Funds.

BGA has established two venture funds. The exact amount in the funds is unclear. Booker indicates that one is $2 million and the other is $4 million. Atkinson suggests that the funds contain $2 million and $3.1 million. Venture Fund I has $2 million. Venture Fund II, also known as the sidecar fund, has approximately $4 million. The theory behind the sidecar fund is to serve as something like a mutual fund. If an individual investor did not have the inclination to vet each opportunity, s/he could invest in the sidecar fund. Volunteer fund managers utilize a committee structure for tasks such as review and due diligence. Therefore, without making an individual investment, Angels can still invest in companies (Interview E, 2012).

In practice, however, the sidecar fund has been over-utilized. Many of the Angels are currently choosing not to make individual investments "and they're just allowing their investment in the [sidecar] fund to be a proxy for investing, themselves" (Interview A, 2012).

The Angels are finding that the fund may make an initial investment up to $150,000, with the understanding that there will likely be additional funding rounds requiring a doubling of the investment. With only $4 million in the sidecar fund, members are not willing to invest more than ten percent in one company. That allows approximately ten investments per year. What they are learning, "and we're always learning" (Interview A, 2012), is that it is less risky to invest lower amounts up front because misreading a company's potential and losing everything is difficult. However, "it's also very demoralizing for companies if they just raise a small amount of money because they have to think about three months later, six months later going back" (Interview A). This can be

frustrating because no matter how strong an idea is, fundraising takes an exorbitant amount of time. Entrepreneurs would prefer to spend that time "developing their idea, fixing the technology, finding customers, [and] building revenue" (Interview A, 2012).

The Angels' approach to investments.

The presentation of an idea or technology plays an important role in the decision making process. The Angels see as many as three presentations per month and do not meet two months of the year. They may see up to 30 presentations annually. Presenters are generally provided 15 minutes to make their pitches. Afterwards, there is a brief question and answer section. Angels occasionally interrupt the presentation prior to the Q&A to clarify a point or indicate skepticism about the market projections or business plan. Entrepreneurs remain at the meeting for the informal wine and cheese session and members can mingle with the presenters (Interview A, Interview E, Interview F; 2012).

The majority of presentations, about 60%, are referrals from UKCED (Interview A, 2012). The decision making process is based upon the quality of presentations. Investors are interested in more than the technology. They consider how presenters "tell their stories". If the information is not "packaged" properly for the meeting or the valuation is too high, the Angels become disinterested (Interview F, 2012). Fundamental questions are, 'Is a problem being solved and is the solution unique?', 'Does the team work together well and represent expertise in the field?', 'Are they realistic about going to the marketplace in a reasonable timeframe?' (Interview F, 2012). Other times, the presenter has a strong idea, but the space is too "crowded" with multiple companies doing similar things (Interview E, Interview F; 2012). Moreover, if the Angels have previously invested in technologies in that field "that's putting a lot of eggs in the [for example]

medical device basket." Even if the idea is novel, if the portfolio already has a number of that type of technology, the response is "Thank you very much. And pass" (Interview F, 2012).

The Angels also admit that they are not professional venture capitalists. They turn down more opportunities than they invest in, but are often being too eager to invest in some of the ideas. "We've set a limit, you know, my wife, I call her the auditor on this thing. She and I went through this and said…we've got about as much tied up in this activity as we could" (Interview A, 2012). It is often difficult to reject an investment when it seems strong on paper, and particularly early in their membership, the Angels contend that they were naïve about the investment horizons (Interview A, Interview E; 2012). Another variable that can lead to poor investing is the "cheerleader" investor (Interview A, 2012). If one member is particularly interested in a technology or has a specific expertise, the Angels may bypass some of their processes and agree to invest without fully considering the risk (Interview A, Interview E, Interview F; 2012).

Some of its early missteps have led BGA to reconsider its strategies. The Angels held a planning meeting on November 5, 2012, to discuss their ideas. Some of the focus areas included the original vision for the group. Some members expressed the need for a clearer definition of the group's mission. Initially, BGA was established as a seed capital group, but it has recently assisted later stage startups with greater financial needs. This has consumed more capital than expected. In addition, several members noted that the Angels should become more involved in the due diligence process, as well as serve in advisory positions in the startups. Members also indicated that they expected to profit from investments and to see more exits (BGA Minutes, 2012).

Thus far, the Angels have had two exits (where companies returned initial investments and profit to the investors) since 2004. A couple of companies have gone out of business, and a few more are inactive (Interview A, Interview E; 2012). Moreover, the exits were not from UK technology spinoffs. The exits came from Bluegrass Venture Fund I. The first company, VRBO, is an online service that provides information about vacation homes for rent by the owners. A small company; it was acquired by a larger corporation within 18 months of its launch. The second company, Global Shelter, manufactures small, blast proof shelters. When a British company acquired Global Shelter, "They didn't make a lot of money but because they [BGA] got out early, the way you calculate the return works out pretty good" (Interview A, 2012). The second fund, established in 2009, has not had any exits (Interview A, Interview E; 2012). Angel investors suggest that the economic recession of 2008 has inhibited both their ability to invest and the progression of spinoffs (Interview A, Interview E, Interview F; 2012). Aside from the recent economic climate, the investors suggest that there are a few challenges to their operation.

Challenges to investment goals.

The Angels recognize economic difficulties as a significant challenge to their goals. Moreover, the lack of a clear mission and procedures provides additional challenges. The Angels suggest that without definitive structures in place, they have found themselves with an abundance of opportunities that have not been addressed with appropriate expertise. This has contributed to an aversion to risks, a lack of attention and assistance to startups, and struggles with entrepreneurs. These issues can contribute to a lack of exits, as well.

For Booker, it is still too early to tell how some spinoffs will fare. He argues that startups, in general, are struggling "because of the economic conditions, because of the lack of capital in the region, and in their space, and in the country." Conceding that there have been some failures, he notes that there were not many "big failures" because the Angels did not invest much in them from the start. "So maybe I would sit here now and say, 'Well, they were never any good.'" His point is that he regularly tracks the progression (or digression) of investment companies. He has come to believe that "our upper middle and middle upper groups are the sweet spot." Although, he would like to see greater political support for small businesses development, "It's really hard for bureaucrats and public servants to work very hard to support the private sector, because there are so many naysayers on the other side." He argues that an important consideration during difficult economic times is whether the creation of an entrepreneurial environment within the community, itself, improves the economic climate. Nonetheless, Chiles suggests that economic uncertainty has led individuals who would normally be inclined to invest in startups "decide to keep their money in their pockets." Chiles tempers that statement by indicating,

> I don't want to overplay that because I think-at least at the Angel investing level-I mean-we were able to raise this $4 million fund in that environment…I don't think most investors are waiting to invest as we decide who's going to win the next presidential election. That's not been my experience, ever.

He does think that during the "crisis of '07 and '08" individuals who would have otherwise invested probably "sat on their hands for a while just waiting to see how things are going." In an economic recession, Chiles feels that investors have become less patient for payoffs. He notes that an investment that previously had a horizon of four to seven

years before payoff has been stretched indefinitely, so certain types of investments are likely not seeing the money that they used to see.

The lack of clear goals and procedures has also been a challenge for BGA. "I think we have a problem with communication, and with expectations. I absolutely do" (Interview A, 2012). This lack of structure was the impetus for the Angels' November planning meeting. It was an opportunity,

> To evaluate what we do, both from the fund standpoint and also, just the general membership and how-what the process is. How we recruit new members, how we market ourselves…The questions are being asked internally… [We've got to] get the members together and say, 'Ok, how do we do this better?' (Interview F, 2012)

Strategies are being revised to consider how to ensure that the Angels see the companies that they want to see and make decisions quickly. They are considering, from an operational perspective, how members could contribute experience, as well as money, to spinoffs. "It's historically been footloose. You just show up to meetings. If you like an idea…you raise your hand and get on an e-mail [list]. You either invest or you don't…We're trying to look at the process." (Interview F, 2012). BGA is examining establishing a group of volunteers with CEO or CFO experience who can assist young companies with setting up their business plans. They recently found a COO for a startup to assist with areas like payroll and insurance, as well as a project management strategy. It has made the entrepreneur's schedule much more manageable and eased some business related concerns of investors (Interview A, Interview E, Interview F; 2012). Entrepreneurs intuitively know many things, but business operations are not usually one of them. The Angels believe that facilitating operations could enhance intellectual

property that is strong and could be executed, "but…calls for some adult supervision sometimes" (Interview F).

For the investors, weeding through the business ideas can be a daunting task, as well. They see a wide variety of opportunities, that any single member is not qualified to pass judgment. There may be one individual knowledgeable enough, but BGA does not track expertise. A proposal is to compile a spreadsheet of different member talents, so an entrepreneur must complete a pre-screening with an expert before presenting. This could also assist members, in that they occasionally see presentations that are not of any investment interest. A diversified portfolio remains an important goal, however, so matching investors to specific fields is an imperative of the group. It would also provide opportunities, similar to the recent COO assignment to a startup, for members to coach entrepreneurs with strong ideas before their presentations (Interview F).

In conjunction with the economic climate of the past few years, some structural issues have led investors to make decisions they lament. This has contributed to some risk aversion among members of the group. Ellison argues, "They've got their ten minutes to wow us." Ten minutes does not provide much time to consider the investment. He suggests that investors might be more comfortable if there were "pre-meetings" or some process in place to allow the Angels more time to understand the technology and business plan. Members have also become apprehensive toward investing because of a "herd mentality" among the group. "This has happened to me. I specifically think about it in Fund I because I have specific memories about it (Interview A, 2012)." When one member is relentless in support of an investment, decisions become less disciplined. Generally, the group informally ensures that companies meet minimum criteria, but a

strong member with either positive or negative opinions, "can really steamroll the thing through." Because of difficulties when this occurred with early investments, though, "We're a little bit better at that now, but it can be a problem (Interview A, 2012)." Another challenge is attendance and involvement. Ellison hopes that at least 60% of the group will attend meetings, and at least 10%-15% of them will personally invest in companies. However, "the economy has stung people…people are a little more careful about it. But its venture investing…It's risky investments by definition." As Booker indicates, the theory behind the funds was that the sidecar fund would augment individual investments. Risk aversion has led to the opposite process. Ellison agrees, "I don't see too often where individual members. I can say this maybe. Never have I seen where individual members invest where the fund hasn't already led. I'd like to see that change a little bit."

The group also feels that investors could do a better job of advising and monitoring startups. Ellison argues that, currently, only four or five members personally invest in startups. He believes that if people with expertise would involve themselves with the companies, it would lead to more private investments. "Once somebody's involved sort of operationally or strategically, then they usually, if they like it, will get involved financially." He feels that a hands-on approach could potentially lead to more exits. Ellison travelled to an investment group meeting in Louisville and saw a different approach.

> I went to Louisville. A guy was pitching up there. They have this little venture club. I forget what it's called. They don't have a sidecar fund, but they are much more involved, it seemed, in getting groups of them together to write-each of them-a $25,000 check-collectively $150,000. Whereas I look at Bluegrass Angels and usually the way the dominos fall is the fund says yes. We set the terms. Then wait and see who comes on board as individuals.

The group does have some individuals who become involved with companies, but the majority, have day jobs and do not have the time. Working with a startup is essentially volunteering to see the company grow. Volunteers are generally retired or semi-retired investors who participated in due diligence and developed an emotional investment in addition to the financial one (Interview E, 2012). Ellison considers, perhaps, assistance or monitoring should be part of the due diligence process. The Angels could provide terms that indicate, "We will only invest if you do X, Y, and Z." He believes oversight is important, particularly, because the Angels have had some antagonistic relationships with CEOs in the past. In some cases, entrepreneurs "look at investors as providing capital… [and] chaff at investors trying to get involved" (Interview A, 2012). Atkinson agrees,

> There are faculty that think they have to be everything. And I hate to be the one telling you this, but I'll say it. There are faculty, sadly enough, they are very, very intelligent and great in their discipline. They're great teachers, but to tell them that they might not be the right one? They don't have the knowledge or expertise. They bristle at that. And why I don't know. You can't be an expert in everything. 'Oh, I know what I'm talking about.' What do you mean? 'I'm a faculty, I publish' 'Yes, you do. Have you run a business? Have you gone and done the dog and pony show to raise money?' That's not a lot of fun... Most faculty can't do that-don't want to do that.

Ellison had a negative experience with a faculty CEO in the past, and he regrets not speaking up early. When he first joined BGA, he invested $25,000 in the company in a $2 million round. "It was royally mismanaged." He contends that the Angels should have monitored the company more closely from the beginning. The first investment communication the Angels received was asking for more funding, immediately. He indicates, "It was not that they just screwed around. A lot of mistakes were made within that company. But the biggest mistake was not keeping investors abreast of what was going on." He believes that the CEO knew, or should have known, months earlier that the

company was about to run out of funds. The most disconcerting part was that the CEO, who was a business professor at a university in another state, did not follow standard business procedures.

> I'm still dubious as to whether his claims-his business claims-were valid or not…because structurally the company wasn't set up correctly… [There were] some things I always questioned. I just didn't sort of stand up and say 'Why didn't you set this up?'…But he came from a business school, [a] professor from the University of XXX. I figured he kinda knew… and especially small business development. I thought maybe he knew something I didn't know at the beginning...So there were warning signs that I probably should have – and I'm not sure the due diligence was done. On that particular company, there was a bit of nepotism involved. There were some familial relations with employees and things. I think it still has complications. The problem is that they've, at least locally, they've kind of screwed up the – no investor wants to touch it now after what's happened in the past.

Booker, Chiles and Ellison all agree that as a group they should better assist their startups. They are also looking into assisting staff at the Von Allmen Center and the ICC. UKCED staff work with entrepreneurs before they present to the Angels. Because they are not investors, entrepreneurs sometimes do not accept their feedback. When the person offering advice is prepared to write a check, entrepreneurs seem more attentive. The hope is that additional assistance will enhance startup performance and potentially lead to more exits.

Angel accomplishments.

Unlike the technology transfer personnel, BGA members considered their achievements from a personal level, as well as from the perspective of economic development. Their positions may differ because they are not professional colleagues. Although Angel investing can provide revenue, and some of the volunteers spend as much time working on projects as they would at a full-time job, it is still at-will membership. They do not need the group in order to make a living. In addition, the

Angels admit that their organization lacks a clear mission or objective (other than to earn money from investments). Dave Richardson believes, "In order to play that game, you've got to have the money. And I think a lot of them play because it's a hobby. They need something to do." Whatever the case, their responses include thoughts about economic development, but lack concrete methods to achieve it.

From a personal perspective, the Angels offer accomplishments or achievements that reflect individual satisfaction. Ellison considers his personal involvement with spinoffs an achievement. He enjoyed developing the pitch and "getting kind of the deal going. That, to me, was fun. I enjoy doing that. I think there was a good idea. That's the reason I was involved." He is proud of his efforts to set up one USO's business plan because it resulted in solid funding.

> Every door that they knocked on, basically, made an investment… The idea that he [the entrepreneur] had is partly the way we structured the presentation of the deal. So that was satisfying. I'd like to do more of those types of things. I like to get involved with the companies rather than just writing the checks and saying, 'Good luck.'

Ellison indicates that being hands-on with entrepreneurs is a passion because he has been an entrepreneur. He feels he learned from his mistakes and enjoys sharing his experiences with entrepreneurs, so that they do not make some of the "common mistakes…when people take financing."

Although Chiles does not specifically refer to achievements on a personal level, he does discuss his involvement in BGA in terms of its appeal. "I just am fascinated by scary smart people who come out of their labs or out of their offices at the university…and want to start a company and solve a new problem." He also notes that the presentations are "interesting and intellectually stimulating." Booker, as well, feels,

"It's interesting, and it's so rewarding." In some ways, the members appear to approach their involvement like a pastime, rather than a pursuit.

While the results of their activities may not be immediately evident to the public, the Angels take pride in their efforts to enhance economic development, but openly admit that they would like to make a profit.

> Generally, if the company is successful, then their [individual Angel's] personal investment is successful. If they're becoming successful, then they hire people. It's economically beneficial for the community. But I don't think individual members, by and large, are looking at deals and saying, 'Yeah, we need to do this for the community.' We're probably just in it just for ourselves. The secondary benefit is for the community. Now, from the fund standpoint, I think, again, we're managing money for the investors. So I don't think we can look at it as a community development effort – sort of legally or ethically. I think it just really has to be just, 'Is this the one thing that's gonna make our investors the rate [of return] they expect?' Right? (Interview F, 2012)

The BGA members are satisfied with their ability to raise $4 million for the sidecar fund in a struggling economy. They are also content with their decision making related to economic development. "We make decisions based, not just on the profit motive, but also based on what we think is going to be good for the local community and state" (Interview E, 2012). Booker agrees, noting, "It is about making money at the end of the day", but it is also about the community. "I mean it is Capitalism. And I'm not ashamed to say that. But again, we need some of these things to pay off. And they've demonstrated that they have, you know, in other communities, especially out West and in Boston." He tempers the statement by clarifying that investors' ambitions of economic change should be balanced. He is well aware that the impact of "Google or something" can distort economic data.

Without implementing direct economic change, the Angels believe that they have helped to foster an environment that encourages a new economy, with state-of-the-art

jobs in the Central Kentucky area. Booker contends that, although there have not been an abundance of successfully funded spinoffs, "Absent our interest in trying to encourage and finance these…I think there would be even fewer…I think that the community has come together to demonstrate that it's interested in this activity."

In terms of organizational achievements, economic development is approached as a work-in-progress. Before facilitating change, the environment must be in place.

> So I would say, you know, the biggest achievement we have is working to create the environment. Have we developed businesses that as of today are writing big checks to UK for royalties and stuff like that? No, but if like [one of the medical technology investments] ... hits the way it could, it'll be writing large checks to the University of Kentucky. I mean that's the whole – it's just we need that. You know, it's either gonna happen or it isn't. If it doesn't happen, you know, it's gonna be – I will have spent five or six years of my life working on something that didn't work, but that's not the first or last time. I really believe that it should, it just it takes a long time. As I said earlier, we're operating under a very difficult economic environment, and everything's slower. Have people made a lot of money? No, okay, that's number one. I'll be honest about that. Number two, have we created an environment? We have the funds and we have the venue. We have the meetings every month. We get a certain number of people. We're trying to get more. I think we've done that. That's an achievement. We're helping create this entrepreneurial – we're part of a number of people in town…creating this entrepreneurial [environment]. I think that's the biggest achievement we have. And I think creating the environment-you have to do that first before you expect all that stuff. (Interview A, 2012)

The other Angels agree that enhancing the local economy is an important aspect of their activities. Chiles suggests that there are probably individuals outside of the business community who assume that what they are doing is "all about money or greed". He notes, "Capitalism only works if…people are motivated to make money." However, he describes the Angels' work as having a "double bottom line". Chiles believes he speaks for almost every member, when he says that investors look for opportunities for a return, but they are also interested in companies "that are going to grow and develop here in the region and have a positive impact on the community and on the economic growth of the

state." He is also proud that the Angels have had opportunities to invest in companies outside the region and- other than a couple of "minor exceptions"- they have declined. Chiles admits that tax incentives for investors often discourage them from investing in non-regional companies, but prior to those incentives, the community benefit always factored into investment decisions.

The impact of administrative change.

Unlike UKCED officers' experiences, the administrative changes at the university have not influenced the funding or operations of the Bluegrass Angels. The Angels, however, do suggest an affinity for Dr. Todd and an admiration of his stated objectives for economic development. They mention the departure of Vice President Len Heller, but largely refer to economic development and technology transfer in relation to Lee Todd. The greatest impact of the administrative changes appears to be related to concerns about the future.

Rob Ellison joined the Bluegrass Angels approximately two years ago. He states that he does not know much of the administrative history of UKCED, other than stories from other investors and reading news accounts. Ellison estimates that when Lee Todd was president, "He had a very strong push toward entrepreneurship and got resources flowing to help that process along." He assumes that the level of assistance will likely decline and considers, "I know the resources available are gonna go down. So how do we, as the local group, respond to that? And perhaps, shoulder more of that burden?" As for any noticeable changes, Ellison asserts that he joined the Angels, "either right after or right before he [Heller] retired", so he is unable to speak to any day to day changes. "I could say we're not sitting around talking about, 'What would Len do?' You know what I

mean?" On one hand, he notes it is generally "business as usual". On the other, the investors are waiting to see what happens. He suggests that financial cuts to UKCED will likely happen, but for now, the Angels are simply making their usual investments.

Presently, not much has changed, but the probable effect on the Von Allmen Center and ICC's operations is troublesome. Chiles and Booker each refer to the financial situation of the Von Allmen Center as signaling upcoming upheaval. Their perspectives are interesting, in that UKCED staff confirm some grant funding, but speak to it as financing that UKCED has consistently utilized over the past decade. The TT personnel's categorizations of upcoming changes do not convey the same sense of urgency as the Angels'. In addition to their frustration over probable changes at UKCED, the investors, specifically the two that have been involved for several years, address Dr. Todd as a champion of their cause, and relay concern over the priorities of VP Jim Tracy and President Capilouto. The following excerpts from interviews conducted in 2012 demonstrate the Angels' perspectives on administrative changes.

On the financial outlook for UKCED:

- Well, I think the potential for an impact is pretty strong. (Interview E)
- These tech transfer offices … during the economic crisis, they laid off a bunch of people, like I think a lot of the universities did. (Interview A)
- *Roger* [*Kemp*] was able to obtain a grant for funding that operation for another year at a reduced sort of footprint. So there's fewer people doing the same amount of work than there was before but that's true really probably across the university. So I'm not complaining about that. However, if he's unable to secure a grant next year, then it's going to have a real damper, or put a real damper, on what has traditionally been I think a good partnership between the university and the entrepreneur community here in central Kentucky. Both in terms of the entrepreneurs, but also in terms of the would-be investors in those startup companies. It could put a real damper on things, if there isn't a continued emphasis on this aspect of what has traditionally been a university role. (Interview E)

On Todd as an innovator and proponent of commercialization and economic development:

- Well, it [change] has affected the mood I would say, because, in Dr. Todd, I think the business community, as it relates to starting up new businesses here in central Kentucky, had a huge ally. (Interview E)

- Dr. Todd… he had a lot of ideas about trying to link the University of Kentucky with the community – the business community in terms of linking the research and commercializing the technology. So then he created …an economic development activity, which was, you know, I thought very forward-thinking, especially given the region that we're in and the need we have. (Interview A)

- [He] was a faculty member who attempted, while being a member of the faculty, to start a business…and roadblocks were placed in his way, to the point where he was told, 'You can either develop your business or you can teach here. You're not going to be able to do both.' And he can point to numerous examples today of universities where, not only are there no obstacles for faculty members who want to try to commercialize something that they've come up with in their own research, but there are universities who encourage and almost insist that faculty members do that. (Interview E)

- I think it's a big, intellectually interesting thing for him and also part of his passion. (Interview E)

- I mean Dr. Todd never stopped talking about it, right? I think he really did decide that this was really something that he wanted to do. And I think he…thought there might be some nuggets in there [in the technology transfer office]. And… I think that there was a feeling that the university could do more to help Kentucky prepare for an economy that had been different than one that it had really experienced in the past. So this all kind of came together. (Interview A)

- The point that I think, for example, Dr. Capilouto makes about focusing on undergraduate education-I would much rather be taught by somebody who is pumped up and motivated and engaged in his or her work in all aspects, including possibly commercialization, than I would somebody who is merely a good teacher. (Interview E)

On the need for time to complete President Todd's mission:

- Dr. Todd… [his goal] was to try to create you know, a place where it would be cross-university, and cross-silo, and create a place where these ideas could be explored more collegially. And I think that because of the fact that it was a relatively-it was certainly a new idea …Dr. Todd …who is a great idea guy. And I love the guy, but he tends to take on, as I do myself, more things than he can get done, so sometimes, you know, you lose a little bit of focus, but basically the thing that killed him was time. He didn't have enough time…because I mean I think an initiative like what he was trying to do takes a generation, and he didn't have a generation, he had half a generation, or not even half a generation. (Interview A)

- Until Dr. Todd left I think UK was doing as good a job. Maybe not the best job in the country, but as good a job as most universities And I can't really speak to what's going to happen now or what is happening now. But to the extent that the emphasis goes away from that, I think it's going to have a deleterious effect on the willingness of would-be entrepreneurs on the faculty to send their stuff outside the lab to see what how they might fare in the greater world outside the university. (Interview E)

- And so, as I said earlier, what really frustrates me is they're sort of throwing the baby out with the bath water, and wasting a lot of time, and just throwing a lot of stuff that was probably good ideas, and – just to build dormitories. I mean. I'm sorry, and that's probably not fair. I mean if Dr. Capilouto was here, he'd probably belt me in the mouth. I don't want to do that because again, I don't think I – I don't fully understand the issues that he's facing so that's not fair. But it is very frustrating. (Interview A)

On President Capilouto's focus:

- I know he's dealing with very limited resources, and I know – it's very obvious to me, based on what's happened since Dr. Todd left, and the fact that there hasn't been much of a groundswell …you know, there hasn't been a groundswell from the university saying bring this all back, we want it. No, instead, you know, you see – when you read about what the faculty is thinking you're doing, you know, they're grumbling about a lot of other things, and I think Dr. Capilouto said, 'I cannot do everything, and I need resources, and this was costing me whatever it was costing, and I'm gonna use that money to do something else.' I mean it's just a business decision, but it's unfortunate. It's unfortunate to somebody like me, that kind of cares about it. (Interview A)

- I don't question his – he's got his own priorities, and he's new. He has the benefit of understanding what the Board of Trustees is telling him to do. But it clearly – it's very, very clear that it's been – that there's a huge de-emphasis of this activity here, from when Dr. Todd was here. And it's almost as if everything Dr. Todd did, they're turning on its head, which is really – I'm sorry, I'll use the world childish, but you know, universities are filled with people who don't think very big. (Interview A)

- I don't think he is particularly inclined toward diving into commercialization. I don't think he is opposed to commercialization, but it's just not-he [President Todd] had somebody at the level of Len Heller to sort of worry about that, and he had one person that he could go to-and Len could kind of keep his boss informed. And now with the restructuring going on at the university, he's pretty swamped, I would think. The fact that there isn't a relatively high level individual working on commercialization and economic development at the university is a concern. (Interview E)

- And ...there's a new sheriff in town, and I don't think Dr. Capilouto-if you look at his CV that was published in the *Herald Leader* when he was first coming, you know, that kind of development was like on page four, and it was like it was almost added .And you know, he's out there building dormitories and trying to figure out where to get money to keep the university going. (Interview A)

On Vice President Tracy's responsibilities and priorities:

- Dr. Tracy…I personally wish that I could spend – I only met him once. I'd like to understand more. My person feeling about Dr. Tracy is, from observation, not from knowledge, is that he had a huge job that is bigger than he really wishes that it were. That he has actually academic interests that are more narrow. That he wishes that – it gets back to this whole idea if he's a professor, and he'd much rather do whatever it is that he's really good at. I don't even know what it is. And instead, he's been sort of saddled with all these administrative things, so that you run into a thing – he's trying to – you know, he's taking one for the team, in terms of helping Dr. Capilouto, but it comes at a price. (Interview A)

- Right now, we're sort of operating under the Department of Research, and it's not clear that the fellow that's running this is very enthusiastic about it [commercialization and economic development]. I'm not exact – I think his reasons for not being enthusiastic – I'd like to think, because I think he's a pretty smart guy – I think he has so many things. (Interview A)

The investors in this study have considerable reservations about changes to the stated priorities (or omitted priorities) of upper level administrators. They contend that it will affect future efforts at technology transfer. They also admit, however, that their participation in UK's TBED efforts has not led to many personal financial returns or a tangible influence on the local economy. To gain a better understanding of the type of companies funded by BGA, the next section looks at three UK spinoffs, at various levels of early stage development.

CHAPTER 5: AN EXPLORATION OF THREE UNIVERSITY OF KENTUCKY USOS

The presentation of the following university spinoff (USO) cases is comparable to that utilized by Mowery, et al. in Chapter 8 of their book, entitled, "What Happens in University-Industry Technology Transfer" to explore five university sponsored technologies. As they indicate, "The heterogeneity within… [a] small sample of cases underscores the need for caution in generalizations about the nature of the technology transfer process" (p. 154). Noting the dissimilarities between cases at the historically dominant institutions, Columbia University and the University of California, they argue that policies and procedures that are appropriate in one field may not be as effective in another. Their presentations include a summary of the technology, the roles of various personnel, and commercialization and development of the product as of the publication date. A similar approach to presentational organization is used here, although, the samples are all of early stage university spinoffs. Therefore, any conclusions as to future revenues would be premature. The purpose of this presentation is a rich description of personnel experiences. The information is derived from interviews and company websites. Note that due to concerns from some participants over the release of proprietary information, the following companies will be described, but not named. For presentation purposes, individuals will be cited using pseudonyms. Moreover, only references will be made to information from related websites, so that the companies are not directly identifiable.

University Spinoff X: Engineering Technology Company

Company X (also referred to simply as X) falls into the *Researcher/Codified* category as a product-oriented spinoff utilizing an idea developed by a researcher (Pirnay, et al.,

2003). The technology was discovered by a faculty member in UK's department of Electrical and Computer Engineering and the initial patent was issued in 2008. Although the faculty member remains involved in X as the Chief Technology Officer, an entrepreneur began working with the technology from UK in 2009. A license was executed in 2011. The entrepreneur serves as President and CEO of Company X. The company's name is derived from a commonly used Japanese word, meaning success. Company X is in the early stage of development. It currently has two locations. The lab and corporate headquarters are located in UK's campus incubator space, ASTeCC. A second office, a wholly owned subsidiary of the corporation, is located in Kawasaki, Japan. The Japanese office is charged with managing global commercialization operations. It is led by an individual with previous experience in the areas of semiconductor components, computing products, projectors, and printers at a large technology company (Interview D; Company X website; 2012).

Technology X

In laymen's terms, the technology consists of four patents that comprise a system and complementary method to produce three dimensional (3D) images using structured light. This system and method offers 3D images that can capture human motion in real-time, which is faster and lower cost than traditional 3D technologies.

Commercialization and Development

The approach to commercialization of this technology stems from the interests of the current president/CEO, *Mark Brown* (pseudonym, Interview D, 2012). Brown's background includes previous work at major technology corporations as an *intrepreneur*, a corporate employee who serves an entrepreneurial role within the confines of the

corporation. In those roles, Brown initiated movements from ideas to products for his employers by organizing support and testing of new ideas or innovations. He has also held executive positions in a number of startup companies in Silicon Valley.

Education and Professional Background

Brown's educational background is in physics and engineering. He holds a Master's degree in Electrical Engineering from an academically prestigious public institution on the West Coast (*Mark Brown*: Bloomberg Businessweek.com Executive Profile, 2012). Brown claims to have no "formal" business training, noting that he felt areas like physics and engineering should be studied at an academic institution. While business could be "learn[ed] better through experience." Brown intentionally pursued business training from a former employer:

> If your role is going to be to build product lines, they give you training. I thought, 'Training and product line management and how to build business will be better at [corporation] than at a business school because the company is all about producing profitable products.' Not that business schools aren't a good thing to have…I went through a lot of internal training about how to build product lines, how to give a product introduction. Most of my product development and product launch training and experience come from [company]. Then I spent time at [company] in sales because I wanted to understand how that was done…because I knew I wanted to do that sort of thing. Pretty early on, from the time I was an undergraduate I knew I wanted to get involved in startups.

Before working with that company, Brown "did the startup tour for a couple of years." His strategy toward training was "sort of consciously done." In addition to pursuing engineering, Brown studied Japanese language because "at the time the Japanese were sort of the premier competitors for American businesses." Due to his engineering focus, he felt Japanese language skills would be important. He targeted employment with companies that could allow him to integrate his academic skills with business and apply them appropriately.

Brown's startup involvement immediately prior to Company X began in 2003 and involved raising $60 million, which he describes as typical for Silicon Valley, as the Vice President of Marketing for a company that produced micro-electro-mechanical system (MEMS) products for projection display. It led him to Tokyo, Japan. While serving as Marketing Vice President, he continued to research emerging startup opportunities. Brown notes, "I didn't expect to spend a decade in Tokyo. It was a little bit longer there than I had planned. But doing startups in Tokyo is a lot harder than doing startups in America. The culture is not really well set up for startups." Brown believes that the same level of infrastructure is not present in Asia. The startup company he worked for as Vice President of Marketing was acquired in 2009 by a large, Asia-based corporation. Brown did not disclose the acquisition price, but indicates that in those situations "You have to have a business plan that says, 'Here's how I'm going to generate $300 million in revenue' and have, you know, a billion dollar exit so you can put in $60 million and get a 10 times or 15 times return."

The Road to Technology Company X

As the company where Brown was Marketing VP was undergoing the acquisition process (2007), he began considering his next move.

> It was first recognizing the 3D whatever. 3D imaging. 3D content creating. 3D applications was going to be a big emerging market. That was a market where you had billions and billions of dollars of opportunity and then you segment it out because there was pieces of it. First is, 'Here's a big market that is going to emerge over the next decade. This is a good sandbox to play in.'

He worked with several venture capitalists (VCs), to pursue his interest in 3D imaging. At the time, Brown believed that 3D displays and content creation could be an emerging trend in media. "You could sort of see it coming." One event that supported Brown's

suspicion was the 2007 release of the movie *Beowulf*. The movie was released in both 2D and 3D formats in theaters. "Beowulf did in its first couple of weeks several hundred million. And it was a lousy movie." Brown felt that the box office results of *Beowulf's* release, suggested a public interest in 3D technology. He reviewed the box office statistics and found that significantly more revenue came from screenings of *Beowulf* on 3D screens as opposed to 2D; indicating that moviegoers may have been less interested in the content of the film than in its novel 3D presentation. He then turned his attention to 3D content. "You can't do anything with 3D displays if you don't have 3D content. The content information was going to be important."

Six months prior to the release of *Beowulf*, Brown approached the Board of Directors at his startup to discuss the emergence of 3D technology. "Nobody believed me." In 2007, he met with approximately 400 people working in consumer electronics or media.

> In that case, [being in Tokyo] helped because it was easy for me to meet everybody at Sony, Panasonic, Toshiba, Sharp. [I] noticed that every one of these groups had somebody doing something in 3D. Went to film festivals, talked to film producers, [and] noticed that…all of these studios have on their roadmap 3D films. Looking at gaming companies… [which] had already made the jump…after enough conversation it was pretty clear that billions and billions of dollars are already being spent moving towards this next level of entertainment.

At the time, Brown recognized part of the driving force was Hollywood; noting that once most of the public had high definition televisions, the industry needed something to draw people into theatres. "They have to have something in the theatre in an experience that could not be replicated at home." Incidentally, around 2005, a group of technologies was emerging to generate better quality 3D images onscreen. Historically, 3D projections were accomplished through two projectors. Theatres utilized the projectors in order to switch film reels from one to the next, in order to project the film continuously. In the

1930s, the industry realized that if the two projectors were aligned properly, they could create a 3D image. Yet, the physics of the projections created disparity between objects and varied experiences from theatre to theatre within the same film. Twenty-first century technologies provided a 3D image using one screen and only one projector that allowed for complete electronic control. Thus providing equivalent experiences across theatres. One well-known American company had been developing a microchip that contained that type of technology since 1998. Since 2002, Brown "had been heavily involved…working with [the well-known company] to create the technology." Rather than focusing strictly on 3D displays, though, Brown watched "that ecosystem, watching not only for the technology to do this, but for an ecosystem to create products that would be inexpensive."

Finding the appropriate technology, environment, and ecosystem.

Determining the proper "technology, environment, and ecosystem" to pursue his interests in 3D technology began with examining academic research and funding opportunities. From about 2005-2009, Brown saw his understanding of 3D technologies and the market converging. Discussions with the Board of Directors at his startup did not lead to any movement in that direction. Continuing to formulate ideas and gather information, he began pursuing the available academic research into 3D technology. As part of this endeavor, he surveyed the venture capital landscape, particularly in Silicon Valley.

"One of the things we saw in 2009, VCs, that venture part kind of went away." By Brown's account, venture capitalists began operating more like banking institutions. If banks were willing to lend startups money, the VCs were more likely to invest. "They really wanted to invest in companies that were cash flow positive. Generally if you're

cash flow positive, you have a bit less need." The types of companies that Silicon Valley investors remained interested in were those that "were these big businesses where lots and lots of money was needed to really get things started." Brown's interpretation is that Silicon Valley, including technology transfer operations at Stanford University, prefers a model largely targeted at *home run*, billion dollar technologies. The reason is that the amount of time spent vetting an investment is essentially the same, whether a business is a billion dollar business or a $100 million business, so investors gravitate toward bigger payoffs. As Brown states, "What Silicon Valley does is make the bet on the big win…invest in ten companies, nine of them will produce nothing and one company will have that big one." He adds that from a support perspective, working in Silicon Valley provides a better infrastructure for developing companies headed in a large-scale revenue trajectory. Although, "that's not the only way to generate a good return", you can still "win a game with a lot of singles." Brown's assessment is that "Most ideas coming out of universities are just around $100 million ideas. But they're probably good, solid [ideas]…I think that there are actually fewer billion dollar business [out there]."

His preference this time around was to begin by exploring the available academic research, a process that included searching for individuals doing 3D imaging and could acquire and process data at a high speed. He assumed that researchers were likely doing work in the field without marketing, business development, or product generation experience, but were developing the core technologies. He followed several research groups across the globe-some in the US and others in Tokyo, looking for a level of execution that could address market needs in human motion and captured human motion.

The level of research involved in finding the right technology requires looking at "real details and patentable activity" at a high level and the mechanics of the technology, itself. He approached the process by examining "those 10 or 15 institutions that are leaders in this field." The next step, "The easy way is to say 'Who is really on the track for patent level stuff?' is to read the publications."After studying the publications, Brown was able to narrow his research down to three groups he felt were worth meeting. He first met with the UK faculty researcher in late summer/early fall 2009. "It was clear after-his stuff was-you had to talk to him. I don't know if it was the best [technology], but it emerged as the best." The research group demonstrated enough focus and interest in the area that,

> There's a good chance they're going to produce something that's really valuable…I read the papers that they published …not only did they have algorithms that had the speed, but those algorithms looked like they mapped into a very inexpensive way of building products.

In 2010, after following the research at UK for about a year, Brown requested a license of the technology from UK's Office of Commercialization and Economic Development, specifically through the Von Allmen Center for Entrepreneurship. He and the faculty member continued to work together as co-founders of Company X, incorporated in Lexington, KY.

In terms of the proper "ecosystem" for Company X's technology, as Brown noted, he first considered entertainment media. In addition to its use in film projection, Brown contemplated gaming. Video game systems have recently utilized motion capture technology to bring human activity into gaming. "I met with Nintendo and Sony and talked to them about what was needed for gaming, because we knew the idea of motion capture was going to be important.

> They all said, 'You really need to be at 125%'. That speed will allow computer processing…fast enough that the game player won't perceive the latency. [After executing the licensing agreement and starting the company], I went back and talked to Nintendo.

The initial prototype that Company X built cost roughly $50,000 to manufacture. "They [Nintendo] said 'We will buy everything you can make for $8.00/unit'. Okay, we'll get back to you on that one." In response to that setback, Brown took the same prototype to a trade show.

Within three days, after meeting with colleagues in similar fields, Company X had 30 unique applications for the prototype. Brown felt it was good validation that they had a strong technology platform, a technology with multiple applications for long-term development. With the new applications in hand, Company X needed to determine which applications were the most viable. One of the "throw away" applications was "actually a real interesting one-and I would still love to do it." The application was using the systems for human motion capture in editing. One consideration was to apply the system to Animé. Animation is less time consuming when animators can modify a model, rather than start from scratch. Company X's technology can further streamline current *green screen* technology, because in that technology, the mechanism captures the motion of individual points (or dots) placed on, for example, an actor. X's technology uses light to capture motion without the use of points. Moreover, the system could be used for special effects in motion pictures. Yet, market considerations have to prevail.

> Only studios in Tokyo are doing Animé and it's 25 [studios]. So we can maybe sell 25 of those systems, right? Nobody is going to invest in a company whose target market is 25. $100,000-that's what Hollywood pays [for point capture systems]. That is an opportunity, but we found that actually the best use of the speed is not in capturing motion. It's in making measurements on people fast enough that movement doesn't blur the image.

Company X pursued the question, “How much motion is there in a half second?” They found that there is “quite a lot.” They adjusted the capture speed down to a 72-millisecond space, where there is a minute amount human movement. At that speed, human movement does not affect a measurement result. This application appears to Brown to be much more valuable.

“Most of our core casting for ‘How big is the market?’ is really bottoms up.”A large amount of time was spent talking to professionals in target fields attempting to gauge: the economic value of the need the technology meets and the upper bound businesses are willing to pay. Two disparate fields emerged with similar needs that could be met by the technology: medical practitioners and pipeline operators.

The first application, for medical practitioners, was arrived at through the deliberations over who needs to take measurements that can be impeded by movement. The first answer was podiatrists. Podiatrists must take precise foot measurements; while their patients may have difficulty holding their feet still for extended periods. “So you need to measure fast. Worldwide, there’s 125,000 [podiatrists], and that’s our market. Podiatrists aren’t the only people. Dentists, 500,000 dentists worldwide, that’s our market.” Consideration of the market leads Brown to estimate 1 million units of a product. “And since each of these units is roughly $5,000-$10,000 that’s a $5 billion opportunity.” Company X has focused part of its attention specifically on dental imaging.

Brown includes among X’s most significant accomplishments, the ability to measure natural teeth. Contemporary imaging systems use powders or sprays to help measure teeth because “Most teeth are not opaque, they’re translucent.” Using optical technology to determine tooth surface creates an issue because light hits the surface of the tooth and

comes back, while also penetrating the tooth and coming back. The problem arises in differentiating between the light on the tooth's surface and the light from below the surface. Company X was able to develop information technology around the problem and demonstrate that it produces accurate measurements. Because of this technology, one of the five products in its line is a handheld, high speed, 3D microscope that can measure semi-transparent objects. The product can measure live teeth without the need for dental impressions or molds. Part of the reason for X's subsidiary in Kawasaki, Japan is access to innovative optics. Another is that Company X found that dental offices in Japan were not using traditional dental imaging systems. In Japan, the systems are considered too large. Company X developed their handheld device in an attempt to meet the needs of the market there. Aside from its streamlined process, X produced a much smaller unit than others available on the market.

Brown notes that dentists tend to be relatively frugal, but that such considerations are important to determine market elasticity. In addition to dental applications, the imaging technology is marketed for several other applications. X is collaborating with an automobile manufacturer in Japan to tailor the technology for tire inspection. Another partnership is with a company to use 3D measurement for medical testing for lung function in infants, unconscious patients and others who are incapable of breathing into a tube.

A less frugal group that Company X's technology is focused toward is pipeline operators. That is because of the economic significance of the technology. Pipeline corrosion can lead to costly damages. Oil pipeline failures can lead to spills that cause widespread damage at environmental and economic levels. Economic consequences can

spread from oil companies to pipeline operators and to the communities where the oil pipelines are located. Natural gas pipeline corrosion can cause, in extreme cases, pipeline explosion. Current inspection techniques for thinning from corrosion are costly and time consuming. Moreover, buried pipelines are difficult to access. With its platform, Company X is able to offer products that acquire 3D images of pipelines and analyze them, to determine whether there is any damage. The process is less expensive and time consuming than traditional methods; allowing for inspections that are more frequent. Company X's effort to write the software for acquisition and analysis of 3D images is the same for the animation industry, medical technology industry, and oil and gas industry. The difference is the market size and projected value.

The University of Kentucky and its Technology Transfer Process

After corresponding with the faculty inventor, Brown contacted UK's Von Allmen Center for Entrepreneurship, in order to license the product through the Office for Commercialization and Economic Development. He describes it as a relatively streamlined process. "They said, 'Sure'…and based on the technology we went off and looked at raising money." He describes it as "pretty easy here", noting that he had been corresponding with the faculty researcher for several months, so the first trip to Lexington was to meet with members of the technology transfer team. Brown describes UKECD as well structured to facilitate licensing. "They want to actually create or take UK property and create vehicles for commercialization." The meetings included representatives from UK's Intellectual Property Office, and he indicates that IP had standard agreements in place that only took a couple of weeks to negotiate. "It was fairly straightforward." The IP agreement, he suggests, was not much different from those at

other universities, as over past decades, licensing agreements have become highly standardized. Terms are essentially the same across institutions, streamlining the negotiation process (Geiger & Sá, 2008; Interview B, Interview D; 2012). Moreover, Brown feels that UK actively pursues licensing agreements, which he feels is "an important factor." In contrast, he argues that attempts to license technology from a Japanese institution are "incredibly difficult" and indicates that American institutions have developed a much better model for licensing of university technologies. He describes licensing agreements overseas as generally "front end loaded." That is, "Give us a million dollars now and you can have the IP now"; before it has demonstrated its value. U.S. institutions, on the other hand, are "back end loaded." UK's position, consistent with others, is that intellectual property "is the main generator of value for return for the university." The process is still speculative, of course, but American institutions take a "We'll never know unless we try" approach. If the barrier to licensing is too strong, potential licensees abandon the effort. University TT enterprises in the U.S. opt to hedge their bets; assuming that some revenue is better than no revenue. A greater reward may be available if, and when, a spinoff begins to see returns, or, when the USO is ultimately acquired by a larger organization. This is where the significance of equity stakes emerges.

Company X and Funding

Brown spends a large amount of time securing seed capital for X. "[He] spends a lot of time [seeking out funding]. He's trying to bring in private equity money, running from these different places in order to do that (Interview C, 2012)." Brown's company is "on the fast track. He has raised a lot of money from the Bluegrass Angels and other private

investors. He's currently going after more (Interview I, 2012)." Brown agrees that response from investors has been supportive, but is surprised that UK did not ask for equity shares in his company, as part of his licensing agreement.

> The one thing that UK doesn't do that Stanford does, and I know that UK can't do it because it's a public university, but it would be great if they could figure out how. Stanford actually participates…shares some ownership in the company…if there were a way for public institutions to do that, that would be very helpful to them. I'm glad they couldn't because it preserved a little equity in the company. But putting my UK background to use, not that I actually have one, but if there were a vehicle that would allow you to have ownership in companies as part of the IP agreement, that would be another way they could benefit on the back end.

UKCED technically does participate in equity shares through Kentucky Technology Inc. (KTI). As noted previously, however, KTI is currently inactive. Brown's response appears to be an assumption about equity stakes, because he is not familiar with KTI's or UK's TBED enterprise histories.

In Brown's case, Richardson says that the university covered some of the early patent fees, while Brown covered others once his license was in place. A signing fee incorporates some of the patent costs in licensing agreements. UKCED attempts to recover some of the fees, if the licensee begins to generate revenue (Interview B, 2012).

Brown notes that funding is the greatest challenge for Company X. In 2011, X was granted $100,000, as part of its Series B funding, in seed capital from Commonwealth Seed Capital (CSC). CSC generally provides debt or equity investments in specific technological areas, such as information technology, environmental and energy technology, and health and human development. It limits investments to early-stage Kentucky businesses. Funding for CSC comes from the Kentucky Economic Development Finance Authority (KEDFA) and the Economic Development Partnership Board (Fuqua, 2011). Additional sources of Series B funding include capital from a lead

investor (a large multi-national automotive and electronics company), individual Bluegrass Angels, BGA Fund II, and some "venture capitalists" in Texas and California. As part of the Bluegrass Angels' terms, Gary Chiles currently serves as on the company's board of directors (Interview E, 2012). Although Brown notes that, "The state of Kentucky has been absolutely great about helping us raise money here in Kentucky", he also concedes, "The pool of venture capital in Kentucky is not that large." Brown has found that "There is still a need to get on an airplane." The reason, he argues, is not limited to location or Kentucky's economy. It is also that venture capitalists do not tend to invest in platform technology. His investors in California are interested in Company X's medical applications, while investors in Houston are attracted by the technology's implications for the oil and gas industry. Creating a structure that allows investors to earmark capital for specific uses of technology has been complex, but from a financial perspective, it is important to allow investors to "do what they're comfortable doing." Brown indicates, "Probably the biggest barrier [to success] is being effective at raising money."

Company X's location, nonetheless, is something Brown considers an asset, in a number of ways.

> The environment here seems to me to be very good for companies whose financial needs are not tens of millions, but might be millions-whose target markets might be billions, in terms of the total market, but the company is looking more to be like a $100 million type company in terms of revenue. And if it's a company that is going to make something, this is a good place to be because there's reasonably priced manufacturing infrastructure here. You can go off and get things made. The Silicon Valley model, you don't typically make stuff because you just can't really make stuff inexpensively or at reasonable prices. It used to be Silicon Valley, and they moved a lot of that production to Taiwan, and then it stopped being interested in Silicon production at all, at least from the startup standpoint. It's mostly software.

He contends that the emerging economic engine of Silicon Valley is different from what the public has traditionally perceived. He recently toured a manufacturing facility in Lexington and considered it "ideal" for Company X's purposes; finding it had "just phenomenal" capabilities, reasonable cost structure, and organization.

In terms of Company X's location on campus, Brown is also satisfied. He believes that ASTeCC's infrastructure "alleviates" some of the responsibilities that fall on startup executives that can divert attention from company development. "The ASTeCC incubator is really for the true startup. [Who] just started [and] they need office space. They need a telephone. They need a little conference room to have meetings in when people come and visit (Interview E, 2012)." While ASTeCC staff do not assist with technological or growth objectives, the "Infrastructure… [takes on] the things that most startups have to do, but don't want to do…I don't have to spend the time on things that don't advance the products of the company." Some of the benefits of the campus incubator are that Brown does not regularly deal with tasks like ordering supplies. Many office essentials are "borrowed from people on a more permanent basis". Moreover, the space in ASTeCC is competitively priced. ASTeCC rent is subsidized (Interview I, 2012). Brown feels that outside of the leasing costs, there are additional financial benefits; noting that in Kentucky, "I couldn't rent an office with exactly this size for exactly what I'm paying. I like to tell people that my office is the same size as the UK campus." He argues that the office provides Company X with access to the internet, the campus library, shipping and receiving, and other integrated benefits. "There are so many extra things that we get that we don't have to pay for"; which include certain aspects of accounts payable. Tenants do

not split their time between company development tasks and office management tasks, like paying utilities. An additional inherent benefit is academic climate.

"Having an incubator on campus is great for us." He suggests that it provides access to the faculty inventor, which is significant, in that, "It's his mind that is behind a lot of what we're doing." If the company were off campus, Brown believes that the level of interaction and conversation, which induces progress, would be limited. The fact that collaborators can discuss ideas, leave to work on them, and then return with results, has provided a distinct advantage for the company.

Growth and Economic Development

Economic development is considered a compelling argument, by upper level administrators and policymakers, for university technology transfer, and specifically university spinoffs (Geiger, 2006). Moreover, university science or research parks are established as a mechanism for high tech cluster promotion, leading to area economic development (Yusuf & Nabeshima, 2007). "The vision of Coldstream was to create a space within central Kentucky area where high tech companies could in fact locate and start their businesses; being able to draw on the employment base of the area (Interview E, 2012)." Considering these factors, I asked Brown about his thoughts concerning Company X's expansion. First, if he would be interested in relocating to UK's Coldstream Research Campus? Second, what role, if any, economic development plays in his business related decisions?

For Company X, Coldstream is an option once it has outgrown its current location in ASTeCC. After visiting the facility a number of times, Brown considers it "a nice place." Although his first choice, once the company expands, is to "move some place very, very

close to campus because we don't want to lose the connection to any… [advanced] research." Alternatively, Company X could move somewhere local that can completely meet its needs. The decision hinges on determining whether X will manufacture its own products. Currently, the company outsources its manufacturing projects. Production needs are relatively low at this point. However, if production needs increase and X opts to manufacture its products, Brown will need to investigate a different level of funding, as well alternative space needs. The advantage to in-house manufacturing, from his perspective, is that the link between engineering and production is "tighter" and provides some level of cost control. "It's more effective and, of course, we're not paying someone else to do a skill that you can develop. Probably we will do something in between…outsource the manufacturing to a local Lexington company…and be near them." The examination of facilities also lends itself to considerations for economic development.

Brown notes that as X grows, it will be creating jobs for some professionals with extensive experience, but also "bringing in a different level" by helping to sustain jobs for companies. Manufacturing jobs, particularly, have recently been moved overseas. He also states,

> This is sort of my own personal agenda. I am a firm believer in globalization, but I think we have swung globalization a little bit too far. I don't think it is, for example, more economically *favorable* to outsource what we're making. There is no reason to go over to China or Taiwan to make that. I don't think it would be an economically beneficial trade off to do that…How do you measure *significantly* cheaper? One of the things we don't do well is-we will reward a business for sending a job overseas. The business pays less dollars to have that made. But it's not an apples to apples comparison. My favorite example is 'What are we doing with Beijing?' We send jobs to Beijing in an unregulated environment. They come over here and drop back down in California. Are we penalizing them for that? No. Is there an economic cost for that? Yeah.

He argues that the structure of the U.S. economy allows companies to improve their bottom lines through outsourcing, but "the burden" is born by U.S. taxpayers. "I just don't think we have really looked at the economic cost of moving stuff out of here." Brown notes that much of his opinion has been influenced by his tenure in Japan. There, he observed what he feels is part of an unintended consequence of outsourcing: the growth of the Chinese military. Brown feels that the trade deficit between America and China has enhanced funding for the development of the Chinese Navy; which worked to push the definition of Chinese borders while he was living in Japan. He argues that outsourcing should be considered "holistically", because it takes jobs from American workers and stimulates shifts in political power.

University Spinoff Y: Entertainment Media Company

Company Y(Y) can be categorized as a *Student/Codified* USO, what Pirnay, et al refer to as a product-oriented spinoff utilizing an idea developed by a student (2003). The inventor/entrepreneur began developing his company while attending the University of Kentucky. The specific intellectual property is a result of cumulative work, begun as an undergraduate. UKCED worked with the entrepreneur to obtain funding, and members of the Bluegrass Angels have invested and consulted on the IP. This specific USO was not originally under consideration as part of the sample. However, several participants referenced it (Interview A, Interview C, Interview E, Interview F, Interview I; 2012), as an interest. In particular, the participants indicate that it is a unique investment, compared to most, because it stems from the emerging and evolving gaming industry. Moreover, the investment horizon on this technology is estimated to be much shorter than most.

> The gaming industry is now bigger than movies. *Andrew Stone* (pseudonym, Interview H, 2012) convinced the Angels to put in a considerable amount of money. You can develop a game in six to nine months. It will soon be on the market and there will be a quick turnaround, whether it goes anywhere or not. [This is] in contrast to [alternative] university investments that are equally high risk, but usually take three, four, eight years to know if it'll go anywhere (Interview I, 2012).

Technology Y

Essentially, Technology Y is an online video game. The principal entrepreneur/inventor works with a team that has written a script, chosen the platform (which is Xbox Live) and is currently developing the game. The company has submitted an application to trademark the name of its game. The CEO, Andrew Stone, has a significant amount of experience in the gaming industry. This property, however, is the first game his team is developing.

Commercialization and Development

Although investors and UKCED personnel note that the turnaround time for this investment will likely be around 18 months, Company X is still in the very early seed phase. It is currently developing the game using a team of seven or eight people, across the country, with extensive experience in gaming journalism and development. Stone calls them "The Justice League" because of their "pretty close to icon status." While Stone and his team "run the business side", they outsource programming and other technical work to specialists across the United States. The company is located in the community incubator, Base 163. Stone feels it is a good opportunity to work among other entrepreneurs in a shared space, who can assist him with company development.

> There's people up here that have been an entrepreneur for – some only, you know, like me, a few years, you know, five, ten years. There's others that have been here for 20- some years that are entrepreneurs that started, you know, 15 companies, and sold them, have been acquired. [It is beneficial because I can ask] 'How do you get on NASDAQ?' You know, there's somebody up here that can, at least,

> tell you the person to talk to. So, we have that experience at our fingertips. It makes being able to kinda hop and skip over some hurdles that would have totally made us trip, you know, five, six years ago. We would have fell on our face big time.

Education and Professional Background

Unlike Brown, who set out to study areas of professional interest, Stone found that the interaction of a number of variables led to his entrepreneurial activities. While a student at the University of Kentucky, he studied Sociology. Stone worked at a local movie theatre his freshman and sophomore years and became involved with some promotional work. "And that's what kinda spurred my, 'Hey, I'm kinda good at this. I kinda can understand how to make people be interested in a product or a service.'"

That experience led him to think about pursuing marketing in UK's College of Business and Economics.

> And that's what spawned the conversation at UK, which didn't – it wasn't fruitful for me from a collegiate standpoint where they were gonna help me in my education on that…At that time, I was still in college, and I kinda had an affinity toward marketing and advertising, but also, I loved video games. It's funny. I went to UK and I wanted to do-I wanted to major in marketing, so I went to the Gatton School. I said, 'Hey, I wanna major in marketing.' They said, 'Oh, you're not smart enough. Your GPA isn't strong enough.' I was like, 'Oh, okay.' So, I just went back to my boss [at the movie theatre] and said, 'What can I do?' And they're like, 'Well, you're close to pretty much anything in arts and sciences.' So, I just literally went, and pointed my finger, and said, 'Oh, sociology. I guess that's what I'll major in.'

When asked whether his Sociology background might have influenced his marketing capabilities, in areas like understanding cultures, Stone notes, "I never thought about that. I think it has. I mean, definitely it has. I just didn't think of it that way." He believes, though, that preparation in business school would have assisted him in his current position.

> That seems to – it would have made sense, but I've met a lot of people that did go to business schools, including Gatton, that didn't know their head from their ass. I mean, it doesn't mean that just because you come out of the school that you are ready to not only run a business, but have the foresight to run a cutting-edge business.

After leaving the movie theatre, around 2004, Stone and his friend *Nick Jones* (pseudonym) took jobs at a website that featured news and information on video games. They reviewed new games. He describes it as, "Basically, *Consumer Reports* for games is a good way to kinda put it." The website was not particularly profitable and the two saw a "very limited future" there. "And so, I thought, 'Well, I'll just put the two things together that I really enjoy and see if I can make a business out of that.'" They left the company and rented some inexpensive office space in Lexington.

> And, from our little office over on Third Street, we would play games…and try to get that news out the same way that we were doing previously. But we wanted to do it with video content, not just written word, because we saw the Internet was kinda going in that direction about that time and it seemed to make sense to do that.

Many of Stone's ventures seem based on what he intuitively knows makes sense. While working out of their Third Street office, Stone read an article on the virtual world, *Second Life (SL).* He downloaded *Second Life* and played it. At the time, *Second Life* had approximately 100,000 global users. As he played the game and met some people in the virtual space, Stone realized that all of the content was generic. "There was no brands. There was no McDonald's. There was no Coca-Cola. None of that stuff existed." Users in *SL* could socialize and make purchases for their avatars. All of the products, though, were community based. For example, users could buy homes to live virtually in, but if they were interested in digital furniture for their homes, or clothing, they purchased it from a local retailer. That led him to consider two things.

First, no "outside entity" existed in *Second Life*. Second, the world was dominated by a sex and drug trade.

> And, of course, sex is a huge trading network, as well. So, people buying and selling virtual body parts. When you're born in that world you don't have proper – you're more like a Barbie doll when you're born in that world… So, anyway…I thought, 'Wow, there's sex. There's drugs. There's all this stuff happening in this world, and yet, there's no brands. That's really interesting. I think someone should make that leap.'

At the time, Stone was a fan of the clothing brand American Apparel (AA). He refers to it as "having a crush" on the brand. American Apparel is the country's largest manufacturer of clothing, accessories, and undergarments. "But their underlying factor is sex. Everything about them is a very sexual brand. So, I thought that may be a perfect match."

By happenstance, Stone attended high school with a woman whose father was the Operations Manager for American Apparel. Stone contacted her and she told her father about his idea. She gave Stone her father's business number and they spoke about his plan. The Operations Manager set up a conference call with AA's Marketing Director. "So, I talked to him just briefly to give him the whole idea and just say, 'Hey, I wanna come out and pitch this thing to you.'" There was also an upcoming video game convention in Los Angeles that Stone and Jones planned to attend for work. He realized that American Apparel headquarters were only 20 minutes away. Stone and Jones, travelled to L.A., and during a break at the convention Stone,

> Shot over to American Apparel headquarters and pitched them all this idea about putting them in *Second Life*. They bit on the idea. They loved it and we built them a virtual store in this world. Full on store to scale, It was like a real store would be in real life. It has like 32 pieces of clothing you could purchase and the part that was revolutionary was you could not only buy it for your digital self, but you could buy it for your real self. So, their campaign was, 'Be your own twin' was kinda the campaign that was dreamed up there. So, you can dress your guy in

> *Second Life* just like you dress yourself in real life. So, that launched. It was the first brand to be in a virtual world.

When asked if *Second Life* is regulated in any way, Stone replies, "No. You could do whatever you want." He clarifies that if someone attempted to simply go into the world and build a store, it would be immediately closed. In order to work in *SL* users must purchase *land*, from a *real* person, which is actually server space. He indicates that the virtual world functions much like the real world, except that *police* are the server managers. If a user infringes on space s/he does not own, the managers will shut down his/her account. "It's literally a light switch on/off situation."

Within a few weeks of American Apparel's launch in *Second Life*, over 350,000 avatars walked through its doors.

> We were covered in about 22 major press outlets, including being on the front page of *Ad Age*, the front page of the *Wall Street Journal*, *Forbes Magazine Inc.*, *Time*. *60 Minutes* even did an American Apparel interview for this whole thing. So, in the world of video games and advertising, it was a big deal. A lot of people talked about it and it skyrocketed our business. And that's when the *Second Life* thing hit, and I was literally, like, in midterms getting phone calls from people at *Wall Street Journal* [and] people at *The New York Times* trying to interview me.

Immediately after the American Apparel launch, Stone was contacted by several companies asking for his assistance. The work he began in *Second Life* led to the intellectual property he is currently developing. He attributes some of his early success to his lack of complacency.

> I don't settle for just good. People are like, 'I guess that's just the way it is or whatever,' and that's just not how I function because I know it's not the way it is. And things don't change by themselves; things change because a person makes it change, you know? I never was a person that just punched my time clock, and I'd get my paycheck, and then, you know, on the weekends, I'd get to spend some of that money, and I'm happy. That was never me. I've never felt that that was a life I wanted to live; it was more I always wanted to see, 'How could this thing in front of me – be it a product, a service, or whatever it is, how could this thing be better?'

Samsung quickly requested Stone to build a store in *Second Life*. Additional clients included Clear Channel Communications, parent company of Spectacolor, which owns the majority of the advertising space in New York's Times Square. Stone worked with Samsung and Clear Channel to build a scaled Times Square in *Second Life.*

> So, we took on that project and started working those two brands. It was a lot of fun. And we kinda had Clear Channel's ear, and so, *Nick* and I pitched them this crazy idea to make a little video game TV show, sorta, and air it on one of their screens in [real] Times Square. No one had ever put together a show, so to speak, and aired it there. They loved the idea. And so, about every 20 minutes on this screen on the corner of 43rd and Broadway, the W Hotel would air our little show that we were producing out of a tiny little office over here on 3rd Street. It was a lot of fun to work on that together, especially to have some of the video game industry elite going to watch. They would be in New York on business, and they would call us, and say, 'Hey, we're trying to find this screen.' I'm like, 'You keep walking. You can't miss it.' Because it was 30 by 40 feet, I mean, it was gigantic. And then, we got to watch their games that they were creating, in pattern, on the screen. So, it was really fun.

The work in *Second Life* led to thoughts about brand content. Stone considered, "The *Second Life* thing is old now, but what's the next thing? What should we be doing next?" He began engaging Clear Channel and other companies in discussions about video games and the *gamer* demographic. He argued that conceptions of the gaming community were completely inaccurate.

> Most people didn't understand. The average gamer is 34. They make $80,000 a year. And we say that to the Chief Creative Officer for Axe body spray, they about jump out of their seat, you know? There's a whole market they didn't even realize.

He contends that the misconception is that gamers are young, without much income. Gamers ask their parents to buy them products. While certain game audiences skew toward the younger demographic, he indicates that, there are over 550 million gamers worldwide and that half of American households have a game console.

Those ideas brought about a new marketing and advertising consulting opportunity. Stone travelled to companies from Klondike Ice Cream to Ford Motor Company. Ford contacted Stone to find out "What's next? What should we be doing next?" and Stone responded that video games were a large part of his business, but he had also heard about a cell phone coming on the market called an Apple iPhone, where customers could utilize a touch screen and other advanced functions. The clients at Ford relayed that the iPhone was on was on their radar, but they were not sure how to exploit it, asking, "What's an app?" Stone had been granted early access to Apple's technology, along with a software development kit. Stone and his team constructed the second automobile application for the iPhone. "Audi beat us by a week, so they get to claim it. But, yeah, we built the Ford Flex [app], which was the first crossover vehicle." Within two weeks of its release, the application had been downloaded 52,000 times. Stone argues that, launched today, it may not have been so popular, given that approximately 1,000 applications are added to Apple's App Store daily. "At the time [though] it was literally like the Wild, Wild, West. There was nothing there. It was like, 'Claim whatever you want!' You know?"

Stone suggests a good comparison for his early involvement with mobile applications, would be the emergence of online commerce.

> It created an entire new channel to touch a user because, if you think about it, from the moment you wake up, to the minute you go to bed, there's nothing you touch more, besides your significant other, than your phone. You touch this more [gesturing toward his iPhone] than anything else in the world. And so, when you have this thing on you, it's a very powerful thing to say, 'We're gonna claim some of the real estate on this. We have a brand.' That you allow that brand to have some real estate on this is very, very powerful. It's more important than your purse or anything. I mean, that's usually how people treat this kinda stuff.

When you work on the cutting edge of technology, Stone argues, the only option is to think, "What's the next one? O.K. We've already done that. What's the next one?"

Stone began contemplating the Xbox technology. He notes a strong amount of "great content that's happening [in gaming consoles], especially with television." He argues that at some point, cable television will be extinct. Instead, individuals will pay an "Xbox bill". Currently, networks like HBO and NBC are represented on Xbox, as well as the movie rental company Netflix. He claims that most content will be advertisement driven. It is essentially the same programming on cable, but available on any device. He suggests that cable companies are grappling with ways to keep up with changing technology, but are "kinda too late." Nevertheless, a cable corporation contacted Stone to consult on how to keep current customers satisfied and address the future of the industry. Much of the focus of those discussions revolved around the gamer demographic. Yet, the conversations were not about video games. Instead, they focused on branding in various types of media, like Skype or Pandora. Stone believed that branding would be his next focus. He assembled a team to advise corporations concerning issues like,

> How can Nike be [viewed] more in Madden football [video] games? That's what we thought our core business was gonna be, but anyone who's ever been an entrepreneur or ran a business realizes, "You don't know [expletive]." You think you know what you're doing when you start, and then, it's not. What we didn't realize was we put together this *Dream Team* and companies like Electronic Arts, and Microsoft, and Activision, you know, games like *Halo, Call of Duty, Battlefield*, those huge mega titles, they actually could use our team more effectively than someone, like Coca-Cola, could.

The team began reaching out to electronic media companies offering to review their games and advise on ways to make them more profitable. About the outreach, Stone adds, "And that doesn't mean we're gonna tell you that you should put Coke in your game." The pitch was to improve user interface and multiplayer functions. User interface refers to the player's experience. It is connected with the menu on a screen, known as a "heads-up-display" (HUD). The HUD is similar to a meter that indicates how much *life* a

player has remaining, or how many weapons s/he has. It is essentially, "how you interact with the game."

Stone's team devised a method for predicting a game's metascore, which is a profitability index. The metascore scale ranges from 0-100. For example, a game that scores an 85 will earn on average $12 million. Stone's method is generally accurate plus or minus two points. The team can review the game's user interface, predict the metascore, and provide feedback for improvement. As Stone says,

> We say, 'Change these ten things and you go up six points.' And those six points could roughly be $20 million for that company. So, they pay us to do that. So, we just took that, leveraged all that experience, leveraged that brain trust that we put together, and said, 'Let's just put our money where our mouth is and make our own game.'

This game is the current intellectual property supported by UKCED, and Stone is developing it as a separate company.

Finding the Appropriate Technology, Environment, and Ecosystem

Stone's path to the appropriate technology was the result of an evolution of previous projects. He indicates that the current focus on developing the game will not keep him from interacting with previous clients, although projects in those areas are "on the back burner".

> If EA [Electronic Arts] calls me tomorrow and says, 'We need some help with our game,' we'll take the contract and we'll help them with it. But it doesn't take any of my time, personally. I push that off to someone else on the team to manage. 'Hey, EA called. They need help. Here. Go do it.' And they know the rates that we charge and it's kinda on autopilot. So, it just-it doesn't require a lot of my assistance.

For now, Stone is focused on development. Earlier in the project's life, he spent most of his time fundraising, with assistance from the Bluegrass Angels.

He believes that Base 163 provides an exceptional environment. He suggests that working at Base 163 is like "living in an entrepreneur dictionary" because of the access to experience. He can walk across the room and find someone who has been in a similar situation for advice. Before coming to the incubator, he "felt like we were stuck in this little office-island-out by ourselves and we were sure surrounded by sharks." He has learned from experience.

> Like we were terrified to push on the client to say, 'No, we demand 15 percent up front because we need to meet payroll,' You know? But we didn't know-we didn't know how to be that way, so it was like you-you coddle your client. You say, 'Whatever you want, we'll do. Because I need you bad' and they know that. And so, they mistreat you, and they ask for free work, and they-I think there's just a lot of lessons that you learn early on that I wish I had known.

Stone enjoys passionately working with fellow entrepreneurs on his project, noting that his childhood dream to make video games always felt intangible. However, now that he is pursuing his dream, he says that,

> Surrounding myself with people that are not only smarter than me, but more talented, and creative. And seeing like…That's what to me has been one of the most rewarding pieces of this, is to sit down and say, 'I have this idea that looks like this.' And I hand it to someone, and they go, 'Well, what if you took this idea and you did this with it?' You know? And then, you're like, 'Whoa! I didn't think of that.'…And it spawns off this whole other- it's like just turning on this creative spigot. It's just like more stuff keeps coming out. You're like, 'Oh, this is so great.'

Although in many ways, this is a fantasy position for Stone, he does indicate some challenging aspects of it. One challenge is the location of the business. For fundraising and other business travel, Stone says,

> I could never get a direct flight anywhere, unless I'm going to Charlotte or Atlanta. I can't – I have to fly to Cincinnati or something. If I was trying to get direct somewhere, it still could be difficult, yeah. Even Louisville – I can't go Louisville to New York. I have to go to Cincinnati to go to New York to get a direct flight. I can fly, like, from Louisville to Detroit and then over to New York. It's weird, you know?

As a native Kentuckian, he also suggests that it is sometimes difficult to be taken seriously in metropolitan areas. “When you're talking to an ad executive for Unilever, you know, and they're either very much New Yorker or British…When they hear you speak, they think, ‘This guy is an idiot’ or, ‘He's uneducated.’” Moreover, working with the right team can be a challenge because of the location. He suggests that the specialists he works with most often are found in across the country: San Francisco, Austin, and Washington State (with a large concentration in Seattle). However, the population in the Research Triangle in North Carolina, is also growing rapidly. “Yeah, for my business, The Triangle, it's fantastic. I mean, I borrowed half a million dollars and half of that is going to a company in Research Triangle.”

Apparently, that area in North Carolina has a number of large game studios, institutions that teach game development, where college students can internship at “mega publishers” and work with major games. That support structure provides students opportunities beyond what Stone experienced in Kentucky. In fact, he is attempting to help establish a game development program at the University of Kentucky, but says, “Who knows?” in terms of whether that will happen.

For his previous work with branding, location was less important. Now, though, he suggests that he would like to hire local developers to work on the project. He has been forced go outside of the state to hire outside help, because that population is not in Lexington. Location is not the only challenge to working on his dream. He argues that a large challenge is “how to monetize cool.” In one respect, he argues that social capital cannot pay the rent. In another, he suggests that “cool” is much more difficult to price than a tangible good.

> Because that's what we were selling through almost everything we're doing-and the proper way to price that. I didn't know how to do that and so we suffered, you know, in the early stages. A lot of times, if–not necessarily–getting pretty close to not paying yourself so you can pay the rest of the team, and yeah, there was a lot of sacrifice to get–but that's how everything is, you know? Because we were–there were so many times that we were right at the edge of shutting it all down because you just don't have enough money to do it, you know? We skyrocketed in terms of social equity amongst our peers and amongst big brands, but that didn't necessarily trickle down for our wallets. I can't walk into Meijer, and fill my grocery cart, and pay with cool. I can't walk up and say, 'Hey, I was on the cover of *Ad Age*.' You know? Like–so, that can't get you squat.

Stone's challenges are resource related. His achievements, however, are mostly on a personal or less concrete professional level.

From a personal and business perspective, he considers seeing himself on Times Square a major accomplishment.

> I had a friend of mine with me…I'd go down, and shoot a video for us on the corner, and just like–to see the cabs, and the people going by. And ads for Maybelline, and all this kinda crazy stuff, and then, there's our logo. And there's our product or our–you know, stuff that we were sitting here slaving over in our little office in 3rd Street down here. That was a pretty big accomplishment for us to just see that happen.

He also considers his experience with his team an asset. Six months before he began fundraising, the validation of the group, felt like a major milestone.

> And so, to have that 'a-ha' moment with them, and then, see it again six months later with the investors go, 'Oh, yeah, this is something different. Yeah, there we go. Now you get it.' And then, it was very easy for them to open their wallets and get involved with it because they moved from understanding to believing.

He suggests that without his team, the company would not be where it is today. Being surrounded by individuals who are "way smarter" than himself is rewarding in that, "You can…make awesome things and build fantastic things and it absolutely requires a village." He also takes pride in the fact that he was instrumental in building a group that works well together.

UK and the Technology Transfer Process

For Stone, the technology transfer process with UK was much more involved than Brown's licensing experience. Stone created his product. Moreover, his involvement began in the ICC, rather than a campus lab. Stone has a family member who previously worked in the Small Business Development Center, a department of UKCED, located in downtown Lexington. He became acquainted with personnel in the Commerce Lexington building when he would stop by to visit over the years. He also spent time in the building as a "quasi-consultant to help out with stuff." Because of that connection, the ICC became aware of his project.

Stone feels the ICC representative, "genuinely wants to help…companies get started". The TT officer inquired as to what Stone was doing and suggested he work with UKCED and BGA to fund a spinoff. Stone relayed his concerns about the investment group, noting, "I don't think they'd understand it. They're old. Their great grandkids play video games. I wish there were some younger people." He was encouraged that there are "a couple of young guys" and the representative offered to schedule a private meeting with the younger members. Stone was able to pitch his idea to the young Angels and they were supportive. Enough so, that they brought him to a full meeting and explained they had privately invested and suggested the other members follow suit. Ellison was in that early meeting. He agrees that he found the idea very interesting.

> Then that sort of transitioned to helping them get the pitch set up because, again, *Andrew* is the founder. He never sort of raised capital, right? He's got experience in his domain of games. He understood his market. But he doesn't understand companies. Didn't understand financing aspects of it, valuation. What investors need to hear versus what he wants to tell them. What's his experience? You've got to balance the two, right, because you've gotta let him sort of shine in his area of expertise. But you also have to satisfy the investors in what they want to hear.

With assistance from Ellison and another younger Angel, Stone was able to refine his pitch and business plan. One aspect of the company that appealed to the investors was the horizon. Investors must acknowledge the "risk with reward." At the end of the year, there may be nothing, but there could be something. Stone's IP came across as an opportunity to "scale pretty quickly", because "the market has some change going on…so there's an opportunity for new companies to come in and do something…games…that's a huge market (Interview F, 2012)." "It will be on the market in six to nine months and will be a quick turnaround (Interview I, 2012)."

Company Y and Funding

Stone was able to secure a solid amount of funding that he and the Angels believe the company requires at this stage.

> I'm a damn good salesman. I'm really good at talking people into stuff. But no, seriously, it's kinda a perfect storm. The story that we told, and the types of leadership and team that we have associated with this project, it was the perfect fit for it. (Interview H, 2012)

Ellison's help substantially influenced Stone's fundraising efforts. Ellison performed the due diligence. The Angels and entrepreneurs working in Base 163 assured Stone, "*Rob* did due diligence and gives you a thumbs up. I trust his judgment." Stone continues, "They were like, 'I understand Rob makes money off what he invests in. I'm gonna put my money where *Rob* does." Stone adds,

> It's the same thing. It's just, I'll get to the analogy, but, you know, the lemming that jumps off the mountain and the rest jump with it; it's that same kinda thing. Once someone does it, they're like, 'Yeah, sure.' It doesn't matter. I thought it was Lexington, but it's everywhere, everywhere. And it's funny because you have the big companies that are helping me try to raise $600 million. I may go to some venture capital firm, and that venture capital firm says, 'We'll give you 150.' All the other big wigs hear that and they go, 'Oh, what do they know that we don't? We need to get in on it. Here's 200.'

Funding Stone's technology has gone well.

> They raised $500,000 from the Bluegrass Angels, money from Commonwealth Seed Capital, Kentucky Science and Technology Corporation, and a number of individual investors. We're doing a follow-up round right now. KSTC is putting more money. Bluegrass Angels might put more money in. I'm putting in a little. So helping them with that has been interesting. That, again, all started from [a phone call] saying, 'Would you meet with these guys?' (Interview F, 2012)

Stone is still surprised at the local investments made in his project.

> I actually didn't expect any money in Lexington. I thought that, since I wasn't opening something that was pharmaceutical, or something that was equine-related, or I wasn't opening a car dealership with Jamal Mashburn [a former University of Kentucky and professional basketball player], that I wouldn't get–I wouldn't raise any money; it just wouldn't happen. But I was delightfully surprised. We went to *one* meeting outside of Lexington. It was in Louisville–to pitch to the local Angels. There's like one–we got one deal out of that, one guy. His own money or whatever.

He has found a drawback to having a large number of investors, which is oversight. He suggests wealthier investors are less concerned with monitoring the company.

> I think, people that invest all these large sums of money usually have large sums of money, and they understand that they can't be Superman for everyone. They realize that, and so, they do put some of their responsibility out to others…But those people that are only putting a small amount of money in usually only have a small amount of money to begin with. So, it's a huge risk–a much larger risk–and so, they always wanna know what's going on because they're so, you know, worried about that dollar amount. It's, 'What are you doing with my money?' You know? And so those people usually get–they'll start reading and seeing more things about the industry that it's invested in, like with us it's video games, and so, some older investors that maybe necessarily never even thought of video games, they invested me, and are now reading the *Wall Street Journal* have some story about video games in it. And they'll be like, 'Hey, it says here that Xbox games are down 18 percent. Do we need to worry about that?' And I'm like, 'Ugh,' you know? 'No, there's no big Xbox game'

He notes that not all investors are like that, but it can be a "beast" to deal with some personalities.

Growth and Economic Development

In terms of growth, Stone suggests that he currently does not have plans for expansion of his staff. “Right now, we’re like a think tank.” He suggests that his team’s role is similar to a movie production team’s. “We do all the stuff behind the scenes, and then we say, ‘Here is this game. Build it for us.’” Although there are times it would be nice to work closely with everyone,

> I don't have to be, you know, literally on them every single day. It would be good if I could get in the car, and drive down the street, and go in, and say, ‘Hey, what's going on?’ and like, ‘Show me stuff.’ Luckily, with technology, we can get all that done. That's-when you walked in, just seen me doing in there, was a video conference with our team, going over the game, going over things we wanna change, and that kinda stuff. So, luckily, that gives us that ability to do that–being a teleconference.

At the same time, he says it would be easier if he were able to call a meeting where everyone could physically be in the same room “because it’s a much more efficient way of communicating. But they're only eight hours away; it's not a crazy drive.”

He does not seriously consider relocating closer to his outsourced team because he is from the area, his family is close, and he and his wife own a home. If the opportunity presents itself, Stone is likely to continue to grow his local team from seven, to thirty, to sixty people, and so on. He considers it a long-term goal for the project, but believes,

> It'll never happen here until you tell UK that they can do a [game developer] program. It just would never happen because no one would. Why would you leave an area that has 100 jobs pitching for you, to come to a company, to a city, that has one–which is my company? And if I didn't like you or we didn't work out well and I had to let you go, what are you gonna do? Pack up and fly back home? And that's a pretty crappy position to be in.

Although Stone does not plan to leave the Lexington area, and seems to consider the impact relocating to Lexington might have on employees, he argues that economic development is not a consideration for his business.

> No, don't think about economic development. It never really crosses my mind, but I know that, in the long term, if our company does well, I know it will drive the economy in Lexington because the games that–you know, here, the industry makes pretty good money. I mean, there's games that are doing $15 million a month in revenue. To bring that kinda money to a city like the size of Lexington, that's a real changer. I mean, you've become one of the top ten companies period in the city when you're doing that kinda revenue. If you're at the $400 to $600 million a year, yeah, you've got–you've got some weight to kinda throw around.

He continues that "weight" in Lexington is not a consideration, either.

> It doesn't mean anything to me because we're launching our game in 15 languages in almost every country in the world. I don't–the local economics and politics of Lexington do very little for me, but that doesn't mean I don't wanna give back to it in some way. And it's kinda–I guess, for me, is it's self-fulfilling–is that I want to see UK start a game program, and I wanna give as much of my time to help them do that because it'll help my business later. If students are coming out of that school, they have experience, and know what they're doing; I can bring those kids in and get some work done that way. So, I would love to see that kinda thing happen, but we're just in the talking stage right now. We'll see.

University Spinoff Z: Biotechnology Company

Company Z (Z) can be categorized as a *Researcher/Codified* USO, what Pirnay, et al refer to as a researcher-oriented spinoff utilizing an idea developed by a researcher or researchers (2003). The faculty began developing the product in the 1990s while researching enzymes at two institutions, including the College of Agriculture at University of Kentucky. Of the three USOs, Company Z is the most mature early stage company. The technology is the result of approximately twelve years of collaborative research between a UK faculty member and a researcher from another institution. The company is one of the first UKCED spinoffs, was launched roughly eight years ago (Interview I, 2012). Company Z's operational unit is located on UK's Coldstream

Research Campus. Coldstream is targeted at companies "a little bit further down the development curve" from those in incubators (Interview E, 2012).

Because of its comparatively advanced status, Z was the most difficult to research. That is, although operations are based in Kentucky, the CEO (not an academic) is stationed in California. Because of scheduling difficulties, the CEO was not available to participate. An operations executive located in Lexington did agree to participate in the study, but voiced concern over sharing proprietary information. Inasmuch, the descriptive information in this section is limited as an effort to keep the USO's identity confidential.

Technology Z

In laymen's terms, technology Z manipulates enzymes to create certain compounds. The class of enzymes that the technology reproduces can produce a variety of products. This process yields more products and is less expensive than traditional methods. Although it is a platform technology, with a number of applications, the current focus of Z is inexpensively producing flavors and fragrances.

Commercialization and Development

Doug Wilson (pseudonym, Interview G, 2012) is an operations executive at Company Z. He suggests that the researchers are "among the first to clone the genes or put out a class of enzymes and…the first to determine the three-dimensional structure of that class of enzymes." Initially, the research was "purely academic". This led to a number of patents. The patent families are part of Company Z's technology portfolio. In total, the company's technology is protected by 62 patents (Company Z website, 2012).

In an effort to further their original study, the researchers realized that they would need to produce large amounts of enzymes. They "developed systems to over-produce

those enzymes and over-produce the product of those enzymes. And it has since led to the commercial interest in those enzymes and the products of those enzymes." The production mechanism is the partial basis for the company, because of its ability to produce compounds.

The technology also allows the researchers,

> To manipulate how enzymes work so they could produce different products because of the diversity of types of products that can be made by this class of enzymes. You can actually convert-change the products that were made by a specific enzyme by changing the amino acids sequence of the enzymes, and they developed technology surrounding changing the specificity of these enzymes.

Wilson continues,

> Yeah. I don't think they went into this thinking we're gonna take this technology and commercialize it. I think their interest was purely academic, but then they saw that there was commercial potential and they took advantage of that opportunity. And so when they filed those patents they filed patents around the structure function relationships of these enzymes and that led to a pretty strong family of patents that work based on this. And it's one of the cornerstones of [Company Z's] intellectual property portfolio.

Education and Professional Background

Wilson's educational background is scientific. He earned a Ph.D. in Biochemistry and pursued some graduate work in chemical engineering. His postdoctoral work was in molecular genetics. He adds,

> This was back in the early '80s when biotechnology was first, it was in its infancy. The talk at the time was 'This is technology that's gonna revolutionize chemicals, fuels, medicine'-and it was really very exciting. And I thought, okay a background in biochemistry, chemical engineering, and genetics would all be very appropriate to practice that technology. So it was all pretty much by design that I came into this. At the time, I was thinking that it would be interesting technology to be applied to make new classes of chemicals that can't be made in traditional synthetic organic chemistry, because maybe they're too complicated to synthesize from scratch. And that's kind of where this technology comes into being.

After completing his postdoctoral research, Wilson worked for a company making amino acids "which are generally made by fermentation involving several things by fermentation or extracted from normal sources or something like proteins or…stuff like that. But we were applying new techniques to doing that using genetic engineering." He moved on from that position to work for a contract research company that used several different technologies and various aspects of biotechnology, including fermentation, genetics, and enzymology. Because the organization handled contract research, Wilson spent fixed periods working on several projects. "A lot of projects are three months; six months…A year is considered a long term project when you're in a company like that. So I got exposed to a lot of different aspects of industrial biotechnologies as a result."

After his time in contract research, Wilson left for a position as Director of Research and Development for an enzyme company. While there, he was contacted by a recruiter for Company Z and says,

> I heard about this opportunity and it all sounded vaguely, more than vaguely familiar. It sounded very familiar. And I realized when I saw the technology that was being developed, I really said 'It originated out of the company I used to work for.' At the time we first came in contact with each other I don't think either of us realized that connection, but we did [eventually].

He also notes that the position at Z is intellectually challenging. He believes that working to produce chemicals, rather than enzymes, is professionally rewarding. Working with a fermentation process that requires balancing of several different enzyme activities is more stimulating than his previous research and development work. "So this is more, like I said, more intellectually interesting problems to solve. And I was familiar with it. And I saw the technology portfolio and it was very interesting."

The Road to Company Z

After initial contact from the recruiter, Wilson had a number of telephone and teleconference interviews. Once they established a mutual interest, Wilson travelled to Lexington to meet the CEO. He requested to meet in Lexington, rather than California, because he wanted to see the facility and meet the team. He admits that he was living in Florida at the time and "Florida is a great place to vacation. I'm not sure it's a great place to live." Lexington, on the other hand reminded Wilson of the Midwest, where he was raised, and he liked the community.

Another factor that influenced Wilson's decision to join Company Z was the strength of the technology and the organization. He indicates that he came to Z because he was impressed initially with the technology and had the appropriate background.

> You know I came here with a lot of experience. I mean [that is] one of the reasons they hired me, because I had experience in a broad range of commercial industrial biotechnology. I had worked for companies that had produced in and had large scales and their commercial scale. We had a complete supply chain for producing products by fermentation. So I knew what it took to get the job done. Although our team was small, we made some key hires, hires in all of the key areas.

He indicates that the CEO is skilled at finding consultants that could "fill in the gaps." He notes that when funding only allows for a small team, "We can't hire everybody…you need to work with people on the outside." In addition to consultants identified by the CEO, Wilson has relationships with many consultants, as well. "We have a good team of hardworking, motivated, smart people here that know how to get the job done."

Finding the Appropriate Technology, Environment, and Ecosystem

Wilson believes his position is "the best job I've ever had". He admits that it comes with challenges, "but the challenges are what make the work interesting." He argues that in the industrial biotechnology field, it is important to understand the limits of

technology. “There are a lot of companies out there that have said they were gonna change the world and they’re not quite meeting expectations right now. And that’s kind of put a black eye on the industry to some extent.” He asserts that what Company Z does right, is that it remains modest in terms of technology expectations. He adds that it is important to “underplay” rather than “overplay” capabilities. “We’re not out there promising things that we don’t think can be done.”

He argues that in the biotechnology industry, “The ones [firms] that make the headlines are the ones that have not delivered, and I would say there a few highly visible cases where the expectations have not been met.” However, overall, companies approach technological value from the perspective of “Let’s do something that we believe in that can be met.” He notes there are a few examples of biofuel or renewable energy technologies where, “I think they actually thought that they could do what they wanted to do, but then reality set in.”

Wilson believes the key to success in science and technology fields is to assess situations, make balanced decisions concerning challenges, and follow through with an action plan.

> Do we go ahead and revise our plan and push out our timelines and increase the cost of development or do we–? Well, basically, we have to go over those decision points. We either go ahead with the increased time and effort that develops going ahead, or do we have the *no-go* decision and say, ‘Okay, this is more difficult than we thought it was gonna be? Is it worth pursuing?’

Wilson indicates that go or no-go decisions are imperative to success. At the USO, he and the team make those kinds of decisions frequently.

> It all depends on a lot of different factors: What is the newly assessed probability of success; and what is the commercial value of the technology? If you were working on something that is a small niche market and you thought it was gonna be easy and it turned out not to be easy, you probably would say, ‘Nah, there’s not

> enough market incentive to continue with this.' But if it's a huge market and there's a big reward at the end if you are successful; if it's not deemed to be impossible you might go ahead and do it.

Company Z has been at several of these decision points and Wilson feels that the no-go decisions are generally easier to make. At the same time, there have been instances where it would have been easier to say, "No-go", but the team has pushed ahead.

> Let's say we have not given up on something that was a really-something that was when it's successful, it will be–really be a lucrative product. When we have made no-go decisions, it was because, 'This is more difficult that we thought it was and it's in the niche market.' We've run across some technically challenging things that are more than the niche market opportunities, so we made the go decision. Now if we had made the no-go decision then, now [presently] we would say, 'Gee Whiz, we did do the right thing!'

It all comes down to risk analysis. If the reward could be greater, there is a tendency to take more time considering a go/no-go decision point. Determining potential reward is also a complicated process. Wilson indicates that, in that case, the strength of the team is essential.

> [Company Z's CEO] is really good at identifying good consultants. And we have a number of consultants from the industry that have been in the industry for a long period of time, know the industry. Not only what the industry wants today, but what the industry may want in the future, and how our technologies can provide those things.

For example, Wilson suggests that when the current market opportunity for the product is low, but Company Z has the ability to bring down the price significantly, the market opportunity can increase. Technology Z's success is based upon solid market analysis. "So when I say something has a huge market opportunity it may not be the current market opportunity but it's a perceived future market opportunity. So it could be a blockbuster."

In terms of location, Wilson feels that if there is any drawback, it is "immediacy." There are times when a question arises and, because of the time difference in locations,

contacting the CEO is not feasible. Most communication is electronic. "Ninety-five percent to ninety-nine percent of the time, that's sufficient. But the one thing I do miss is, like when I worked in places where everybody was in one location, you could, you know, go to lunch with people [or] talk in the hallways." Currently discussions must take place over the phone or in meetings. "It doesn't get done by osmosis, but it does if you're all in one place." Wilson suggests, though, that being "forced" to make a call or send an e-mail "requires more focus." Therefore, communications tend to be more specific and clear than a chat in the hallway.

Wilson includes, among Company Z's greatest accomplishments, its development progress.

> We've taken technology that was developed in the laboratory, brought it to commercial, not only to commercial viability, but all the way up to commercial manufacturing and sales. When it comes to producing [Company Z's product] we're the only company that has any products that are being manufactured at that scale and being sold. So I think that's a pretty significant accomplishment. We, you know, we accomplish it with a pretty small team and then fairly short period of time. So I think that's something we can all be pretty proud of.

Product manufacturing is outsourced. Because of a non-disclosure agreement, Wilson could not reveal where it takes place, other than to say, "We work with contract manufacturing companies and organizations. Well, we have worked with people in the country and worked with people outside the country. I can't tell you who they are." He indicates that when producing products at a 50,000 a year scale, a large facility is required. "A fermentation plant, a fully capable fermentation plant, would cost tens of millions of dollars to build. We intend to have our own manufacturing facility at some point, but when you're first starting out that's an awful lot of expansion."

Producing Company Z's products can be challenging. Although Wilson had experience, it was "mostly technical." He insists that the logistics and regulatory details were new to him and he was surprised by the level of details.

> I have much greater respect for the VP of manufacturing that I used to work with. Not that I didn't respect him in the past, but when I realize now all the things that he did, I even have more respect for him! Because there's a lot of details that go into that to make it all work. [It] requires a significant attention to detail and obviously [to] make the effort in a lot of different areas. So one of the biggest challenges is, I would say, is getting that all together and in a cohesive fashion that all the pieces fit together well.

UK and the Technology Transfer Process

Wilson admits that he has never really had direct contact with the university. He states that collaboration with UKCED is most important when a company is "first starting out and that was before I came." He says the CEO "did a lot of that initial leg work, I guess. And [the CEO] used to be the primary point of contact with the patent process. I mean we still communicate with them, but it's not like it's vital to the conduct of the business."

Company Z and Funding

In addition to its general development progress, Company Z has amassed the greatest amount of funding of the three USOs identified. Since 2005, Z has secured approximately $33.5 million in funding. In its initial seed round, Z received almost $3 million. The Series A round was led by the Bluegrass Angels. In 2007, Company Z went through a Series B round, in the form of a convertible note, worth $3.35 million. That round was backed by a global food and beverage conglomerate, based out of London, England, and Tech Coast Angels. Series C funding added an additional $9 million in early 2010. It was backed by two venture capital firms, as well as the London-based

Corporation. In March 2012, a venture capital firm's subsidiary invested $13.5 million. The subsidiary led an $18.5 million Series D financing round, joined by the investors involved in the Series C round. (Interview G, 2012; Company Z website, 2012). In addition to the Series D financing, Company Z acquired state incentive funds to create 14 new positions. It cannot be classified as "a success", however, because no investors have seen a return (Interview I, 2012).

Growth and Economic Development

Company Z is "probably the farthest down the road in terms of developing into a good sized business. That's where the [hypothetical] 300 jobs become 3,000 jobs. You get all of the companies that started seven or eight years ago to get to the stage where [Company Z] is now, and you begin to have multiplier effects in terms of employment (Interview I, 2012)." Although Z manufactures and sells its products, Wilson indicates, "We still consider ourselves an early-stage company…developing our initial pipeline of products." Before investigating the development of a manufacturing facility, Z must find out how widely its products are embraced by the industry, and how economically the products can be manufactured.

Company Z recently distributed a press release announcing that it would be hiring for several positions at its Lexington location (with the assistance of the state's incentive funds). Each technology transfer officer and investor that participated in this study mentioned the press release as a promising sign for UK's TBED enterprise. When asked to discuss the positions in terms of qualifications, Wilson states,

> There are whole different levels. Some of the positions are a Ph.D. and experience on top of that. And there's our entry level positions that are a bachelor's-with just a bachelor's degree. Some are even non-degree positions. So they cover the whole range. Well, I mean, like I said, our new hires encompass that entire range. But

> the majority of those jobs do require a degree-and most of the positions that we are currently looking at now [require advanced education] because they have some pretty specific needs. As I said, some of the positions are pretty high-level jobs, and you know a Ph.D. with 10 years of experience, for example. That's a good job I'd say….highly technical position, and we have several of those.

In regard to the number of "high level" positions compared to entry-level positions,

> So we've, if you look at our current hiring plan, out of those 14 people I would say seven or eight of them are Ph.D.s plus experience. And most of the rest require a bachelor's or master's degree, and a couple of them are technical positions.

Concerning employment needs beyond the current hiring plan,

> And we need media makers, dishwashers, glassware washers, media preparers, and people that help out. And so those positions, like I say, don't even really require a degree. Sometimes we've got people that work part-time who are going to school, going to college, for example.

Company Z anticipates continued growth. Wilson states that Coldstream has been a satisfactory location for operations. When asked if there are plans to remain in Lexington, for example if Z moves forward to construct a manufacturing facility, he does not want to speculate. He feels the company is still too young and there are too many unknown variables. Company Z's market success and profitability are the primary variables considered in terms of growth. Any economic development in the region is ancillary. The cross-country split of the executive team implies that, at least from the CEO's perspective, a Lexington location is not fundamental for success.

CHAPTER 6: DISCUSSION AND CONCLUSION

The objectives of this study are to address five interrelated questions concerning the University of Kentucky's approach toward a program for technology based economic development. UK was chosen for the study based on its characteristics as a mid-level performer, based on contemporary standards of measurement, in terms of technology transfer. Moreover, as a public institution, the University of Kentucky is faced with a number of variables that many of the top performing institutions are not. Those include a land grant and flagship heritage, access to funding, and collaborative connections to state and local government. The majority of previous studies concerning university technology transfer address private, highly ranked, strong performers. In addition, UK has undergone administrative changes in recent years, which based upon the results of this research, have influenced its TBED enterprise in various ways. The level of influence appears dependent upon the nature of the relationship with UKCED. The following section addresses the study's research questions individually, in the hope that a broad understanding of the case will be reached. As noted throughout, the study is intrinsic, and not meant for generalization. Because intrinsic studies allow the reader to draw his/her own conclusions, this section is intentionally brief. The discussion is not meant to encompass the large number of possible interpretations. The findings may have implications for future areas of study.

Question 1: How can the organizational structure of the TBED enterprise at the University of Kentucky be described?

The nature of the TBED enterprise is farther reaching than the technology transfer operation, itself. As Geiger and Sá suggest, technology transfer activities are linked to the

private sector, directly or indirectly. Examples of technology transfer operations often include discussions of patenting and licensing. University spinoffs have emerged as a "distinct sector of technology transfer, one that largely complements and amplifies university patenting and licensing (p. 134)." Although directly connected to patenting and licensing, spinoffs require a greater amount of work than license execution (2008). UKCED's description of the intellectual property process suggests a much more straightforward process than what actually occurs. UKCED's *Intellectual Property Overview* indicates that researchers submit their disclosure(s), work with the Intellectual Property Development Office and present the disclosure to the IP committee. A brief paragraph at the top of the UKCED IP development website, states that UKCED will,

> Protect IP through patenting, and develop the IP into useful technologies and products to benefit the public through licensing. In addition, UK inventors, their departments and their colleges benefit from royalty sharing. Inventors can further develop their IP by licensing their own startup company (UKCED, 2012 b).

However, participants' discussions of the number of organizations and partnerships involved, indicate a much more intricate and difficult road from disclosure to spinoff. In addition, personnel continue to change strategies as they learn. Establishing structures takes time, but the inherent nature of government and institutional structures and partnerships is that they continue to evolve. For UKCED, that involves its own evolutionary nature, a number of local and state organizations, as well as private individuals and corporations.

Question 2: From an organizational perspective, what are the goals of UK's TBED enterprise, as perceived by affiliated professionals?

The primary goal when President Todd created UKCED was job creation. Several considerations within this study take into account economic development as the

principal goal. As President Todd demonstrated in his strategic and business plans concerning the Top 20 Compact, several strategies and measures must be in place, in order for a diverse organization to meet a goal. In this case, individuals and groups relayed their own stakes in the effort. For the Office for Commercialization and Development, the primary goal was establishing a foundation for economic development by creating the necessary infrastructure. For the Bluegrass Angels, the goal was to see returns on investments, which could lead to economic development. Finally, for USO personnel, the goal was to operate successful companies. Although one USO officer had personal feelings about economic development, it was in opposition to outsourcing overseas, as opposed to local job creation.

The majority of participants saw job growth as a long-term, auxiliary outcome of other accomplishments. This was contradictory to the way that TBED was marketed by the university. It also begets a *chicken or egg* type scenario. The premise of much of the actions of parties involved was that, given the proper environment, job growth would occur. However, as seen in many of the technology clusters, the environment may also be a consequence of economic development.

In some ways, considering a climate for economic development is analogous to considering the viability of an intellectual property disclosure. One must consider, 'Is it novel-solving a problem and is the solution unique?' ' For UK, as a relative latecomer to the technology based economic development enterprise, it seems that the approach is not unique. It could address a problem, but it is not directly addressing the state's economic problems today. 'Does the team work together well and represent expertise in the field?' UKCED's professional staff, as well as the USO

officers, appears to work well together and, overall, to represent certain levels of expertise. The Angels, however, readily admit that they are not venture capitalists. They do not have the same level of financial expertise or access to capital. As an initial link between UKCED technologies and USO viability, their limitations appear significant. 'Are the timeframes realistic?' No timeline was set. As UKCED personnel suggested, the public is impatient, but economic development initiatives take time. The amount of time is unclear. 'Is the market overcrowded?' The answer, concerning the number of alternative communities with similar programs, is yes. As of 1994, eight years prior to the establishment of UKCED, 1,056 such organizations existed in the United States (Cohen, Florida, & Goe, as cited in Yusuf & Nabeshima, 2007). These answers indicate that, even with an entrepreneurial climate, the University of Kentucky and the city of Lexington may not meet be able to meet the specific needs of technology firms. Even if they can, there is little impetus to choose UK or Lexington over the large number of options available.

Question 3: What are the challenges to the TBED enterprise's goals, as perceived by affiliated professionals?

A number of participants referenced a lack of resources as a challenge to goals. Resources, in this case, generally included funding, buy-in, and talent or expertise. However, while the groups were working directly or indirectly to affect economic development, it was rarely mentioned as an immediate goal. This could relate to St. John and Parson's argument about the "pervasive role of…self-interest and political ideology in policy development (p. 19)." Although their argument concerns federal policy, it appears appropriate in reference to some institutional policies, as well. They

suggest that uniform theories concerning policy development may be impossible achieve. Policy decisions are often influenced by areas like educational research and economic theories, but informed by political ideology (2004).

Several participants in this study, who understood that the primary goal of UKCED was specified as job creation; continued to reference economic development from a *trickle down* perspective. Three participants mentioned the influence a small number of high tech positions could have on the economy, indicating that those individuals will have expanded purchasing power (Interview C, Interview E, Interview F; 2012). Only one participant believed that the economic development argument was largely influenced by political ideology (Interview B, 2012). When asked about job creation, as one Angel responded, "I mean I think a lot of these ideas – they – it's hard to argue with them because they seem to make sense (Interview A, 2012)."

This comes back to the argument that, overall, the groups did not subscribe to a specific rationale for their involvement. Technology transfer personnel discussed the importance of economic development as an institutional goal. Angels discussed economic growth as an important offshoot of their activities, but did not implement a system to achieve it, likely, because their primary goal was to see returns. Finally, USO personnel seemed to have little concern for local economic development initiatives. The basis for state matching programs was to encourage companies to remain in, or relocate to, Kentucky. Yet the primary ambition of the USO personnel was to manage a successful firm. However, all of these individuals and groups comprise UK's technology based economic development network.

Question 4: What goals have been achieved by the TBED enterprise, as perceived by affiliated professionals?

Achievements of individuals and groups were also not specific to job creation. Based upon affiliation, individuals indicated a range of accomplishments. Technology transfer personnel suggested accomplishments related to establishing a foundation for TBED in the state, organizing groups, and streamlining processes. Angels' accomplishments were generally personal or financial. Although one Angel indicated that he was "proud" that the group rarely invested in companies outside of the region, he was clear that state tax incentives were a persuasive factor (Interview E, 2012). Finally, the majority of USO personnel achievements fell within the realm of business development, including technology and process improvements. Accomplishments outside of business enhancement were related to areas such as team building and personal achievements. None of the participants indicated that they had achieved significant job growth.

Question 5: What factors, as perceived by affiliated professionals, have influenced challenges and achievements to the TBED enterprises' goals?

Concerning challenges to attainment of goals, technology transfer personnel cited a change in administrative goals, insecurity about the future of the organization, and a lack of infrastructure. Angel investors referenced different administrative priorities within UK, the economic recession, and lack of input with USOs as factors that led to challenges. Of the three groups, the Angels appeared most effected, in terms of morale, by President Todd's retirement. That could be because in their discussions of Todd, they seemed to view him as a model for faculty entrepreneurs. From their perspectives, he was the ultimate academic turned entrepreneur, and represented their understanding of the

investment opportunities that should emerge from the university. Finally, USOs, overall, referenced funding opportunities and lack of experience with specific procedures as contributing to challenges.

As far as influences on accomplishments, each group, sighted influences based upon its own interpretation of essential goals. TT personnel indicated the existence of strong networks and teams in helping to build infrastructure. Angels suggested their personal financial influences on the economic environment in Kentucky. Finally, USOs, like technology transfer personnel, considered factors like solid teams and collaboration as contributing to their successes. This could be partly because, as part of a large institution, UKCED officers were provided with objectives from upper level administrators. USO officers had guidelines to follow, such as traditional business plans or procedures. The Angels, on the other hand, were persuaded largely by personal financial objectives, which can make group goal setting and achievement complicated.

Conclusion

Overall, this study indicates that UK's TBED enterprise consists of complex network of loosely and tightly affiliated individuals and groups. Members of the network have some common and disparate goals. Aside from varying group priorities, individuals suggest different goals, as well. This is particularly the case for private investors and entrepreneurs. The study also provides some areas of interest for future research. Spinoff funding appears to be a major challenge. A more detailed look at the investment community could provide insight into spinoff funding, in terms of the rationales and decision-making processes of investors. Moreover, it would be exciting to pursue the concept of ideology and its impact on technology transfer. Many of the participants in

this study expressed conservative viewpoints. Only one, a technology transfer officer, expressed a different perspective. It could be beneficial to gain a greater understanding of the influence that ideological outlooks have on the priorities and interactions of groups involved in technology based economic development.

Appendices

Appendix A: Legend for Oral History Interviews

Interview A: Personal Communication with Investor: Randall Booker* November 6, 2012

Interview B: Personal Communication with Technology Transfer Officer Dave Richardson*: October 22, 2012

Interview C: Personal Communication with Technology Transfer Officer: Terry Atkinson* November 3, 2012

Interview D: Personal Communication with University Spinoff Officer Mark Brown*: October 18, 2012

Interview E: Personal Communication with Investor: Gary Chiles* October 9, 2012

Interview F: Personal Communication with Investor: Rob Ellison October 28, 2012

Interview G: Personal Communication with University Spinoff Officer Doug Wilson*: October 30, 2012

Interview H: Personal Communication with University Spinoff Officer Andrew Stone*: November 2, 2012

Interview I: Personal Communication with Technology Transfer Officer: Roger Kemp* October 4, 2012

Interview J: Personal Communication with Technology Transfer Officer: November 14, 2012: Roger Kemp*

*For narrative purposes, the participant has been referenced throughout the study by this pseudonym.

Appendix B: Text of Introductory E-mails to Sampling Frame/ Invitations to Participate in the Study: Entrepreneurs/Investors

Dear [Prospective Participant],

[Gatekeeper/and or Intermediary], with [Organization], referred me to you. I am a PhD candidate in Educational Policy Studies and Evaluation at the University of Kentucky, and [Gatekeeper and/or Intermediary] suggested you as a possible resource for my dissertation study. My dissertation attempts to gain a deeper understanding of factors that influence university spin-off development. As a part of my study, I am asking individuals connected to that process to answer some broad questions regarding their experiences.

Would you be interested in speaking with me and answering some of my questions? The timeframe is generally an hour. If so, could you let me know of some times that you may be available in the near future? Also, please do not hesitate to contact me if you have any questions/concerns regarding my study. Thank you for your time, and have a great day.

Best,

Tara K. Baas, M.S.Ed
PhD Candidate
Educational Policy Studies and Evaluation
University of Kentucky
Tara.Baas@uky.edu
Phone: [xxx-xxx-xxxx]

Appendix C: Text of Introductory E-mails to Sampling Frame/ Invitations to Participate in the Study: Technology Transfer Personnel

Dear [Prospective Participant],

[Gatekeeper/and or Intermediary], with [Organization], referred me to you. I am a PhD candidate in Educational Policy Studies and Evaluation at the University of Kentucky, and [Gatekeeper/and or Intermediary] suggested you as a possible resource for my dissertation study. My dissertation attempts to gain a deeper understanding of factors that influence university spin-off development. As a part of my study, I am asking individuals connected to that process to answer some broad questions regarding their experiences.

Would you be interested in speaking with me and answering some of my questions? The timeframe is generally an hour. If so, could you let me know of some times that you may be available in the near future? Also, please do not hesitate to contact me if you have any questions/concerns regarding my study. Thank you for your time, and have a great day.

Best,

Tara K. Baas, M.S.Ed
PhD Candidate
Educational Policy Studies and Evaluation
University of Kentucky
Tara.Baas@uky.edu
Phone: [xxx-xxx-xxxx]

Appendix D: Text of Introductory E-mails to Sampling Frame/ Invitations to Participate in the Study: USO Officers

Dear [Prospective Participant],

[Gatekeeper/and or Intermediary], with [Organization], referred me to you. I am a PhD candidate in Educational Policy Studies and Evaluation at the University of Kentucky, and [Gatekeeper/and or Intermediary] suggested you as a possible resource for my dissertation study. My dissertation attempts to gain a deeper understanding of factors that influence university spin-off development. As a part of my study, I am asking individuals connected to that process to answer some broad questions regarding their experiences. As part of that effort, I hope to look specifically at a few technology companies, in order to gather more in-depth data concerning their unique circumstances.

Would you be interested in speaking with me and answering some of my questions? The timeframe is generally an hour. If so, could you let me know of some times that you may be available in the near future? Also, please do not hesitate to contact me if you have any questions/concerns regarding my study. Thank you for your time, and have a great day.

Best,

Tara K. Baas, M.S.Ed
PhD Candidate
Educational Policy Studies and Evaluation
University of Kentucky
Tara.Baas@uky.edu
Phone: [xxx-xxx-xxxx]

Appendix E: IRB Exemption Certification

UK
UNIVERSITY OF
KENTUCKY

Office of Research Integrity
IRB, IACUC, RDRC
815 Kinkead Hall
Lexington, KY 40506-0057
859-257-9428
fax 859-257-8995
www.research.uky.edu/ori/

EXEMPTION CERTIFICATION

MEMO: Tara Beaz, MSEd
126 Shady Lane
Lexington, KY 40505
PI phone #: (859)230-0305

FROM: Institutional Review Board
c/o Office of Research Integrity

SUBJECT: Exemption Certification for Protocol No. 12-0349-X4B

DATE: June 25, 2012

On June 19, 2012, it was determined that your project entitled, *The Public Research University in the 21st Century: A Case Study of Technology Based Economic Development Initiatives*, meets federal criteria to qualify as an exempt study.

Because the study has been certified as exempt, you will not be required to complete continuation or final review reports. However, it is your responsibility to notify the IRB prior to making any changes to the study. Please note that changes made to an exempt protocol may disqualify it from exempt status and may require an expedited or full review.

The Office of Research Integrity will hold your exemption application for six years. Before the end of the sixth year, you will be notified that your file will be closed and the application destroyed. If your project is still ongoing, you will need to contact the Office of Research Integrity upon receipt of that letter and follow the instructions for completing a new exemption application. It is, therefore, important that you keep your address current with the Office of Research Integrity.

For information describing investigator responsibilities after obtaining IRB approval, download and read the document "PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research" from the Office of Research Integrity's Guidance and Policy Documents web page [http://www.research.uky.edu/ori/human/guidance/ori_Policy.htm]. Additional information regarding IRB review, federal regulations, and institutional policies may be found through ORI's web site [http://www.research.uky.edu/ori/]. If you have questions, need additional information, or would like a paper copy of the above mentioned document, contact the Office of Research Integrity at (859) 257-9428.

Appendix F: Copy of Informed Consent Form

Consent to Participate in a Research Study

The Public Research University in the 21st Century: A Case Study of Technology Based Economic Development Initiatives (Working Title)

WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH?

You are being invited to take part in a research study about the efforts of public research universities to enhance economic development. If you volunteer to take part in this study, you will be one of about 10 people to do so.

WHO IS DOING THE STUDY?

The person in charge of this study is Tara Baas, a PhD student at the University of Kentucky, in the Department of Educational Policy Studies and Evaluation. She is being guided in this research by *Drs. Alan J. DeYoung and John R. Thelin.*

WHAT IS THE PURPOSE OF THIS STUDY?

By doing this study, we hope to gain greater insight into the efforts of public flagship universities to enhance state or regional economic development.

ARE THERE REASONS WHY YOU SHOULD NOT TAKE PART IN THIS STUDY?

You should not take part in this study if you feel that answering questions regarding your experiences would cause excessive emotional or physical stress.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted at your office at the University of Kentucky. The interviewer will need to come to your office approximately one (1) time during the study. Each visit will take about one hour. The total amount of time you will be asked to volunteer for this study is up to your discretion over the next six (6) months.

WHAT WILL YOU BE ASKED TO DO?

You will be asked to provide an oral history of your experiences related the University of Kentucky's Office of Commercialization and Economic Development.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

To the best of our knowledge, the things you will be doing have no more risk of harm than you would experience in everyday life.

You may find some questions we ask you to be upsetting or stressful. If so, we can tell you about some people who may be able to help you with these feelings.

In addition to the risks listed above, you may experience a previously unknown risk or side effect.

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?

You will not get any personal benefit from taking part in this study.

DO YOU HAVE TO TAKE PART IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?

If you do not want to be in the study, there are no other choices except not to take part in the study.

WHAT WILL IT COST YOU TO PARTICIPATE?

There are no costs associated with taking part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You will not receive any rewards or payment for taking part in the study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE?

We will make every effort to keep private all research records that identify you to the extent allowed by law.

Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be identified by name. You will be assigned a random number connected to your oral history. The number will be linked to a general description of your position in an appendix. As an oral history/case study, you may be indirectly identifiable in these written materials, based on the description of your position. We may publish the results of this study; however, we will keep your name private. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. A digital recording of your oral history will be saved by the primary investigator on a password-protected computer for six years after the completion of the study. At the conclusion of six years, the recording will be erased/destroyed.

We will keep private all research records that identify you to the extent allowed by law. However, there are some circumstances, in which we may have to show your information to other people. We may be required to show information, which identifies you, to people who need to be sure we have done the research correctly; these would be people from such organizations as the University of Kentucky.

CAN YOUR TAKING PART IN THE STUDY END EARLY?

If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. You will not be treated differently if you decide to stop taking part in the study.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Tara Baas at Tara.Baas@uky.edu. If you have any questions about your rights as a volunteer in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. We will give you a signed copy of this consent form to take with you.

WHAT ELSE DO YOU NEED TO KNOW?

This study is being conducted as part of the requirements of the primary investigator, Tara Baas, to complete the PhD. Degree. No other individuals (besides the dissertation advisory committee), institutions, or companies are involved in the study through funding, cooperative research, or by providing supplies or equipment

_____ _____

Signature of person agreeing to take part in the study Date

_____

Printed name of person agreeing to take part in the study

_____Tara Baas_____ _____

Name of [authorized] person obtaining informed consent Date

Appendix G: Basic Interview Script for Entrepreneurs/Investors

Oral History Interview Script for Investors *

Provide Informed Consent for Signature & ask again for permission to record

1. Describe purpose of study.
2. I'd like to start by learning more about how you came to be in this position. I've reviewed your biosketch (if applicable), but can you tell me briefly about your background and interest in the Angels and how you were recruited?
3. How would you describe the investment process-presentation, discussion, decision?
4. I understand that the Top 20 plan was part of the impetus for creating CED. Can you tell me if/how it has influenced any investments?
5. From an administrative perspective, I understand that the explicit expectations for UKCED were job creation. Is that a consideration for the investment group, as well?
6. Are you familiar with any of the results of investments, in terms of job creation?
    a. Tech jobs
    b. Mid-level
    c. Entry-level
7. Have expectations/processes changed now that UK has a new president/has made administrative changes?
8. The successes of technopoles like Route 128, Silicon Valley & Research Triangle are relatively well known. As the investment process has developed, did other institutions serve as models/influences for your decisions?
9. What would you consider some of the major accomplishments/outcomes associated with the Bluegrass Angels and UKCED-what factors influenced those outcomes?
10. I assume that there have also been challenges to the achievement of these goals. Could you talk to me about some of the hurdles investors have faced? What factors would you attribute to these challenges?
11. What are the qualities/characteristics that you find attractive in a start up-in terms of investment?
12. What are the qualities/characteristics that are less appealing for a start up-in terms of investment?
13. Re Spinoff Sample: What can you tell me about Case(s) x, y, & z?
14. Are you aware of any additional individuals I could speak with or documents I could review to shed further light on our discussion?

**During the interview, follow up questions to clarify responses or further explore respondents' statements may be utilized. The oral history script for this study is*

purposely broad and flexible for two reasons. First, it seeks to obtain the unique experiences of individuals' involvement in these processes through broad, extensive, and interpretive answers. Second, as an exploratory and descriptive study, it seeks to elicit information that may not be available in the current research literature. Using examples for reference, as opposed to offering choices/options for responses, allows new information to surface, when applicable.

Appendix H: Basic Interview Script for Technology Transfer Personnel

Oral History Interview Script for Departmental Personnel-UK Office of Commercialization & Economic Development/Technology Transfer*

Provide Informed Consent for Signature & ask again for permission to record

1. Describe purpose of study.
2. I understand that the Top 20 plan was part of the impetus for creating this office. Can you tell me if/how the Top 20 plan influenced the development of your office?
3. From an administrative perspective, what are the explicit expectations for UKCED? Have you noticed/had any experiences with informal/implicit expectations?
4. Have expectations or operations changed now that UK has a new president/has made administrative changes?
5. What do you consider some of the major accomplishments/outcomes associated IP development?
6. I assume that there have also been challenges to the achievement of these goals. Could you talk to me about some of the hurdles your office has faced? What factors could be attributed to them?
7. The successes of technopoles like Route 128, Silicon Valley & Research Triangle are relatively well known. As the TT office has developed, did other institutions serve as models for the organization?
8. We've reviewed major accomplishments and challenges. Reflecting upon those, have you found the need to revise some of your original strategies or expectations for UKCED, or your position in particular?
9. Re Spinoff Sample: What can you tell me about Case(s) x, y, & z?
10. Are you aware of any documents I could review or individuals I could speak with that could shed further light on our discussion?

**During the interview, follow up questions to clarify responses or further explore respondents' statements may be utilized. The oral history script for this study is purposely broad and flexible for two reasons. First, it seeks to obtain the unique experiences of individuals' involvement in these processes through broad, extensive, and interpretive answers. Second, as an exploratory and descriptive study, it seeks to elicit information that may not be available in the current research literature. Using examples for reference, as opposed to offering choices/options for responses, allows new information to surface, when applicable.*

Appendix I: Basic Interview Script for USO Personnel

Oral History Interview Script for USO Personnel*

Provide Informed Consent for Signature & ask again for permission to record

1. Describe purpose of study.
2. I'd like to start by learning more about how you came to be in this position. I've reviewed your biosketch (if applicable), but can you tell me briefly about your background and how you came to be in this position?
3. The backgrounds of innovations are often unique. Can you tell me about the research that led to this discovery?
4. What was the IP disclosure process like? What interactions did you have with UKCED staff?
5. What processes have occurred during the development stage, thus far? For example, with whom have you interacted, what have been your impressions of interactions with the technology transfer office?
6. What interactions, if any, have you had with the Angels and other investors?
7. What do you consider some of the major accomplishments/outcomes associated with the spinoff process, thus far? What factors would you attribute to them?
8. I assume that there have also been challenges related to the spinoff process. Could you talk to me about some of the hurdles you have faced? As with accomplishments, what factors would you attribute to them?
9. Are you aware of any documents I could review or individuals I could speak with that could shed further light on our discussion?

**During the interview, follow up questions to clarify responses or further explore respondents' statements may be utilized. The oral history script for this study is purposely broad and flexible for two reasons. First, it seeks to obtain the unique experiences of individuals' involvement in these processes through broad, extensive, and interpretive answers. Second, as an exploratory and descriptive study, it seeks to elicit information that may not be available in the current research literature. Using examples for reference, as opposed to offering choices/options for responses, allows new information to surface, when applicable.*

References

Association of University Technology Managers (AUTM) (2012). AUTM board of directors-missions and goals. Retrieved December 29, 2012 from http://www.autm.net/Mission_and_Goals/9885.htm

Awesome, Inc. (2012 a). About Retrieved November 6, 2012, from http://awesomeinc.org/about

Awesome, Inc. (2012 b). Events Retrieved November 6, 2012, from http://awesomeinc.org/Eventshttp://awesomeinc.org/Events

Babbie, E. (2008). *The basics of social research* (4th ed.). Belmont, CA: Thomson Wadsworth.

Bluegrass Angels, Incorporated (2009). Bluegrass Angels Retrieved November 6, 2012, 2012, from http://www.bluegrassangels.com/index.htm

Bluegrass Angels, Incorporated. (2012). *Minutes of November 5, 2012 planning meeting*.

Bluegrass Business Development Partnership. (2012). Bluegrass Business Development Partnership Retrieved October 12, 2012, from http://www.thinkbluegrass.com/index.php

Bok, D. (2003). *Universities in the marketplace: The commercialization of higher education.* Princeton, NJ: Princeton University Press.

Coldstream (2009). Available facilities: Coldstream research campus Retrieved October 2, 2012, 2012, from http://www.uky.edu/coldstream/available-facilities

Commerce Lexington, Inc. (2012). Greater Lexington Chamber of Commerce Retrieved November 12, 2012, from http://www.commercelexington.com/chamber

DeYoung, A., & Baas, T. (2012). Making the case for a strong research university: The University of Kentucky top-20 business plan. In G. Stanley, W. Bienkowsky & J. Brada (Eds.), *The university in the age of globalization: Rankings, resources, and reforms*: Palgrave-McMillan.

Fuqua, G. (2011). *2011 Annual report to Governor Steve Beshear, the Legislative Research Commission, and the Kentucky Innovation Commission pursuant to KRS154, 12-278* Frankfort, KY.

Ford, B. K., Shino, K. J., Sander, E., & Harden, J. M. (2008). SBIR and STTR programs: The private sector, public sector and university trifecta. *Journal of Research Administration, 39*(1), 58-80.

Geiger, R. L. (2006). The quest for 'economic relevance' by US research universities. *Higher Education Policy, 19*(4), 411-431.

Geiger, R. L. (2009). *Research and relevant knowledge: American research universities since World War II* (2nd ed.). New Brunswick, NJ: Transaction Publishers.

Geiger, R. & Sá, C. (2008). *Tapping the riches of science: Universities and the promise of economic growth*. Cambridge, MA: Harvard University Press.

Glesne, C. (1999). *Becoming qualitative researchers: An introduction* (2nd ed.) New York: Longman.

Glesne, C. (2006). *Becoming qualitative researchers: An introduction* (3rd ed.). Boston: Pearson Education, Inc.

Graham, H., & Diamond, N. (1997). *The rise of American research universities: Elites and challengers in the postwar era*. Baltimore: Johns Hopkins University Press.

Hedge, D. (2005). Public and private universities: Unequal sources of regional innovation? *Economic Development Quarterly, 19*, 15.

Hesse-Biber, S. N., & Leavy, P. (Eds.). (2006). *Emergent methods in social research*. Thousand Oaks, CA: Sage Publications.

Investopedia. (2013). Preferred Stock Retrieved November 6, 2012, 2012, from http://www.investopedia.com/terms/p/preferredstock.asp#axzz2IboYjDlX

Jackson, S., & Audretsch, D. (2004). The Indiana University Advanced Research and Technology Institute: A case study. *Journal of Technology Transfer* (29), 119-124.

Janesick, V. J. (2003). The choreography of qualitative research design. In N. K. Denzin & Y. S. Lincoln (Eds.), *Strategies of qualitative inquiry* (2nd ed., pp. 46-79). Thousand Oaks, CA: Sage Publications.

Kelly, R. (2013). Here are the 5 major stages of startup funding. *Rob D Kelly* Retrieved January 4, 2013, 2013, from http://robdkelly.com/blog/fundraising/5-stages-of-startup-funding/

Kentucky Cabinet for Economic Development. (2009). Kentucky SBIR-STTR Matching Funds Program Retrieved October 4, 2012, 2012, from http://thinkkentucky.com/dci/sbir/sbirsttr.aspx

Kentucky Cabinet for Economic Development. (2012). Who we are Retrieved October 23, 2012, 2012, from http://www.thinkkentucky.com/KYEDC/WhoWeAre.aspx

Kentucky Innovation Network. (2012). About Us Retrieved October 24, 2012, from http://kyinnovation.com/index.php/aboutus

Kyvig, D. E., & Marty, M. A. (2000). *Nearby history: Exploring the past around you* (2nd ed.). Oxford: AltaMira Press.

Lexington Venture Club. (2012). Celebrating the disco stars of our startup community (Office for Commercialization and Economic Development, Trans.): University of Kentucky

Lowen, R. (1997). *Creating the Cold War university: The transformation of Stanford.* Berkeley: University of California Press.

Marginson, S. (2007). The public/private divide in higher education: A global revision. *Higher Education, 53*(3), 307-333.

Martin, M., Gruetzmacher, R. R., Lanham, R., & Brady, J. (2004). Assessing technology transfer and business development potential: Technology cluster analysis. *Economic Development Quarterly, 18*(2), 168-173.

Maxwell, J. A. (1996). *Qualitative research design: An interactive approach*. Thousand Oaks, CA: Sage Publications.

Mendoza, P., & Berger, J. P. (2005). Patenting productivity and intellectual property policies at research I universities: An exploratory comparative study. *Education Policy Analysis Archives, 13*(5), 1-22.

Mowery, D., Nelson, R., Nelson, B., & Ziedonis, A. (2004). *Ivory tower and industrial innovation: University-industry technology transfer before and after the Bayh-Dole Act.* Stanford, CA: Stanford University Press.

National Research Council, The (2010). *Managing university intellectual property in the public interest.* Washington: The National Academy of Sciences.

Pirnay, F., Surlemont, B., & Nlemvo, F. (2003). Toward a typology of university spin-offs. *Small Business Economics*(21), 355-369.

Securities and Exchange Commission. (2012). Accredited investors Retrieved November 7, 2012, 2012, from http://www.sec.gov/answers/accred.htm

St. John, E. P. & Parsons, M. D. (Eds.). (2004). *Public funding of higher education: Changing contexts and new rationales*. Baltimore.

Stake, R. E. (2008). Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Strategies of Qualitative Inquiry* (3rd ed., pp. 119-151). Thousand Oaks, CA: Sage Publications, Inc.

The Center for Measuring University Performance. (2011). The top American research universities: 2011 annual report. Tempe, AZ: Arizona State University.

Thorp, H., & Goldstein, B. (2010). *Engines of innovation: The entrepreneurial university in the twenty-first century*. Chapel Hill, NC: The University of North Carolina Press.

Turk-Bicakci, L., & Brint, S. (2005). University-industry collaboration: Patterns of growth for low- and middle-level performers. *Higher Education, 49*(1 of 2), 61-89.

UKCED. (2012 a). Eleven UK-affiliated high tech small businesses receive $3.7 million in state matching funds. *ECONDEV* Retrieved October 28, 2012, from http://www.uky.edu/econdev/eleven-uk-affiliated-high-tech-small-businesses-receive-37- million-state-matching-funds

UKCED. (2012 b). Technology transfer & intellectual property development: Protecting and commercializing innovations and technologies. *ECONDEV* Retrieved October 28, 2012, from http://www.uky.edu/econdev/econdev/faculty-staff- clinicians/intellectual-property-development

UKCED. (2012 c). Kentucky Technology, Inc.: Generating income to reinvest in university spinoffs. *ECONDEV* Retrieved January 7, 2013, from http://www.uky.edu/econdev/kentucky-technology-inc

UKCED. (2012 d). Leonard E. "Len" Heller, Ed.D. *ECONDEV* Retrieved October 4, 2012, from http://www.uky.edu/econdev/leonard-e-len-heller-edd

University of Kentucky. (2012 a). ASTeCC building Retrieved October 2, 2012 from http://www.uky.edu/Campus Tour/

University of Kentucky. (2012 b, November 21, 2012). Office of the President Retrieved December 3, 2012, 2012, from http://www.uky.edu/President/index.html

University of Kentucky. (2012 c). Pharmacy faculty-Joseph Fink - B.S.Pharm., J.D., F.A.Ph.A Retrieved January 1, 2013, from http://pharmacy.mc.uky.edu/faculty/JosephFink.php

United States Small Business Administration. (2012). SBIR/STTR frequently asked questions Retrieved November 7, 2012 from http://www.sbir.gov/faq/sttr#t2n66952.

Woodward, D., Figueiredo, O., & Guimarães, P. (2006). Beyond the Silicon Valley: University R&D and high-technology location. *Journal of Urban Economics, 60*, 18.

Yates, S. J. (2004). *Doing social science research* (2nd ed.): Sage Publications.

Yusuf, J.-E., & Fink III, J. L. (2007). Technology-based economic development: Connecting the research university and community leaders. *Applied Research in Economic Development, 4*(1), 95-105.

Yusuf, S., & Nabeshima, K. (Eds.). (2007). *How universities promote economic growth*. Washington, DC: The World Bank.

VITA

Tara K. Baas

Place of Birth: Louisville, Kentucky

Education

2007, M.S.Ed. University of Kentucky, Lexington, KY
Higher Education

2001, B.A. University of Kentucky, Lexington, KY
Political Science

Professional Experience

Research Assistant
Educational Policy Studies and Evaluation
University of Kentucky, Lexington, KY
2013-Present

Accreditation Manager
Graduate Medical Education
University of Kentucky, Lexington, KY
2012-2013

Research Assistant
Educational Policy Studies and Evaluation
University of Kentucky, Lexington, KY
2010-2012

Research Assistant
P-20 Innovation Lab for College & Career Readiness
University of Kentucky, Lexington, KY
2011

Instructor
Educational Policy Studies and Evaluation
University of Kentucky, Lexington, KY
2006-2010

Research Assistant
Educational Policy Studies and Evaluation
University of Kentucky, Lexington, KY
2008-2009

Academic Consultant
Office of Academic Enhancement

University of Kentucky, Lexington, KY
2006-2008

Program Coordinator
Center for Community Outreach
University of Kentucky, Lexington, KY
2005-2006

Pharmacy Business Analyst
Coventry Healthcare, Incorporated
Franklin, TN
2004-2005

Pharmaceutical Contract Analyst
Coventry Healthcare, Incorporated
Franklin, TN
2002-2004

Paralegal
Siebert and Johnson, PLLC
Louisville, KY
2001-2002

Peer-Reviewed Presentations

Bradley, K., Royal, K. Cunningham, J., Weber, J., Eli, J., **Baas, T**., & Harris, W. (2007) "A Consideration of Ethics, Methods and Theory: Is There Consensus on What Constitutes Good Education Research?" Paper presentation at Midwest Regional Educational Research Association annual meeting; St. Louis, MO.

Peer-Reviewed Publications

DeYoung, A. & **Baas, T**. (2012). "Making the Case for a Strong Public Research University: The University of Kentucky Top-20 Business Plan" in G. Stanley, W. Bienkowsky, & J. Brada, Editors, The University in the Age of Globalization: Rankings, Resources, and Reforms (Palgrave-MacMillan).

Awards and Recognition

2011-Present	*Member*, Omicron Delta Kappa Honorary Society
2011	*Selected Participant*, 32nd Annual ASHE Graduate Student Public Policy Seminar, Charlotte, NC
2011	*Recipient*, Edgar L. and Marilyn A. Sagan Fellowship,
2011	*Departmental Nominee*, UK Presidential Dissertation Fellowship
1996	*Recipient*, William B. Pegram Scholarship
1995	*Recipient*, University of Kentucky Academic Excellence Scholarship

Professional Affiliations and Service

2011-Present	*Member*, ASHE (Association for the Study of Higher Education)
2011- Present	*Member*, AEFP (Association for Education Finance and Policy)
2005-Present	*Member*, Central Kentucky Alpha Delta Pi Alumnae Association
2005-2006	*President*, Central Kentucky Alpha Delta Pi Alumnae Association
2004-2005	*Co-President*, Middle Tennessee Panhellenic Association
2003-2005	*Member*, Middle Tennessee Alpha Delta Pi Alumnae Association
2003-2005	*Advisor*, Zeta Rho Chapter of Alpha Delta Pi, Vanderbilt University