University Entrepreneurship: Context, Process and Performance

by

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<tr>
<td>AUCC</td>
<td>Association of Universities and Colleges of Canada</td>
</tr>
<tr>
<td>AURIL</td>
<td>Association for University Research and Industry Links</td>
</tr>
<tr>
<td>AUTM</td>
<td>Association of university technology managers</td>
</tr>
<tr>
<td>CBC</td>
<td>Conference Board of Canada</td>
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<tr>
<td>EE</td>
<td>Entrepreneurship Education</td>
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<td>EU</td>
<td>European Union</td>
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<td>FG-1</td>
<td>Entrepreneurial university model – first tier</td>
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<td>SG-2</td>
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<td>UG-3</td>
<td>Entrepreneurial university framework – general</td>
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<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>GEM</td>
<td>Global Entrepreneurship Monitor</td>
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<tr>
<td>GERD</td>
<td>Gross expenditure on research and development</td>
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<tr>
<td>HCR</td>
<td>High commercialization revenue (university)</td>
</tr>
<tr>
<td>HB</td>
<td>Hindle’s bridge</td>
</tr>
<tr>
<td>IP</td>
<td>Intellectual property</td>
</tr>
<tr>
<td>LCR</td>
<td>Low commercialization revenue (university)</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>NDA</td>
<td>Non disclosure agreement</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation &amp; Development</td>
</tr>
<tr>
<td>POC</td>
<td>Proof of concept</td>
</tr>
<tr>
<td>POM</td>
<td>Proof of market</td>
</tr>
<tr>
<td>SSTI</td>
<td>Semi structured interview</td>
</tr>
<tr>
<td>TGR</td>
<td>Total Gross Revenues from Commercialization</td>
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<tr>
<td>TTO</td>
<td>Technology transfer office</td>
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<tr>
<td>USO</td>
<td>University spin off</td>
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Thesis Abstract

Background and Motivation: This thesis was motivated by the findings of Moroz, Hindle, and Anderson (2007, p. 15) who, in studying a set of 37 North American Universities found no statistical correlation between research commercialisation success (in the form of university spin outs or USO) and whether or not they had an entrepreneurship curriculum. The only outstanding common feature of the ‘performers’ was the munificence of their resources: they were simply rich (as defined by total research expenditures) and tended to do everything well. The research commercialisation performance of this minority cohort (the ‘rich’ or ‘first tier’ universities) was very good on most measures and stood in sharp contrast to the very poor research commercialisation performance of the majority cohort (the ‘less rich’ or ‘second tier’ universities) (Moroz, et al, 2008). Accordingly it seemed reasonable to make some hypotheses worth testing. First, it seemed possible that currently prevailing research commercialisation systems (RCS) in both first and second tier universities were neither efficacious nor congruent with sound entrepreneurial theory and practice. Second, even if prevailing RCS at top tier universities were efficacious in their munificent context, the prevailing RCS of second tier universities (which were copies of the top tier RCS) might not be working because these systems were not appropriate or viable in a very different, non-munificent context. Finally, everything I read concerning ‘the entrepreneurial university’ and research commercialization in the university context made for an inconsistent, poorly evidenced and unconvincing literature. I decided that the entire area of research commercialisation at university needed deeper and wider investigation and thus this thesis was born.

The Research Problem and its Resolution: This project embraced empirical work that studied existing research commercialization systems (RCS) at both first tier and second tier universities, found them flawed and produced an
enhanced framework that is definitely applicable to second tier universities (the vast majority) and possibly applicable to first tier universities as well.

**Framing a Precise Unit of Analysis:** The establishment of ‘RCS’ as a precisely defined, clearly measurable unit of analysis was difficult. The task was bedevilled by an ambiguous and confusing literature based on the hazy concept of 'the entrepreneurial university'. Using a systems perspective, I explored this notion and related concepts and studies to devise a well structured model of the full gamut of entrepreneurship in the university context (not merely the subset comprising commercialisation of research outputs). The importance attached to viewing entrepreneurship at university using a systems perspective was that the RCS must be viewed as a distinct part of entrepreneurship at university. It was not the whole. Only in the light of this thoroughly enhanced holistic concept of entrepreneurship at university did I return to focus on a well defined, contextually positioned RCS subset.

**Method and Objectives:** A research procedure of literature review and content analysis found:
- existing research commercialisation systems were deeply flawed;
- the extant canon of case literature that informed the context-process relationship of RCS was heavy on the study of first tier universities and almost silent on anything to do with RCS at second tier universities.

These discoveries prompted the design and execution of the empirical component of the project, one aimed at producing an enhanced model: a framework contextually relevant to guiding the strategy, objectives and best practices of RCS for the majority of the world’s universities not blessed with munificent resources. This task involved the development of a theoretical/analytical framework to guide the project and an aligned research design for executing it. My approach embraced the most recent, leading edge work in theory related to entrepreneurial context, entrepreneurial process and a broad version of systems theory on which to anchor it. Using a lens
constructed from this trinity – entrepreneurial process theory, entrepreneurial context perspective and systems theory - I adopted a multiple case study methodology to empirically investigate the RCS of six universities across three nations in rigorous detail.

**Findings:** The analysis of this rich data set was synthesized into a general model and then compared and contrasted against a model distilled from the extant case literature composed of mainly first tier universities using Glaser (1965) and Lincoln and Guba (1985) as touchstones for method, rigor and quality. One of the main yields of this study was that the posited enhanced model of RCS was focused on the factors that were important to all universities, whether they were munificent or not.

**Implications:** The key theoretical contribution of this project comes in the form of an enhanced framework that serves to refocus policy makers and practitioners on factors that are more easily adaptable to change and therefore represents a substantially improved general model of RCS applicable to all universities, not just an extreme minority of them. As a guide to practice, these findings argue that concentration on university spinouts (USO) may be a poor strategy for commercialization in contexts that are found to have weak entrepreneurial infrastructures. There are a range of commercialization strategies that can be deployed with greater potential effect. Future research in this area should focus on the examination and classification of typologies to further inform and enhance models of RCS that become progressively more contextually fine-tuned, adapting RCS processes to the highly specific circumstances of similar groups of universities and individual universities.
Chapter One  The Research Context and an Overview of the Thesis

Chapter Abstract
This chapter is used to introduce the background and context of the research project. It begins with an overview of the motivations and past research upon which this thesis is founded. Before the key research objectives and questions may be fully developed, two key concepts must be addressed: process and context (as related to the activity of entrepreneurship at university). The research project is then theoretically positioned in the field of entrepreneurship research. Definitions of key terms are provided in the next section. This is followed by a clear description of the unit of analysis selected for viewing my research problem. Key research objectives are formulated and specific questions developed as a means for achieving them. The last section presents the overall research design of the thesis. The chapter ends with a brief summary of chapters two through nine.

1.1 Research Background
The research project presented is the result of an iterative process that spans the course of five years. In this section, I seek to summarize in succinct, linear expression, the motivations that drove the project, the key concepts that are necessary for understanding how I arrived at the research problem, and the underlying issues that required resolution before the main research objective(s) could be aligned with clear, manageable questions. This section is also used to position the project in the field of entrepreneurship research. Due to the need for parsimony, where issues are not fully resolved, cross reference to subsequent sections in this chapter or other chapters (where they are dealt with in greater detail) are provided.
1.1.1 Underlying motivations and key conceptual issues

The larger project that is this thesis – an investigation of the entrepreneurial processes second tier (poor) universities use to commercialise the research they do within their walls - began with a smaller one. I was curious to know if there was a correlation among the number of spinout firms generated from a university and the size, capacity and focus of its entrepreneurship education programs (P. Moroz, Hindle, & Anderson, 2006). Although a correlation was identified, the results of a linear regression analysis showed that it was not statistically significant. What was significant, (so much so, that it effectively overwhelmed all other independent variables) was the amount of research funding a university received as represented by the independent variable total research expenditures. In other words, rich universities, unsurprisingly, did better at commercializing research (as they performed better on almost everything else that universities do) than less well endowed institutions. This conclusion was disappointing. It ran counter to current perceptions and received wisdom on the nature of innovation as a combination of inventive and entrepreneurial processes (Drucker, 1985; K. Hindle, 2009; Rogers, 1962). It was also intriguing. The only factor that mattered was the funding of knowledge creation: money talked. Entrepreneurial research and teaching programme expertise seemingly had nothing to say and did not corroborate with burgeoning research in this area (Boni & Emerson, 2005; Galloway & Brown, 2002; A. Nelson & Byers, 2005; D. Siegel & Phan, 2004). A second follow up study confirmed that technology transfer units and their activities were observed to be isolated from programs for teaching and facilitating entrepreneurship in Canadian universities; even though the entrepreneurship educators surveyed thought that cross pollination between the two would be beneficial (P. Moroz et al., 2007).

Exploring the notion that only rich universities commercialized intellectual property well, I conducted further research that suggests large disparities exist between rich and poor universities (P. W. Moroz, Hindle, & Anderson, 2008).
As the methods used to classify universities in this study was based on sorting a range of commercialization measures into top (high outcomes) and bottom (low outcomes) tiers, rich universities were characterized by a small number of top tier institutions that generate high revenues from their commercialization systems while poor universities were characterized by a large number of bottom tier institutions that generate modest or low revenues from their commercialization systems.

An interesting finding emerged from this work. A very small number of top tier universities produced the majority of outcomes from commercialization (based on typical indicators such as patents, licenses, spinouts and licensing revenues). Furthermore, the performance disparities between top tier and bottom tier had increased over a ten year span (P. W. Moroz et al., 2008). This evidence suggested two things: (1) that the policies and practices in the top tier may be moderated by how rich they were (and potentially flawed) and (2) that the policies and practices employed among a large majority of bottom tier universities were not working as well as they could to generate innovation from their research commercialization systems (especially if they were similar to policies used by top tier universities). Supported by this research, an argument could then be made that perhaps the policies and practices employed by top tier universities were not transferable to bottom tier universities (if the predominating factor for success was based on how rich they were). This was an interesting and underserved area of study. A review of the literature led to the development of three interesting propositions: (1) that top tier universities who do commercialization well may benefit from distinctly different contextual circumstances than bottom tier universities (Shane, 2002) and (2) that if the policies and practices that were employed by bottom tier universities were developed through the observation/emulation of top tier universities, that they may be the wrong models to emulate (Degroof & Roberts, 2004) and (3) that the activity of entrepreneurship should play a role in the creation of innovation (Schumpeter, 1942; Rogers, 1962; Drucker,
1985; Hindle, 2009). This pointed to the need for understanding the contextual differences among top tier (rich) and bottom tier universities (poor) that might influence or constrain the entrepreneurial process relevant to the commercialisation of knowledge at these institutions.

In order to investigate these insights further, I first had to find a way to distinguish between top tier and bottom tier ‘entrepreneurial universities’. Two issues emerged. The first issue had to do with the process of entrepreneurship at university. The need for identifying a clear definition of the term ‘entrepreneurial university’ was beset by the many processes and objectives that were associated with it. As a unit of analysis, the entrepreneurial university concept was much too broad and involved the measurement of too many different things. This prompted a need to review, define and limit exactly what I sought to measure. The outcome of this endeavour clarified the term entrepreneurial university by breaking it down into four different systems for achieving specific objectives. In so doing I could then limit the study to a unit of analysis that was much more manageable with respect to measurement: a university research commercialization system or RCS (see section 1.3 and chapter 2).

The second issue had to do with context, particularly the classification of universities by their commercialization performance. It encompassed the need to specifically identify or develop a performance based taxonomy so as to study specific contextual conditions (see chapter 3). Typologies used within the literature were found to be inadequate. This presented an actionable research gap that resulted in the classification of two RCS specific performance types: first tier (rich) and second tier (not rich). Furthermore, analysis of the canon of case literature on the entrepreneurial university pointed to the fact that an overwhelming number of cases were drawn from first tier universities. Few were drawn from the study of second tier universities (see chapter four). This was problematic as it suggested that much
of our informed understanding of how to facilitate entrepreneurship at university so as to better commercialize knowledge was derived from exemplar cases (the rich). As stated above, it is posited that the context of first tier universities may be much different than those of second tier universities. The scarcity of research on second tier universities left the question, “how they may be contextually different”, “and how does context influence the entrepreneurial process”, largely unanswered (this would ultimately become the main empirical and analytical component of my thesis project).

1.1.2 Theoretical positioning of this study
This dissertation is positioned in the field of entrepreneurship research in general and entrepreneurship at university specifically. It is predicated on recognizing the interdependence of process and context if one is to understand entrepreneurship. There are many respected authors in the field who share this view (Baumol, 1990; W.B. Gartner, 1995; Julien, 2007; M. Low & I. MacMillan, 1988). Most recent, Welter (2011) argues that:

There is growing recognition in entrepreneurship research that economic behaviour can be better understood within its historical, temporal, institutional, spatial, and social contexts, as these contexts provide individuals with opportunities and set boundaries for their actions.

entrepreneurship that is balanced between the external and internal realities of ‘people acting entrepreneurially’ in a defined ‘space’ is a valid starting point for my thesis. It focuses on doing entrepreneurship within a well defined context: the university. The substantive area I choose to study encompasses two types of universities that undertake the activity of commercialization: first tier RCS and second tier RCS. The entrepreneurial processes of interest are those that underpin the creation of valuable innovation: the commercialization of new knowledge derived from a university’s research program.

As I believe that the reader will benefit from a clear association of terms with definitions going forward, I provide an overview of the specific contextual types and processes of interest, as well as other key terms, before proceeding to frame the unit of analysis and discuss the research problem.

1.2 Definition of Key Terms

In this section a set of key terms about the phenomena under study and the discipline specific background are clearly defined.

**Entrepreneurship:** Notwithstanding its tenuous acceptance in academia as a legitimate area of managerial science, the field of entrepreneurship research has suffered from conceptual fragmentation and therefore claims no uniform accepted definition (Low & MacMillan, 1988). As other closely related, but highly differentiated terms such as innovation, commercialization, and technology transfer are also used in this thesis, it makes the selection of a guiding definition of entrepreneurship very important to a study.

There are several research perspectives within the field itself that have developed over time. These perspectives require review and eventual

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1In 1989, the American Academy of Social Sciences formally recognized entrepreneurship as a distinct scientific discipline.
selection. Aldrich (2005) highlights four of the main approaches that have emerged for researching entrepreneurship: 1) the creation of innovative products and markets through transformation of resources, (Drucker, 1985; Leibenstein, 1968; Schumpeter, 1934), 2) the nature of high growth firms, (P. Davidsson, Delmar, & Wiklund, 2006; P. Davidsson & Henrekson, 2002), 3) the emergence of new firms, (Gartner, 1985; Gartner, 1988; Low & MacMillan, 1988) and 4) opportunity pursuit through an alertness to asymmetric information and risk taking (Kirzner, 1997; Knight, 1921; Shane & Venkataraman, 2000).

Taking into consideration the above perspectives, it seems that the most expeditious way forward is to determine which approach is best suited to the research problem and to select the most cutting edge conceptual definition. In accordance with published work in entrepreneurial process (Moroz and Hindle, 2012), the following definition of entrepreneurship is adopted for this thesis:

*Entrepreneurship is the process of evaluating, committing to and achieving, under contextual constraints, the creation of new value from new knowledge for the benefit of defined stakeholders.* (Hindle, 2010a: 100)

This definition is an extension of the perspective adopted by Shane & Venkataraman (2000), which views the scope of the field as being about “*the scholarly examination of how, by whom, and with what effects opportunities to create goods and services are discovered, evaluated, and exploited.*” This is a cutting-edge perspective from which to view the phenomenon of entrepreneurship, and is therefore adopted as the general position. This viewpoint argues that researchers in the field should focus on (1) how, why, and when opportunities exist, (2) the processes of discovering, evaluating, and exploiting opportunities, and (3) the importance of the individual entrepreneur
and the emphasis on creating new means-ends relationships (emphasis added with respect to the importance of process).

**Entrepreneurial process:** The term places emphasis on the entrepreneurial event or situation. This approach to studying entrepreneurship has two key implications. First, it assumes that individuals are in a state of flux where at times they are engaging in entrepreneurial processes and at other times not (Katz & Steyaert, 2004). Second, this perspective accepts that individuals acting as entrepreneurs are part of a highly structural system, where the actual transformative process of entrepreneurship is formed through a sequential and iterative interrelationship between individuals and the world around them. In this manner, studying process allows the researcher to “cut to the chase” and explore exactly ‘how’ and ‘when’ an economic opportunity is created, by studying the whole of an entrepreneurial event, not just the parts.

After conducting a rigorous assessment of the extant models of entrepreneurial process (see chapter five), only one could be found that attempted to define what was both general and distinct (P. Moroz & Hindle, 2012). In Hindle’s (2010) paper, he defines entrepreneurial process as:

*Entrepreneurship is the process of evaluating, committing to and achieving, under contextual constraints, the creation of new value from new knowledge for the benefit of defined stakeholders.* (Hindle, 2010a: 100)

More importantly, he illustrates his model of entrepreneurial process (MEP) and goes on to structure it by conceptualizing three interrelated domains and three distinctive capacities within each (see Hindle, 2010a). This model is highlighted as a key artefact for distinguishing amongst other types of processes that are interrelated or closely aligned (such as the
commercialization process, technology transfer process and spinout process outlined below).

**Context:** For any model of entrepreneurial process to be meaningful, the study of context that is both discursive and integrative of three domains of research - organizational, sociological and environmental - is vital (J. Katz & Steyaert, 2004; P. H. Phan, 2004; D. Ucbasaran, Westhead, & Wright, 2001). I therefore loosely adopt a socio-spatial conceptual interpretation of context that corresponds to Minniti and Bygrave’s theory as a decision to engage in entrepreneurship that is a function of three interrelated and simultaneous levels of social space: (1) the subjective initial endowment (entrepreneurial capacity) of the entrepreneurial team, (2) institutional and economic circumstances of the economy (the environment) and (3) the perceived level of support for entrepreneurship within a community and ensuing levels of entrepreneurial activity. A refined formulation of context is developed into a precise theoretical/analytical framework to be used as a lens for viewing the research problem and guiding the empirical components of this thesis (chapter five). Ultimately, an enhanced conceptualization of context as community is presented to better structure the holistic analysis of socio-spatial factors relevant to entrepreneurship at university associated with RCS.

**Innovation:** is a highly complex and multi-faceted concept that has been suggested to have a distinct relationship with entrepreneurship (Drucker, 1985; Schumpeter, 1934). Although there are many definitions, the following definition is clear, parsimonious and aligns with many of the influential extant theories (Dodgson & Bessant, 1996; Drucker, 1985; Rogers, 1962; Sundbo, 1998). It frames the concept within an epistemology of process where the importance of transformation (action) is emphasized as a necessary factor for achieving a valuable outcome from a set of inputs (knowledge). I present the definition below:
Innovation is the combination of an inventive process and an entrepreneurial process to create new economic value for defined stakeholders (Hindle, 2009, p. 3).

This definition of innovation aligns well with the focus of my thesis. It is founded on an explicit relationship between knowledge (ideas, technology, etc.) and entrepreneurship (transformative actions) that is indivisible and complementary in nature: successful innovation cannot be achieved with the absence of either the creation of new knowledge or entrepreneurship that transforms it into new value.

Technology Transfer: can be defined in many ways and is usually dependent upon the discipline from which it is being studied, such as economics (focusing on the generic properties of knowledge), sociology (focusing on its links to innovation and the processes that reduce the uncertainty for achieving desired outcomes) or anthropology (a factor that produces cultural change). Operationally, the term ‘technology transfer’ may encompass a spectrum of firm based, institutional and governmental interactions across multiple levels of analysis that involve some sort of technology related exchange (Bozeman, 2000b). Although the main focus of this study is on the university context as a potential ‘source’ for new technology, the processes involved often include a wide range of knowledge and human capital based inputs and includes the participation of multiple stakeholders (H. Etzkowitz, 2008). Thus a general definition is adopted:

The movement of know-how, technical knowledge, or technology from one organizational setting to another (Roessner, 2001, p. 1)

Inferred from this definition, there may or may not be a profit motivation attached and the process may or may not generate revenues. As well, the
process may or may not be entrepreneurial, and may or may not be innovative.

Commercialization: is a complex, iterative process that encompasses a variety of perspectives that are also highly dependent upon context (Bordt, 2005). At a broad level, commercialization consists of all the processes for producing and delivering products for sale. Thus it differs from technology transfer in that it conditionally requires a sales transaction of some kind to take place. At a narrow level it encompasses the study of the movement of products to the marketplace through agreed upon transactions with a disproportionate focus on patenting and licensing knowledge. From a broader perspective, it largely ignores the highly crucial product/service to market aspect that is important to firms (Dechenaux, Goldfarb, Shane, & Thursby, 2006; Jaffe & Lerner, 2001). Furthermore, the process of commercialization, much like technology transfer may or may not be profitable, although the differentiating factor is that profit is the key objective (Di Gregorio & Shane, 2003; Griliches, 1990; Morgan, Kruytbosch, & Kannankutty, 2001). Lastly, the process itself may or may not be innovative and may or may not be entrepreneurial (Hindle, 2009).

University: is defined as any institution of higher education, either public or private, that is accredited by Act of Parliament or Government statute as an academic higher degree granting entity. It is also necessary to provide two definitions of the term ‘entrepreneurial university’.

Entrepreneurial university: (broad view) is one that seeks to generate innovative outcomes from one of four interrelated domains: (1) systems of commercialization, (2) entrepreneurship education systems, (3) teaching and research systems and (4) administrative systems (see chapter 2).
An **entrepreneurial university** (narrow view) is one which possesses a system for the commercialization of knowledge (RCS).

**First Tier University:** is classified as belonging to the high commercialization revenue (rich) set of a nation as measured by total gross revenues from commercialization (see chapter 3)

**Second Tier University:** is classified as belonging to the low commercialization revenue (poor) set of a nation as measured by total gross revenues from commercialization (see chapter 3)

**University Spinoff Organization (USO):** is a term that is often associated and used synonymously with others such as ‘spinout’ or ‘spinoff’ and reflects the contextual nature of a specific type of new venture formation that typically emerges from a university. Although this is a catch all term, there are many different ways to define and categorize USO’s. Djokovic and Souitaris (2008) suggest that the USO be defined by specifying the outcome, the parties involved and the core elements transferred. Spinoffs may take diverse forms, exhibiting a myriad of characteristics, objectives and performance-related measurements.
I synthesized a taxonomy from Hindle and Yencken (2004) and Harrison and Leitch (2010) that offers a useful overview of such spinoffs classified according to their structures, (organizational type) objectives, (business models) and types of individuals involved (see Table 1.1 above).

<table>
<thead>
<tr>
<th>Organization Type</th>
<th>Explanation</th>
<th>Business Model</th>
<th>Explanation</th>
<th>Principal Originator</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct research spinoff</td>
<td>A company created and owned by (or in part) the university for the purpose of commercializing IP</td>
<td>Consultancy contracting</td>
<td>Set up to deliver services, either technical or knowledge-based in a supportive role of regional R&amp;D activities</td>
<td>Faculty Member</td>
<td>University-employed Faculty member</td>
</tr>
<tr>
<td>Technology transfer company</td>
<td>Set up by a university to exploit tacit knowledge that is more process than patent-based</td>
<td>Product-oriented</td>
<td>Developed around a product or process that achieves a sustainable growth pattern</td>
<td>Surrogate entrepreneur</td>
<td>Outside management consultant, financier, or entrepreneur engaged to become CEO of company</td>
</tr>
<tr>
<td>Indirect spinoff company</td>
<td>Started by current or former faculty or students in which the university does not have a direct IP relationship (legal status)</td>
<td>Technology asset-oriented companies</td>
<td>Developed around a patented technological asset (or platform)</td>
<td>Graduate student</td>
<td>Student (usually graduate or post doctoral) that is enrolled at the university</td>
</tr>
<tr>
<td>Spin-in</td>
<td>A company spun in by existing companies to exploit licensed or collaborative research generated by universities</td>
<td>Team</td>
<td>Constellation of the above or any other alignment (where more than one person takes lead)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Hindle and Yencken, 2004; Harrison and Leitch, 2010

1.3 Focus and Boundaries: Distillation of a Complex Unit of Analysis

My objective was to synthesize from the literature, a precise unit of analysis. This task is guided by General Systems Theory (L. von Bertalanffy, 1951). A review of the relevant literature surfaces the term “entrepreneurial university” as the main focus of researchers and a potential unit of analysis. The literature is further categorized into five themes: (1) transformation (mandates and capabilities), (2) regional economic development, (3) institutional issues, (4) function, and (5) classification of the research field (see chapter two). This review does not sufficiently limit the scope of what an entrepreneurial
university does, and ultimately, what it produces (as entrepreneurial universities are systems for producing many different outcomes\(^2\)).

Attempting to narrow my focus to processes and objectives, guided by insight from a lecture I attended in Denmark, I reviewed the literature to develop a model that categorizes entrepreneurial processes and outcomes into four quadrants of innovation: (1) administrative, (2) commercialization, (3) teaching and research programs, and (4) entrepreneurship education (see chapter two). Although previous research indicates that these quadrants are interrelated (some more than others), my previous study found at least two of these domains (entrepreneurship education and commercialization) to be, by and large, isolated from one another. The model yields a specific unit of analysis with clear and well defined boundaries to limit the study of the entrepreneurial university to its research commercialization systems – or RCS (see chapter 2 and glossary above).

1.4 The Core Research Objectives and Associated Research Questions

1.4.1 Overview of the general research problem
The extant literature strongly reflects the importance of research universities as a key contributor to knowledge creation and an important component of a nation’s innovation system (D. Audretsch, Lehmann, & Warning, 2005; O'Shea et al., 2008; Saxenian, 1994; Siegel, et al., 2007; Zaharia & Gibert, 2005). Technologies arising from new knowledge creation have been shown to contribute significantly to the emergence of innovations that spawn new markets, industries and economic regions (Audretsch, et al., 2005; Saxenian, 1994; Tornatzky, Waugaman, & Gray, 1999). Thus an emphasis on increasing

\(^2\) Working in close proximity to my supervisor, I witnessed a presentation he made at Aarhus University in Denmark that discussed the four different ways to determine how a university might be classified as “entrepreneurial”. This provided me with the idea of how to test this hypothesis.
commercialization performance at research universities is a key focus of many researchers.

Traditionally, a university’s main function involves education and basic research (Etzkowitz, et al., 2000). With the rise of the knowledge economy (Warsh, 2006), the mandate of the modern research university is now altered to include a more significant and direct role in economic development (H. Etzkowitz, 2008; Feldman, 1994; Goldstein, 2008). Greater demands compounded with funding shortages require that universities seek new revenue streams. The pull and push to institutionally engage in market processes through the commercialization of all types of knowledge has introduced the need to promote and facilitate entrepreneurial behaviour within an academic environment (Martinelli, et al., B. Clark, 1998; 2008; Slaughter & Leslie, 1997).

But universities are argued to be ill suited for the role of playing entrepreneur (Harrison & Leitch, 2010; Kirby, 2006). Studies suggest that even though considerable investments are targeted at inputs (such as research funding and seed capital for USO ventures), complimentary commercialization efforts have not yielded the outputs expected for the majority of universities around the globe (Jones-Evans & Klofsten, 1997; OECD, 2005; Venkataraman, 2004; Wright et al., 2007). As the university context is evidenced as being structurally different than typical business environments, this move towards a ‘third mandate’ has resulted in several challenges for those tasked with driving the development and promotion of a wide range of entrepreneurial processes (Rothaermel et al., 2007). Although researchers and policy makers are addressing many of these challenges, there are still many problems that exist and substantial gaps in our understanding of these issues (Colyvas & Powell, 2009; Patzelt & Shepherd, 2009; Shane, 2005; Yusof & Jain, 2010).
1.4.2 Research objectives and questions

Considering the previous work stated above, I have approached this general problem from a performance based perspective to arrive at the assumption that first tier universities may benefit from contextual realities that differ greatly from second tier universities with respect to the performance of their RCS. But exactly how they may differ is not well known. Furthermore, if innovation is the key desired outcome of commercialization at university, it follows that the activity of entrepreneurship must play a role in creating that innovation (K. Hindle, 2009). An approach that considers the relationship among context, entrepreneurial process and performance is thus well warranted.

Enabled by literature review work and content analysis completed in chapters two, three, and four, a well informed, general research problem is framed: the need to examine the contextual differences between first tier and second tier universities engaged in the commercialization of knowledge as they relate to the entrepreneurial process - so as to better inform upon how to improve the RCS within second tier universities: a well defined gap.

The first objective is conceptual and involves the review of case studies classified as first tier universities. The means to achieve this objective is represented by answering the question:

1) How does context influence the entrepreneurial process in research commercialization systems (RCS) at universities classified as first tier (rich)?

The second objective is the foundation of the primary empirical component of the thesis and involves the design of a multi-case, three nation study of universities classified as second tier. The means to achieve this objective is represented by answering the question:
2) How does context influence the entrepreneurial process in RCS at universities classified as second tier (not rich)?

The third objective is analytical and involves the comparison and contrast of the two sets by examining the yield from answering questions one and two.

3) What are the key contextual differences/similarities of first tier and second tier universities relevant to the activity of entrepreneurship within their RCS?

The yield of this work potentially frames a more refined problem. If there are contextually distinct factors that arise from 'the richness' of first tier universities, then the policies, practices and processes for commercialization (through the process of entrepreneurship) that they employ may not be as effective when used within second tier universities. This is a question that has been raised by key authors in the field and attests to its importance (Di Gregorio & Shane, 2003; O'Shea, et al., 2007).

The fourth objective is analytical. The means to achieve this objective is represented by answering the question:

4) What are the policies and best practices for facilitating entrepreneurship found in the first tier set that may (or may not) be effectively transposed into the second tier set to improve innovation performance of RCS?

Not only may policies be ineffective, but the objectives set for achieving well defined outcomes using specific types of entrepreneurial processes may be misdirected as well. The exploitation of entrepreneurial opportunities and the emergence of new technological ventures are not always value creating
endeavours (P. Phan, 2005; S. Venkataraman, 2004). Entrepreneurial processes may be destructive (decrease overall wealth), or may shift wealth around but create little value to society (arbitrage and limited or no societal spill over of wealth). As an example, one study finds that it is extremely unlikely that a technology start up company will move from a low profit and low growth profile to a high profit and high growth profile (Brännback et al., 2009). This is echoed throughout the literature with respect to the low number of high growth USOs that have been generated (Degroof & Roberts, 2004; Djokovic & Souitaris, 2008; Rothaermel et al., 2007). In other words, there are very few ‘black swans’ or ‘home runs’ (Shane, 2005). This raises questions as to the value of different types of entrepreneurial processes, outcomes and/or measures currently used to report them (Colyvas & Powell, 2009; Jakobson & Ritso, 2008; Lowe & Suzanne, 2005; D. Siegel, Wright, Chapple, & Lockett, 2008). As well, many of the benefits of commercialization via entrepreneurship may not be captured by current measures (Chrisman, et al., 1995; Langford, et al., 2006; S. Venkataraman, 2004). Other studies have focused directly on the impact of USO companies and have found that while there may be knowledge spill over’s produced that benefit a geographical region around the university, the net revenues produced for the university (after all expenses) are often a zero or negative sum return (Harrison & Leitch, 2010).

This leads to the development of a fifth objective that is conceptual. The means to achieve this objective is to design a testable framework for improving the performance of research commercialization systems that may be applicable to all universities. This leads to a final question:

5) **What is a succinct and testable framework that illustrates the factors that are essential to fostering the most appropriate entrepreneurial processes and objectives for improving innovation performance within all university contexts?**
The resultant *sui generis* framework, thus derived, will be useful in critiquing the current situation of universities with weak entrepreneurial infrastructures to better direct the activities and objectives of their RCS (Degroof & Roberts, 2004). Although testing the framework is not within the scope of this research project, discussion on future research will clarify how this might be achieved.

### 1.5 Research Design and Methods

I use the centrality and primacy of the research questions posed and refined through literature discovery and intuition to select the appropriate philosophical approach (interpretivist), the broad epistemology to be used (systems theory), the main unit of analysis (RCS), the most adequate ontological perspectives for testing the questions (entrepreneurial process theory/concept of context as community) and ultimately, the methods to be used (content analysis, multiple case studies, key informant interviews and secondary data collection and analysis).

#### 1.5.1 Conceptual framework

*Systems Theory* has become known as a ‘skeleton of science’ as a way to build around content that links theory development to the world around it through the acknowledgement that knowledge is not something which exists and grows in the abstract, but is a function of humans social organization (Boulding, 1956). It is thus an excellent framework on which to build a corpus of knowledge from research problems that exhibit many complex and interrelated variables. With its emphasis on equifinality (Jennings & Hindle, 2009), it is also an excellent epistemological form from which to study the heterogeneous, socio-spatial realized processes involved with entrepreneurship. The key weakness derived from a Systems Theory epistemology is that it is overly broad.
Process theory is founded upon a worldview that conceptualizes processes, rather than objects as the basic building blocks of how we understand the world around us. Through process theory, reality is interpreted as a continuous string of changing states of existence categorized into sets of ‘occasions of experience’ that can then be classified into distinct processes (Whitehead, 1929). Researchers guided by the study of process are thus critically interested in change focused through the question of the ‘how’ of a particular outcome. The questions concerning what, why, when and who are a second order consideration used in support of the first (K. Hindle, 2010; P. Moroz & Hindle, 2012).

Communities consist of individuals within a delimited group that may be framed by social, geo spatial, cultural or other perspectives and that have members who share common beliefs, values or objectives (Peredo & Chrisman, 2006). Members who see themselves as part of a community adhere to agreed to behavioral constraints, have direct and many-sided relations, and have an obligation of loyalty and reciprocity (S. Dasgupta, 1996; Taylor, 1982). Through this concept I seek to frame socio-spatiality as a means for defining and structuring the study of the nexus between entrepreneurial process and context (K. Hindle, 2010; Julien, 2007).

1.5.2 Research Design
Following Hindle’s canonical development approach (2004) and working from past research that identified gaps in the extant literature on entrepreneurial universities, I decided upon a mixed methods research design that incorporated literature review, quantitative and qualitative analysis. An illustrated overview of the research design is provided below in figure 1.1.
1.6 Structure of the Thesis

This thesis is structured using a total of nine chapters. An abstract provides a short executive summary of the thesis and its findings.

Chapter one is an overview of the background, underlying motivations, theoretical positioning and key issues to be resolved before the primary research objectives and core research question(s) for achieving these objectives may be developed and presented. It also provides a glossary of key terms and serves as a structural guide for the research project.

Chapter two is primarily concerned with the issue of process. The entrepreneurial university literature is surveyed. A means for clarifying the convoluted concept of the entrepreneurial university is developed using
general systems theory as a guide. The work completed in this chapter yields a systems model of the entrepreneurial university and results in the establishment and selection of a clear unit of analysis by delimiting the entrepreneurial university into its RCS.

Chapter three identifies a second key issue: the concept of context. The need to develop a reproducible and reliable means for classifying universities into top and bottom tier sets for examination is addressed. The literature on entrepreneurial performance is consulted for establishing the best means for the measurement of commercialization at university. An empirical examination of three nation’s commercialization data sets are employed to test skewed patterns of university commercialization performance. The yield of this chapter is a set of taxonomic rules for classifying universities into first tier and second tier sets.

Chapter four employs literature review techniques, content analysis and secondary data collection to examine cases classified to the first tier set. Guided by the taxonomic rules developed in chapter three, selection of case studies that belong to the first tier set in five nations are analysed. The yield of this chapter is a general context process map representing the first tier set (existing models) of universities: FG-1. It also identifies a gap in the literature corresponding to a dearth in the studies on bottom tier universities.

Chapter five develops an appropriate guiding framework for better viewing and understanding the research problem and ultimately, answering the research questions derived. Consideration of philosophical, epistemological and ontological perspectives that are well aligned with the literature discovery and research questions help to develop a theoretical framework for understanding the relationship between the socio-spatial issues relevant to context and entrepreneurship. The concept of community is thus adopted as the theoretical/analytical lens for which to view the research problem.
Chapter six provides a specific overview of the qualitative methodology for conducting the primary empirical component of the research project.

Chapter seven reports upon the field work conducted through six case studies of paired universities across Denmark, Australia and the USA. These case studies represent the second tier set. The yields from this chapter include six specific context-process maps SS-1-2-3-4-5 and 6.

Chapter eight positions the six specific second tier case studies into a general context process map: SG-2. Comparison and contrast between FG-1 and SG-2 provides insight into whether or not some policies and practices may be effectively transferred between the two sets. Last of all, it results in the development of a conceptual framework (UG-3). This satisfies the main objective of the thesis by successfully allowing for the primary research questions to be answered.

Chapter nine discusses the limitations and implications of the study, presents a conclusion reached by the researcher and is used to point to future research in this area.

Summary of Chapter 1
In this chapter, I have presented an overview of my study and outlined the research problem and its importance, the development of research questions and the means used to answer them including:

- A description of the preliminary problems and their resolution
- A definition of key terms
- A clarification of the unit of analysis
- An overview of the primary research problems and the questions posed to answer them
- An overview of the research design
A preview of the chapters to follow.

Chapter Two  Entrepreneurship at University – Process

Chapter Abstract
My thesis begins with a major problem of terminology: ‘the entrepreneurial university’. Does this term imply the full gamut of everything to do with entrepreneurship or is it merely a term associated with and virtually synonymous with ‘the commercialization of research outputs’. If I am to focus on the latter, as I wish to do, I need both to be aware of the larger concept of entrepreneurship and the need to distinguish my specific interest (research commercialisation systems) from the full gamut of everything entrepreneurial that a university may do. Accordingly, this chapter contains a literature review and evaluation of the ‘entrepreneurial university’ concept. Prompted by past research, my goal was to determine whether or not this concept, as currently generally used, is a suitable term to use for describing a unit of analysis for my research purposes. Review of the literature suggests that the concept, ‘the entrepreneurial university’ is not clearly defined. It is loosely synonymous with ‘commercialization of research output’ but does not cover all aspects that ought to be considered when contemplating the full range of activities and meanings that might reasonably be embraced when considering entrepreneurship in the university context. This is especially so with regard to the many processes and objectives observed to be linked to entrepreneurship at university. My goals were first to identify, examine, and conceptualize the many processes associated with entrepreneurship at university then to distinguish, where in this pantheon, the specific activity of research commercialization was positioned and finally to come up with a clear, unambiguous label for the focus of my research interest. I used ‘general systems’ theory to guide the development of a model that conceptualises the full range of entrepreneurial activities that occur in the university context.
under four distinct but potentially interrelated system domains: one of these is, indeed, the commercialisation of research outputs. Focusing on this domain permitted the classification of a well framed, clearly named unit of analysis: ‘systems for commercialization of research (SCR) at university’. My thesis is a study of the SCR phenomenon.

2.1 Introduction: Underlying Motivations and Past Research

The goal of this chapter is to develop a precise unit of analysis for assessing the relationship among context, process, and performance with regard to university-based entrepreneurship. This quest is informed and motivated by previous research on the commercialization performance of North American universities (P. Moroz et al., 2006; P. W. Moroz et al., 2008; P. W. Moroz, Hindle, & Anderson, 2010). The insight gained from that research ultimately provided the foundation for this thesis, namely, to understand the nature of the contexts for facilitating entrepreneurship that, in turn, enhances commercialization of knowledge in second-tier (poor) universities.

Two studies led to the development of insights into the relationship among different processes associated with entrepreneurship at universities. Moroz et al., (2006) tested the relationship between the processes for generating university spin outs (USO) and the processes for teaching entrepreneurship at university, and found that the strength and size of a university’s entrepreneurship education programs was not significantly related to spinout propensity. A follow-up study (Moroz, et al., 2007) provided further evidence of the limited interrelationship between them: linkages were observed to be informal, if at all. Furthermore, the objectives attached to each activity were found to be different, even though the entrepreneurial process was a key consideration for achieving success in both (P. Moroz et al., 2007).

There were several issues with respect to understanding entrepreneurship at university that complicated achievement of the research objective noted above that extended from the multitude of aspects taken on
the subject by researchers. The issues were addressed by conducting a systematic review of the literature on the topic of “entrepreneurship at university.” The goal was to: (1) develop a better understanding of the university context as it relates to entrepreneurship, (2) identify the activities and objectives that facilitate entrepreneurial processes, which in turn encourage commercialization, and (3) identify a unit of analysis which limits and frames the specific processes observed. Analysis of the literature showed that there is a need to clarify what the term “entrepreneurial university” means, i.e., what is an entrepreneurial university, what does an entrepreneurial university do, and what are the outcomes of an entrepreneurial university?

2.2 The “Entrepreneurship at University” Literature

2.2.1 Setting up the systematic review
Tranfeld, et al., (2003) suggest a close look at literature reviews that are related to the key question under scrutiny. Three such literature reviews were examined. Rothaermel et al., (2007) identified four major areas of study 1) entrepreneurial universities, 2) the productivity of technology transfer offices, 3) new firm creation, and 4) environmental context. The second review (Yusof and Jain, 2010) looked only at organizational-level issues, and found three highly interrelated categories: 1) the entrepreneurial university, 2) academic entrepreneurship, and 3) technology transfer. The third review (Slaughter and Leslie, 1997) took a much broader approach and delineated the political, social and economic issues aligned with and relevant to “academic capitalism.” Within these literature reviews, other narrow but important terms are uncovered such as spinouts/spinoffs (Djokovic & Souitaris, 2008; R. P. O'Shea et al., 2007) and academic entrepreneurs (Landry, Amara, & Rherrad, 2006; L. G. Zucker & Darby, 2001). Using these key terms, 295 articles were returned from multiple queries made to the ABI/Inform database. Rothaermel et al., (2007) indicated the newness of the
research field and that the bulk of the literature found was not concentrated in top journals, so no limitations on journal quality were imposed.

As shown in Table 2.1, eight coded areas of focus were seen as important to researchers across a wide spectrum of disciplines. The table may be read as “53 articles had entrepreneurial university as their main focus”. Themes considered to be a secondary focus in each set are also noted to the far right column. Secondary themes have not been coded beyond first raw impressions and therefore contain a highly diverse set of terms, issues, and factors. There are several points of convergence amongst the secondary themes that are representative in each of the main coded themes that suggest a high level of interrelation between them. Due to this high correlation in secondary themes, only the articles that focused on the most prevalent theme—the entrepreneurial university—were chosen. Thus, a review was conducted that was manageable, rigorous, and focused on a concept that had the potential to be an appropriate unit of analysis.

Table 2.1 Literature search results

<table>
<thead>
<tr>
<th>Main focus*</th>
<th>#</th>
<th>Secondary focus**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneurial</td>
<td>53</td>
<td>Processes, differences between nations, faculty, spinoffs, context, measures, culture, new institutional structures, performance, serial entrepreneurs, incentives, sustained change</td>
</tr>
<tr>
<td>university</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Transfer</td>
<td>40</td>
<td>Success factors, measures, twin skills, context, outcomes, forms, models, processes, TTO, policies, barriers, international comparison, context/structure, regional development, collaboration with firms, culture, training, dept, EE, equity, taxonomy, spinoffs, triple helix</td>
</tr>
<tr>
<td>Academic</td>
<td>39</td>
<td>Processes, differences between nations, faculty, spinoffs, context, measures, culture, new institutional structures, performance, serial entrepreneurs, incentives, sustained change</td>
</tr>
<tr>
<td>entrepreneurship</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinoffs/</td>
<td>39</td>
<td>K type, patents, industry context, context, LR, networks, process, research parks, social sciences, inti comparison, ent types, financing, networks, measures, policy, process, EE, resources, routines, social capital, social networks, teams, TTO's, regional development, VC</td>
</tr>
<tr>
<td>Technology firms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td>35</td>
<td>tech transfer, spinoffs, outcomes, new paradigms, measures, culture, social sciences, outreach, innovation, curriculum, students</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>33</td>
<td>Innovation/Knowledge, Institutions, culture, differences, processes, collaboration with firms, incubators, dual structure, institutional entrepreneurship, intellectual property, K spillover effects, new paradigms, patents, measures, research groups, research parks, spatial context, spinoffs, technology firms, taxonomy, performance</td>
</tr>
<tr>
<td>Entrepreneurial</td>
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<td>social sciences, competition/secret, incentives, motivations, culture, context, collaboration with firms, culture, networks, patents, role identity, spin outs, TTO, VC, value,</td>
</tr>
<tr>
<td>Faculty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional development</td>
<td>17</td>
<td>clusters, networks, context, patents, small unit's, social capital, spinoffs, transformation, groups, leadership, networks, spatial contexts</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td>13</td>
<td>Field, discipline, environment/context, govt, history, learning, planning/performance, qualitative, research, history, rule breaking, structuration, teams, process, theory</td>
</tr>
<tr>
<td>TOTAL</td>
<td>295</td>
<td>**</td>
</tr>
</tbody>
</table>

* The main focus was the central focus or objective of the work reviewed.
** Several of the works had more than one secondary focus beyond the main focus or objective.

*** Works that were duplicated or redundant (authors making similar points or discussing results from studies already reviewed) were not included.

2.2.2 A breakdown of ‘the entrepreneurial university’ literature

In determining whether or not a study should be scrutinized, much narrower criteria were used than those employed in other literature reviews (see for example, Rothaermel et al., 2007). Papers had to satisfy at least one of the following criteria: (1) contain the phrase “entrepreneurial university” in its title or abstract, (2) implicitly or explicitly make reference to the term “entrepreneurial university” within its core objective or theme, and/or (3) attempt to directly define, conceptualize, or explore the characteristics of an entrepreneurial university, whether or not it was part of the core objective of the work reviewed. The goal of the literature review was to discern the function and outcomes of the entrepreneurial university. Thus coded themes focused on what an entrepreneurial university did (processes) and what it achieved as a result of these processes (outcomes). Tables 2.2a, b and c have been broken down from one larger table into three (to make the presentation of data more flexible to page format). They should be viewed as one congruous table that is sorted by main theme code from top to bottom (thus authors are not in alphabetical order).
Table 2.2a An overview of “the entrepreneurial university” literature

<table>
<thead>
<tr>
<th>Author</th>
<th>Date</th>
<th>Type</th>
<th>Origin</th>
<th>Level of Analysis</th>
<th>Theory</th>
<th>Code (Main theme/issue)</th>
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<tbody>
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<td>Clark, B.</td>
<td>2003</td>
<td>Ecs</td>
<td>JHR</td>
<td>Org</td>
<td>Grounded Theory; Transformation, International comparison, Holism</td>
<td></td>
</tr>
<tr>
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<td>2004</td>
<td>Ecs</td>
<td>JHR</td>
<td>Org</td>
<td>Grounded Theory; Transformation, Policy</td>
<td></td>
</tr>
<tr>
<td>Deem, R.</td>
<td>2001</td>
<td>T</td>
<td>JHR</td>
<td>MacroE</td>
<td>New managerialism, entrepreneurial, academic capitalism</td>
<td>Transformation, Globalism</td>
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<tr>
<td>Goldstein, H.A.</td>
<td>2008</td>
<td>Eque</td>
<td>JHR</td>
<td>Ind</td>
<td>Ent uni model</td>
<td>Transformation</td>
</tr>
<tr>
<td>Grigg, T.</td>
<td>1994</td>
<td>T</td>
<td>JHR</td>
<td>Org</td>
<td>Innovation / entrepreneurship, Transformation, Change agents</td>
<td></td>
</tr>
<tr>
<td>Ibarra-Colado, E.</td>
<td>2007</td>
<td>Ecs</td>
<td>JHR</td>
<td>Org</td>
<td>Ent uni model</td>
<td>Transformation, Governance</td>
</tr>
<tr>
<td>Jacob, M., et al.</td>
<td>2003</td>
<td>Ecs</td>
<td>JHR</td>
<td>Org</td>
<td>Ent uni model</td>
<td>Transformation, Policy</td>
</tr>
<tr>
<td>Kirby, D.A.</td>
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<td>Ecs</td>
<td>ITB</td>
<td>Org</td>
<td>Cognition, intra-preneurship, Transformation, Culture</td>
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<td>Kristensen, B.</td>
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<td>Ecs</td>
<td>JHR</td>
<td>Org</td>
<td>Institutional change, Transformation, Governance</td>
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</tr>
<tr>
<td>Rinne &amp; Koliva</td>
<td>2005</td>
<td>LR</td>
<td>JHR</td>
<td>Org</td>
<td>K theory</td>
<td>Transformation, Policy</td>
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<td>Schulte, P.</td>
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<td>T</td>
<td>JHR</td>
<td>Org</td>
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<td>Transformation, Policy</td>
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<td>Soare &amp; Amurah</td>
<td>1999</td>
<td>T</td>
<td>JHR</td>
<td>Org</td>
<td>Ent uni model</td>
<td>Transformation, L/R</td>
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<td>Ecs</td>
<td>JHR</td>
<td>Org</td>
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<td>Transformation, Org forms</td>
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<td>JHR</td>
<td>Org</td>
<td>K production theory</td>
<td>Transformation (dead ahead)</td>
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<td>Williams &amp; Kitaev</td>
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<td>JHR</td>
<td>Nation</td>
<td>K theory</td>
<td>Transformation, Policy</td>
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<td>Ecs</td>
<td>JHR</td>
<td>Nation</td>
<td>triple helix</td>
<td>Transformation, Policy</td>
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<td>Zakaria &amp; Gilbert</td>
<td>2005</td>
<td>T</td>
<td>JHR</td>
<td>Org</td>
<td>Field</td>
<td>Transformation</td>
</tr>
<tr>
<td>Andretich &amp; Phillips,</td>
<td>2007</td>
<td>T</td>
<td>Report</td>
<td>region</td>
<td>K spillover</td>
<td>Reg development, Policy</td>
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</table>

Table 2.2b An overview of “the entrepreneurial university” literature

<table>
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<tr>
<th>Author</th>
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<th>Theory</th>
<th>Code (Main theme/issue)</th>
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<td>Branswell &amp; Wolfe</td>
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<td>JHR</td>
<td>Region</td>
<td>K theory</td>
<td>Reg development, Learning</td>
</tr>
<tr>
<td>Christian, J et al.</td>
<td>1995</td>
<td>Ecs</td>
<td>JHR</td>
<td>Ind</td>
<td>K spillover theory</td>
<td>Reg development, Human Capital</td>
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<tr>
<td>Ettzowtiz &amp; Klocken</td>
<td>2005</td>
<td>Ecs</td>
<td>JHR</td>
<td>MacroE</td>
<td>Innovating regions model</td>
<td>Reg development</td>
</tr>
<tr>
<td>Harrison &amp; Letich</td>
<td>2009</td>
<td>Ecs</td>
<td>JHR</td>
<td>MacroE</td>
<td>System theory</td>
<td>Reg development, Spinoffs</td>
</tr>
<tr>
<td>Kitagawa &amp; Page</td>
<td>2005</td>
<td>T</td>
<td>JHR</td>
<td>MacroE</td>
<td>Sparsity</td>
<td>Reg development, Governance</td>
</tr>
<tr>
<td>Lazzaroni &amp; Piccaluga</td>
<td>2003</td>
<td>T</td>
<td>JHR</td>
<td>Nation</td>
<td>K spillover</td>
<td>Reg development, Measurements</td>
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<td>Schutte, F.</td>
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<td>Ecs</td>
<td>JHR</td>
<td>Region</td>
<td>Reg development, Measures;</td>
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<tr>
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<td>Ecs</td>
<td>JHR</td>
<td>Group</td>
<td>Collective entrepreneur</td>
<td>Reg development, Triple helix</td>
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<td>T</td>
<td>JHR</td>
<td>System</td>
<td>Open system innovation</td>
<td>Reg development, Triple Helix</td>
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<td>JHR</td>
<td>MacroE</td>
<td>Triple helix</td>
<td>Reg development, Triple Helix</td>
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<td>Leong, et al.</td>
<td>2008</td>
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<td>JHR</td>
<td>Firm</td>
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<td>Inst, policy, inf companson</td>
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<td>JHR</td>
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<td>Inst, Culture</td>
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<td>Gjerding &amp; Schenning</td>
<td>2006</td>
<td>Ecs</td>
<td>JHR</td>
<td>Org</td>
<td>Ent uni model</td>
<td>Inst, Culture, Measures</td>
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<td>SS</td>
<td>Society</td>
<td>Discourse analysis</td>
<td>Inst, Culture, Corpus linguistics</td>
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<td>JHR</td>
<td>Ind</td>
<td>EO</td>
<td>Inst, Culture, Cognition</td>
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<td>JHR</td>
<td>Org</td>
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<td>Inst, Culture, Governance</td>
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<td>JHR</td>
<td>Ind</td>
<td>Cognition</td>
<td>Inst, Culture</td>
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</table>
Table 2.2c An overview of “the entrepreneurial university” literature

<table>
<thead>
<tr>
<th>Author</th>
<th>Date</th>
<th>Type</th>
<th>Origin</th>
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<th>Theory</th>
<th>Code (Main theme/issue)</th>
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<td>LR</td>
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<td>Nation</td>
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<td>E cs</td>
<td>Journal SS</td>
<td>Org</td>
<td>Organizational theory</td>
<td>Inst, Boundaries, Role separation</td>
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<tr>
<td>Tunninen &amp; Kunnutila</td>
<td>2009</td>
<td>E cs</td>
<td>Journal SS</td>
<td>Org</td>
<td>Organizational theory</td>
<td>Inst, Boundaries, Role separation</td>
</tr>
<tr>
<td>Vestergaard, J.</td>
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<td>E cs</td>
<td>Journal SS</td>
<td>Org</td>
<td>Social epistemology</td>
<td>Inst, Boundaries, Role identity</td>
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<tr>
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<td>E cs</td>
<td>Journal TTB</td>
<td>Ind Org</td>
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<td>Outcomes, Collab with firms,</td>
</tr>
<tr>
<td>Etzkowitz, H.</td>
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<td>E cs</td>
<td>Book</td>
<td>Org</td>
<td>Triple helix</td>
<td>Outcomes, Collab with firms</td>
</tr>
<tr>
<td>Errord, I</td>
<td>2009</td>
<td>E qu</td>
<td>Journal HE B</td>
<td>Ind</td>
<td></td>
<td>Outcomes, E prod, publications</td>
</tr>
<tr>
<td>Eppke, J.</td>
<td>1998</td>
<td>T</td>
<td>Manuscript</td>
<td>Ind</td>
<td>Innovation theory</td>
<td>Outcomes, E prod, Learning</td>
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<tr>
<td>Lopez, S.</td>
<td>2009</td>
<td>E qu</td>
<td>Journal Man</td>
<td>Org</td>
<td>K theory</td>
<td>Outcomes, Patents</td>
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<tr>
<td>Cargill, B. J.</td>
<td>2007</td>
<td>E cs</td>
<td>Journal HE NR</td>
<td>Org Ind</td>
<td>Corporate Entship</td>
<td>Research field, measure</td>
</tr>
<tr>
<td>Rothaermel, F., et al.</td>
<td>2007</td>
<td>LR</td>
<td>Journal Man B</td>
<td>Field</td>
<td>Ent uni model</td>
<td>Research field, LR</td>
</tr>
<tr>
<td>Yusuf &amp; Jan,</td>
<td>2007</td>
<td>LR</td>
<td>Journal Man</td>
<td>Field</td>
<td>Research streams</td>
<td>Research field, LR</td>
</tr>
</tbody>
</table>

*Type: T=theoretical, E=empirical, LR= literature review, cs=case study, sst=semi-structured interview, quan=quantitative study, txt bib=bibliometric.

**Origin: HE=higher education, Reg=regional development, SS=social science, Man=management, TT=technology transfer, Pol=political studies, Econ=economics (where possible rankings by letter or NR for not ranked are supplied with all those journals that had several ranking systems that conflicted were left empty).

In total, 53 papers were analysed using content analysis (Krippendorff, 2004; Tranfield et al., 2003). The literature was characterized by: (1) an abundance of qualitative research in the form of cases, (2) a wide range of disciplinary contributions with the major sources coming from higher education studies and management journals, (3) an overwhelming number of studies focused on the organization as the primary level of analysis, and (4) a large variance in theories cited but with relatively few studies guided by theory³. An overview of the main themes/issues is provided in table 2.3 below.

³ Descriptive, exploratory and qualitative studies are common to nascent areas of academic inquiry.
Table 2.3 “The entrepreneurial university” literature: basic statistics

<table>
<thead>
<tr>
<th>Type</th>
<th>Origin</th>
<th>Level of Analysis</th>
<th>Theory</th>
<th>Main Theme/Issue</th>
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</thead>
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<tr>
<td>35 Case studies</td>
<td>19 Journal HE</td>
<td>27 ORG</td>
<td>6 MAN Theory</td>
<td>20 Transformation</td>
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<td>13 Theory</td>
<td>12 Journal MAN</td>
<td>9 IND</td>
<td>6 Entrep University</td>
<td>12 Reg develop</td>
</tr>
<tr>
<td>5 Lit Review</td>
<td>6 Journal POL</td>
<td>5 MACRO ECON</td>
<td>5 K-ledge spill over</td>
<td>12 Institutional issues</td>
</tr>
<tr>
<td>3 SSI</td>
<td>5 Journal SS</td>
<td>5 NATION</td>
<td>4 K theory</td>
<td>6 Function</td>
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<td>3 Quantitative</td>
<td>2 Journal REG</td>
<td>4 REGION</td>
<td>4 Org/Inst Theory</td>
<td>4 LR/research Field</td>
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<td>2 Journal TT</td>
<td>3 FIELD</td>
<td>3 Systems</td>
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<tr>
<td>2 Report</td>
<td>1 SOCIETY</td>
<td>3 Triple Helix</td>
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</tr>
<tr>
<td>1 Manuscript</td>
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<td></td>
</tr>
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2.2.3 Overview of key themes/issues of “the entrepreneurial university” literature

Four main themes are evident in the literature (corresponding to tables 2.2a, b and c), each of which is discussed in the following paragraphs: transformation as an objective, regional development, enacting sustainable change, and relating specific objectives to entrepreneurial activities. The fifth theme is made up of literature reviews or that could be categorized as an attempt to frame or describe the research field: “entrepreneurial university”.

Transformation as a key objective

Authors contributing works in this stream are fundamentally interested in the evolutionary processes of sustainable change within universities, the forces driving this change, the nature of the change process itself, and the desired outcome of this change, i.e., an institution that has embraced an entrepreneurial paradigm. Entrepreneurial processes are viewed as the means
for change. The primary unit of analysis employed is the organization/institution. One of the most influential of the scholars in this area is Burton Clark. In his 1998 book, “Creating Entrepreneurial Universities: Organizational Pathways of Transformation,” he reports on a study of five universities across five nations. Using a case study technique to collect interview data from university administrators over a period of two years, he formulated his findings into a general set of principles addressing the issue of moving universities toward a sustainable entrepreneurial paradigm. These principles are:

- **The development of a diversified funding base via three general routes:**
  - (a) other government sources, (b) private organizations, and (c) new streams of university generated income,
- **a strengthened steering core,** that consists of top down support of bottom up activities and the flexibility of governance structures to allow for departments to move at their own pace,
- **an expanded developmental periphery,** in the form of interdisciplinary and trans-disciplinary research centres, a stimulated academic heartland that consists of entrepreneurial, competitive and opportunity alert departments, and,
- **an integrated entrepreneurial culture that is action based over symbolic and that openly promotes and supports entrepreneurial endeavours by students, faculty, and administrators** (Clark 1998, p 21).

In follow-up work (B. Clark, R., 2003, 2004), several new international cases were employed resulting in the proposal of three necessary processes:

- **re-enforcing interaction among transforming elements** (maintaining changes on a number of fronts so that change is actually a steady state),
- **perpetual momentum resulting from steady accumulation of incremental changes**; (making major investments across a diversified portfolio of projects and initiatives) and
ambitious volition embedded in the university as collective commitment and institutional will (creating virtuous circles of self-reliance).

Clark’s conceptualization of “the entrepreneurial university” is closely aligned with Schumpeter’s idea of endogenous innovation where inputs are created by the dynamic internal conditions of a system, not by the availability or growth of exogenous factor inputs (Schumpeter, 1912/1934, p. 63), and with Penrose’s concepts of entrepreneurial development in the “Theory of the Growth of the Firm” (Penrose, 1959). In Clark’s view, entrepreneurial universities possess the capacity to enact changes from within that allow them to become innovative and entrepreneurial. Unfortunately, Clark’s perspectives on what drives change, how change is specifically enacted, and the nature of the context in which it takes place are extremely vague. His work is also beset with methodological biases in that interviews were only conducted with one category of university employee—administrators—and no criteria for selection of the universities studied were specified (Deem, 2001; Finlay, 2004).

Other scholars interested in the transformational aspects of entrepreneurial universities have attempted to move beyond Clark’s general guidelines to conceptualize the contextual milieu in a much more specific manner. In doing so, they strive to uncover the factors driving transformational change, gain a better understanding of the context in which it is taking place, and determine exactly how entrepreneurship is actually conceptualized and/or facilitated to achieve a variety of goals/objectives. The work of several of these authors is briefly discussed below.

The entrepreneurial transformation in universities is assumed to be driven by both external and internal factors. External factors include changes in government funding for higher education, globalism and its implications for regionalism (internationalization and the surging demand for education and research), the growth of a knowledge-based economy, and demands for institutions to be more responsive to societal needs (Deem, 2001; Sporn, 2001; Williams & Kitaev, 2005; Wong, Ho, & Singh, 2007; Zaharia & Gibert,
Internal factors include the drive for autonomy, the need for new sources of revenue, institutional inefficiencies (a move to total quality management), shifting faculty demographics, and a growing belief that community/industry partnerships may be mutually beneficial (Sporn, 2001; Stankovic, 2006; Subotzky, 1999).

These external and internal factors are thought to be responsible for universities taking an “entrepreneurial turn.” On a functional level, this means the following: (1) the direct involvement of universities in the development and commercialization of knowledge derived from university based research; (2) reform of the traditional functions of teaching, research, and community service so as to meet the growing expectations of society; (3) strategic change involving the recasting of policies, incentives, and governance structures with the objective of removing barriers to individuals, teams, and departments and encouraging behaviour that leads more directly to knowledge innovation (Goldstein, 2008; Grigg, 1994); and (4) the teaching of entrepreneurship at university through pedagogical programs and centres that support skills, the creation of social networks, and opportunity evaluation development amongst individuals/students/faculty (Ropke, 1998).

From a transformational perspective, the entrepreneurial paradigm shift in universities represents both conflict and compromise across several dimensions. On an individual level, there are disciplinary differences in faculty attitudes about what types of behaviours are legitimate (Braunerhjelm, 2007). On an organizational level it involves a specific orientation toward entrepreneurship, the types of objectives that are desired and the types of achievements that are rewarded, typically in an institutional environment where normal principal-agent rules often do not apply (Walter, Michael, & Thomas, 2006). Evidence of cultural change resulting from the resolution of a wide range of multiple logics is difficult to ascertain (Deem, 2001), but some scholars suggest that changes (hybridization) in organizational forms, their objectives and the services offered may be more valid proxies for
evaluating progress with respect to achieving an entrepreneurial paradigm shift (Ferlie, et al., 1996; Sporn, 2001).

At a philosophical level, transformational change often accompanies debate between the commitment to open science and the creation of knowledge as a public good. This reflects the often cited ethical dilemma that encompasses aspects of commercialization: who has the right to exclude others from using valuable knowledge (P. Dasgupta & David, 2002; H. Etzkowitz et al., 2000; Goldstein, 2008; Subotzky, 1999). There are also international considerations that may be significant to change, such as the structural differences between Western and emerging economies (Wong et al., 2007). Across all these domains, the themes of change, conflict and compromise are often conceptualized as evolutionary pathways to new paradigms (Rherrad, 2009; Rinne & Koivula, 2005).

**Regional development as a broad outcome**

One of the broad objectives of university transformation is the social demand for an increased economic footprint on the local community. While transformationalists like Clark have a somewhat inward looking view, scholars interested in regional development tend to view “the entrepreneurial university” as part of a larger interlinked system of innovation and thus have a much more outward-looking view that motivates study of entrepreneurial environments (Berggren & Dahlstrand, 2009; Bramwell & Wolfe, 2008; Breznitz, O’Shea, & Allen, 2008; Brundin, Wigren, Isaacs, Friedrich, & Visser, 2008; Coenen, 2007; Diez & Mildahn, 2007; Dzisah, 2008; Gnyawali & Fogel, 1994; Gunasekara, 2006; Huffman & Quigley, 2002; Steenhuis & Gray, 2006). More often than not, the university is only a sub-component of an economic development system and not a central focus (Anselin, Varga, & Acs, 1997; Lee, Florida, & Acs, 2004). As there is a burgeoning demand for research into the complex socio-spatial relationships between universities and other economic agents, authors interested in the regional development aspect of entrepreneurial universities usually study processes and interactions on
three levels: micro (actors), meso (institutions) and macro (rules, policies and regulations) (Kitagawa, 2005).

The impact of universities on regional development has traditionally been viewed from a labour market perspective involving the generation of jobs and the development of human capital to be plugged into the local labour force (de Groot, et al., 2001; de Groot, et al., 2004; Johansson, 2009; Pickernell, et al., 2007). The concept of “the entrepreneurial university” adds another dimension to this debate by considering universities as a structural component in the task of integrating various factors into a coherent regional economic development. Therefore universities do not just generate jobs and create human capital; they are also directly involved in partnerships to achieve a third mission: the development of new firms and industries (either through spinning off new firms or through the attraction of established firms) whereby new labour markets are formed creating a virtuous circle (H. Etzkowitz et al., 2000). Furthermore, entrepreneurial universities act as attractors of human capital, an important factor in the creation of knowledge spillovers (Audretsch, et al., 2005).

Much of the work conducted in this area involves the study of knowledge production, transfer and recombination into valuable innovations within regional systems (H. Etzkowitz & Klofsten, 2005). But there are several other important sub-perspectives, such as the real impact of university spinoffs and faculty entrepreneurial behaviour on the immediate environment (Chrisman et al., 1995; R. Harrison & Leitch, 2010), the absorptive capacity of the region and its significance to university knowledge spillovers (Audretsch, et al., 2005; Bramwell & Wolfe, 2008; Cohen, et al., 2002), the type of knowledge that is created, its effect, what is actually measured (Lazzeroni & Piccaluga, 2003), and the mechanisms for transferring knowledge to critical stakeholders within a regional innovation system (Schutte, 1999).

One of the most well known conceptualizations of “the entrepreneurial university” and its role in regional development is what Etzkowitz (2008) has
called the “triple helix.” Etzkowitz argues that due to the increasing importance of knowledge and knowledge-based societies, a university may play a pronounced role in regional development. His theory stands in contrast to a national system of innovation approach which sees industry (more specifically, the firm) as playing a leading role in the creation of valuable innovation (Nelson, 1993). Applying an assisted linear model of innovation⁴, Etzkowitz posits that networks and collaborations between universities, industry, and government are focused on new and constantly evolving modes of production where strategic alliances among a variety of actors in each of the three domains are necessary for successful innovation. While the system is primarily driven by profit motives, actors in each of these domains may hold differing objectives and seek different outcomes, ultimately creating tension amongst stakeholders with different objectives. A socio-spatial culture is created within and throughout these helices that over time is capable of crossing boundaries and relieving organizational tensions by continuous redefinition of these boundaries (H. Etzkowitz & Leydesdorff, 2000). In this manner, knowledge can be better managed and focused in order to produce higher numbers of innovations that are foundational to economic growth.

Yet the triple helix theory contains several problems. The most important are the threshold of the economies of scale, quality of research, and the necessary investments in infrastructure required to implement an effective triple helix system. Etzkowitz’s theory emerged from the study of atypical cases (munificent, strong entrepreneurial infrastructures and prestigious universities in technologically developed regions). It is yet to be rigorously tested on universities that operate within typical or challenged contextual environments.

⁴ Although innovation is conceptualized as a non-linear and dynamic process, university-based innovation is often assumed to be a linear model, where inventions are patented, prototyped, market evaluated, and produced for commercial consumption. This is not a smooth process, and thus institutional mechanisms are required to ‘assist’ in the process, especially between academic and commercial actors. This issue will recur in many places in this thesis.
Enacting sustainable change: institutional processes

A third general theme—which is closely related to the themes of transformation and regional development, but which is guided by theory that has emerged from institutional and organizational scholars—involves the examination of three institutional issues relevant to implementing or facilitating change at entrepreneurial universities: organizational culture, institutional governance, and boundary spanning. Scholars interested in organizational culture hypothesize that entrepreneurship at university is moderated by several factors that serve to reconcile potentially contradictory practices, values, policies, and purposes. Organizational level factors, for example, include the type and availability of liaison programs, rules on informal consulting (or other entrepreneurial activities), the number of firms spun out but still connected to the university, and the extent to which departments engage in joint R&D projects with industry and government (H. Etzkowitz, 1998). These factors are further contingent upon the level of incompatibility between goals and expectations, the type of resources available, and the individual propensity of academics to apply commercial thinking to their research programs. Tensions originating from these factors cause serious role conflicts for individual academics and influence their capacity or desire to accept risk (Todorovic, et al., 2005). These tensions are often more pronounced within established, traditional universities as compared to younger universities (Gjerding & Scheunert, 2006).

Institutional governance appears to be important in facilitating entrepreneurship at universities. Vogel & Kaghan (2001) argue that administrators have a role to play as brokers between the academic community and industry, and that policies must be aligned to help bridge existing cultures that are dissimilar. Other authors focus on the importance of governance in managing the compatibility between academic and commercial functions by creating a shared and transparent vision in the entrepreneurial objectives chosen and an agreed-upon means for measuring them (Liesner, 2006). Techniques used to build an entrepreneurial university include the use
of total quality management (TQM), setting an institutional venturing strategy which emphasizes customer service, instituting best practices and programs for continuous improvement, creating the right reward structure, and exerting internal leadership required to drive these strategies (Nkamnebe, 2009).

Using Stevenson & Gumpert’s (1985) descriptive framework of management cultures, Neal (1998) compares and contrasts several critical dimensions to highlight entrepreneurial and administrative approaches to university functions. He illustrates that the governance profile of a university may be assessed on its commitment to institutional entrepreneurship by examining its strategic orientation, commitment to seize opportunities, its use and control of resources and its overall management structure.

Both institutional governance and cultural issues are drawn together through the conceptualization of boundary spanning and its impact on role conflict (H. Aldrich & Herker, 1977; Ashforth, Kreiner, & Fugate, 2000). This improves our understanding of organizational influence on the venturing propensities of scientists at university. Using findings from his case study review of a Finnish USO process, Tuunainen (2005) challenges Etzkowitz’s thesis of the entrepreneurial university concept, particularly the development of hybrid spaces for innovation amongst university, industry, and government linkages. He argues that there are sufficient boundary issues between public and private cultures, functions and objectives to warrant complete separation between them through the spinoff process. He cites specific evidence gathered from this case to refute Etzkowitz’s claim and argues that developing an entrepreneurial university based on generalized concepts may not fit in most cases.

The existence of cases where a need for specific understanding of context may yield different empirical results is evidenced by several examples of contextually relevant situations or circumstances at universities, especially where barriers such as bureaucratic authority, allocation of teaching loads, materials and equipment ownership issues, and ambiguous intellectual property rights are factors. A complete separation of the commercial and
academic objectives of the research group via a formal contract is used to focus attention on the institutional boundaries present. (Tuunainen & Knuuttila, 2009) took an individual level perspective of the conflicts resulting from the dual roles assumed by the academic entrepreneur, and provide further evidence to suggest that the demarcation of boundaries reflects the specific multifaceted socio-spatial environment of the institution.

Re-interpreting Tuunainen’s data, Vestergaard (2007) concludes that inadequate role separation resulting from the ambiguous nature of the university environment toward entrepreneurship is responsible for the majority of the conflict reported. He suggests that the creation of appropriate role identities is potentially more effective than role separation. Doing this is a key factor in facilitating entrepreneurship at university by integrating new roles into the core of institutional norms by addressing both social and spatial boundaries between industry and academia. He suggests policies for stimulating knowledge transfer that specifically outline IP rules, researcher incentives, and the need for inviting industry into the university using various means. Perhaps the most interesting point he makes is that perfect role separation would involve faculty as strictly researchers and students, and industry as entrepreneurs within a not-for-profit structure. This would effectively relax the boundaries between science and industry yet allow boundaries between entrepreneurs and the university to be effectively managed by ensuring faculty tenure, allowing only collective royalties, and organizing university entrepreneurship using collaborative research mechanisms.

While neither perspective is strongly supported by a high volume of evidence, especially when contrasted against other findings in the literature, there are some key points to be drawn from these contradictory positions. First, Tuunainen states that Etzkowitz’s model is developed from data gathered from one of the most entrepreneurial universities in the world: MIT. He argues that generalizations from the MIT model are not fully applicable in other university contexts. Second, the identification of role conflicts by both
these scholars is nothing new to university entrepreneurship. Conflict is a pervasive sub-theme throughout the literature. But perspectives on how internal and external boundaries are formalized may provide insight into how cultures are created, defined, and structurally evaluated—especially within a university context. The specific operationalization of how boundaries may be effectively bridged is currently lacking in Etzkowitz’s triple helix work and Clark’s transformational thesis. Finally, while Tuunanein expresses how boundaries are formed and what they may mean to an institution, Vestergaard is more interested in who crosses these boundaries. Implications extending from this work may be applied to the types of individuals attempting to boundary cross as well as the types of boundaries they face.

**Relating specific objectives to the activity of entrepreneurship**

A fourth theme focuses on the notion of extending “innovation logic” to the concept of entrepreneurial universities and distinguishing it from classical input logic (that currently dominates most university strategies). Ropke (1998) argues that knowledge creation in universities is not just an output, but also an input to the innovative activity responsible for endogenous growth. The characterization of these inputs is framed through the creation of new capabilities, the elimination of inefficiencies and the development of new norms/routines/capacities (Leibenstein, 1978). Thus output growth is not characterized simply by new products, new technology, and growth in revenues and resources, but also by qualitative changes that can be expressed through individual and organizational learning. Ropke argues that innovative outputs are created at: 1) the individual level (where members of the university faculty, students, and employees are acting entrepreneurially), 2) the organizational level (the university itself becomes entrepreneurial and 3) the environment (entrepreneurial patterns created by the interaction of the university with the region). It is implied that at each of these levels, entrepreneurial learning (or tacit knowledge development) takes place as an output of innovative logic that feeds back into the system.
One of the key implications of this conceptualization of new knowledge creation at university is that the organizational transfer of mainly codified knowledge, while useful, is not particularly entrepreneurial. Thus it is argued that universities who view their institutional mission as purely that of a transfer agent should not be classified as entrepreneurial. This “soft view” of knowledge transfer is reflected by Rherrard (2009), who suggests that there are two kinds of knowledge transfer: 1) the commercial transfer of knowledge in the form of patents, licensing and the like, and 2) the non-commercial transfer of knowledge that uses traditional mechanisms, such as teaching activities, publications, and the diffusion of academic and practical knowledge to students (which indirectly fertilizes entrepreneurial opportunities and develops the skills necessary to evaluate and exploit them). While knowledge production is a necessary but not sufficient component for the creation of innovation, citing Ylijoki (2003), Rherrad suggests that critical issues involve the examination of what makes up the entrepreneurial side of the innovation function in modern universities. This area of research is argued to be empirically understudied.

Perhaps the most well known specific type of objective associated with the entrepreneurial university literature is the creation of the university spinoff (USO). When viewing the USO as a dependent variable, activities and other outcomes such as disclosures, patents, licences etc, are treated as variables for predicting USO creation. Using a case study of MIT and a review of the spinoff literature to date, O’Shea, et al., (2007) provide a comprehensive set of inputs that are each deemed necessary (but not sufficient as individual factors) for predicting the USO propensity of a university. Perhaps most important, they state that science and size matters. Thus factors like the quality of research, the sources of research funding, and committing resources to departments with a greater potential for conceiving technologies that may be quickly taken up by the market (e.g., engineering, biotechnology, computer science, medicine and other hard sciences) are significant in USO creation (Lopez, Otero, Rodeiro, & Rodriguez, 2009). They go on to explain
that science must be coupled with institutional leadership, institutional mechanisms, and a wide range of supporting policies (such as technology transfer offices, incubators and research parks) that explicitly establish and support the university mission as encompassing entrepreneurial activities. Last, they posit that history, tradition, and sometimes geographic location often play a major role in developing a culture of entrepreneurship within a university, and that this process is systematic, involves institutional learning, is driven by past success and therefore takes a great deal of time.

Of some relevance to the main research problem developed in this thesis (see chapter 1), O’Shea, et al., (2007; 2008) suggest that efforts at replicating single elements of their model may have limited utility given the synergetic nature of the drivers of spinoff activity within the unique context of MIT. Using an in-depth study of the institution that examined the roles of key individuals, the evolution of its mission, and the historical context of its emergence/ transformation, they describe a unique process that allows for the breakdown and understanding of what they define as “an entrepreneurial culture.” Findings also suggest that the regional environment is also a key factor in spinning out new ventures, especially where there are structures for supporting entrepreneurial behaviour and the capacity to absorb knowledge spillovers (Azagra-Caro, Fragiskos, Antonio, & Ignacio, 2006). Thus a region creates specific demands for technology, knowledge, and human capital and also acts as a supplier of resources and know-how within an open innovation system in which a research university plays a complementary role (David B. Audretsch & Phillips, 2007).

There is also evidence from the literature suggesting that collaboration with firms/ industry is both an objective of the entrepreneurial university and an important part of the entrepreneurial process involved in commercialization. Academic work done in this area investigates how, when, and with whom partnerships, formal contracts or other forms of knowledge transfer between industry and university come about that add an entrepreneurial dimension to science (H. Etzkowitz, 2002).
Several observations are made on how individual scientists and departments, in social sciences and humanities as well as the natural sciences (Pilegaard, Moroz, & Neergard, 2010), form and maintain social networks that link universities to a wide array of external (market) stakeholders (Martinelli, et al., 2008). First, there are several key agents involved in university/firm collaboration, such as individual scientists, research groups (or departments), technology transfer officers and (outreach focused) administrators as well as external entrepreneurs, financiers, firm scientists, and government research organizations (Bozeman, 2000a). Second, there are often informal channels of exchange involving individual network ties and organizational nodes, as well as the more formal arrangements such as contracts, partnerships, joint ventures, or strategic alliances (Bramwell & Wolfe, 2008). Third, collaborations involve a variety of processes, such as presentations by scientists, consultation, and the usage of private equipment by university scientists (and vice versa), involvement in business activities and knowledge transfer through exclusive and non-exclusive rights to patent use (Couchman & Fulop, 2009; Daniel, Hempel, & Srinivasan, 2002; A. B. Jaffe & Lerner, 1999; Kitagawa, 2005). Martinelli, et al., (2008) provide a typology of external linkages, objectives and outcomes. They are:

- Royalties from patents
- Consultancy: expert advisory or analysis services
- Collaborative research: projects in which academics and industry work together on shared problems
- Research contracts: projects that are in response to a specification by the funding body
- Research grants: funds received by government or charitable funding bodies, following a proposal drawn up by academic researchers that may or may not include industry partners as a key consideration
- Research students: sponsorship of an individual student’s work by a firm
Knowledge transfer schemes: where companies take on graduate students to develop a new product or process with the full support of the university

Others

Aligned with the theme of conflict discussed earlier, many of these objectives (research collaboration and/or partnerships with firms) are also a source of individual and institutional tensions. The introduction of market-based incentives into university science can often cause time pressures, a shift of research toward applied science, disclosure delays (as findings are mined for potential market value), ethical conflicts, disputes with regard to the criteria used for determining promotion and tenure, and potential internal rancour surrounding faculty teaching loads, equitable treatment and peer jealousy.

There are also tensions that emerge from policies that govern intellectual property rights, incentives, and rewards for engaging in entrepreneurial activities (Henry Etzkowitz, Andrew, Christine, & Branca Regina Cantisano, 2000; Laukkanen, 2003; O.-H. Ylijoki, 2003). The nature of policies, their ambiguity or rigidness in how IP rights are assigned, the optics of fairness, the suitability of these codes to faculty members, and whether or not they clash with what external partners see as suitable, are all potential areas for conflict due to variance in the norms, standards and values across the stakeholders involved (Siegel, et al., 2003).

“*The entrepreneurial university*” as a field of research

There are several papers that assemble the extant work directly or indirectly associated with the concept of “the entrepreneurial university.” (Mautner, 2005), for example, uses discourse analysis to examine the corpus linguistics of entrepreneurship (words used in describing the phenomenon) within the domain of higher education to determine how its usage may reveal perceptions and meaning surrounding the term. Internet searches revealed that collocates of the term “entrepreneurial university” include adjectives such as
strong, modern, dynamic, top, new, innovative, pre-eminent, young, nimble, responsive and corporate. Significant adverbs were highly, distinctively, and truly. The evidence illustrates that the concept of the entrepreneurial university and its cognates are positive and have significant commercial and profit seeking connotations.

Other papers provide different perspectives from which scholars have approached the study of the phenomenon of “the entrepreneurial university.” In a survey designed to identify the categories of university level entrepreneurship and the factors that are significant to its emergence, Yusof and Jain (2010) identified three research categories: “entrepreneurial university,” “academic entrepreneurship,” and “university technology transfer.” Papers in the “entrepreneurial university” category are described as focusing on institutional level issues, policies on higher education, the triple helix model, national policies and socio-economic development (Audretsch et al., 2005; Feldman & Desrochers, 2003; Gibb & Hannon, 2006; Henrekson & Rosenberg, 2001). For the most part, these issues are reflected in this review, with only the last four papers cited above missing. “Academic entrepreneurship” themed papers were found to be predominantly published within business journals and focused on the outcomes of entrepreneurship in the form of the commercialization of technology (Klofsten & Jones-Evans, 2000; Powers & McDougall, 2005) and the enablers and barriers to academic new venture creation activities (Brennan & McGowan, 2006; Laukkanen, 2003).

Another review of the literature (Rohearmel et al., 2007)—which focused on answering questions regarding the state of the field of university entrepreneurship research—concluded that the literature can be broken down into four domains: (1) the entrepreneurial university, (2) the productivity of technology transfer offices,(3) new firm creation, and (4) environmental context (including networks of innovation). These four domains represent a conceptual framework of university entrepreneurship. The authors also note that there are a few studies that seek to examine the intersections of these
domains. Nevertheless, there are several consistent themes that are identified throughout each of the domains, such as conflicting viewpoints on the function of the university and its role in systems of innovation.

Rothearmel et al., identify several key issues looked at by researchers that help to conceptualize the university context, both internally and externally and how it may impact upon entrepreneurial activity:

**Internal**
- incentives systems,
- the status/structure
- culture (peer, team, research group, departmental, college and discipline),
- faculty,
- intermediary agents,
- internal policy,
- experience/history,
- defined role/identity
- knowledge/technology

**External**
- Industry (type, size, relevant technologies, growth, etc)
- Government policies
- Innovation networks between all three
- Geographical location,

They conclude by stating that the field of study can benefit from multi-level approaches that move beyond the investigation of the parts to embrace the complexity of the whole phenomenon. This confirms the importance of the research questions raised in this thesis that seek to understand the array of differences among universities found to have large performance disparities in the area of commercialization.
2.2.4 A summary of “the entrepreneurial university” literature

The review of the literature on “entrepreneurial university” suggests that it is a discordant mixture of objectives, functions, processes, and outcomes. The term is much too broad in its conceptualization to be useful as a primary unit of analysis for this thesis. A better nomenclature is needed to label the key unit of analysis in this thesis. One promising approach was suggested in a lecture by Professor Kevin Hindle in Denmark in 2008. Hindle spoke of four different perspectives for evaluating the level of entrepreneurialism found within a university context. His first example reflected the growing activity of patenting, licensing, and spinning out of new ventures from university-derived IP. His second example was of a Spanish Catholic University that had no hard science faculty, but that had marketed itself in a way that was highly entrepreneurial so that it could position itself as a world class institution within a limited scope. The third example related to teaching and research being conducted in ways that were brazenly innovative, creating value for students and communities through new pedagogical processes and research techniques that empowered (Aboriginal) communities. Finally, he used the example of the Danish education system and its development of a new entrepreneurship curriculum for specifically teaching and facilitating the creation of new ventures. Stressing the need for blending both curriculum development and research in entrepreneurship as complementary strengths, Hindle offered examples of cross disciplinary entrepreneurship centres and the wide gamut of services offered that sought to promote the activity throughout all aspects of university and community (K. Hindle, 2008).

This lecture provided insight into how one might better classify the full range of activities defined as “entrepreneurship at university.” Viewing the mandates observed to be in effect within the literature reviewed above, a simpler assessment of both the “full range” and the “precise nature” relevant to the current research may then be drawn. In its widest sense (rather than just a narrow sense of “research transfer”), entrepreneurship can then be incorporated into one or all of these mandates to generate innovative
outcomes through: (1) the commercialization of research, (2) teaching and research, (3) governance/management, and (4) entrepreneurship education. In the next section general systems theory is used as the means for classifying and identifying the relationship between these mandates.

2.3 Getting From a Diffuse Literature to a Precise Unit of Analysis

The fundamental topic of interest here is to understand the relationship among context, entrepreneurial process, and the performance of universities in the commercialisation of research outputs, otherwise called “technological transfer.” But a topic of interest is not a research project. The heart of a manageable research project involves selection of a fundamental unit of analysis. In the following paragraphs, this unit of analysis is articulated. The discussion focuses on what is being talked about, what is being observed, and what is ultimately being measured (and how it is being measured). This articulation is achieved after considering the implications of systems theory for the literature that has been reviewed in this chapter.

2.3.1 A brief overview of systems theory and its application to the problem at hand

This thesis has as its theoretical foundation a simplified perspective of General Systems Theory (von Bertalanffy 1951) as it applies to the relationship between context and entrepreneurial process (Fletcher, 2006; Pentland, 1999; A. Van de Ven & Engleman, 2004). Systems Theory was introduced by von Bertalanffy in 1951 and has become known as a “skeleton of science,” and as a way to build around content that links theory development to the world around it through the acknowledgement that knowledge is not something which exists and grows in the abstract, but is a function of human social organization (Boulding, 1956). Von Bertalanffy proposed that problems/phenomena could be better solved if component parts are viewed as integrating to a whole (Ackoff, 1973). Systems are also complex: the actors in a system interact strongly with one another and the
natural world (Sterman, 2000). Actors in complex systems can change their capabilities and decision rules (Ackoff, 1973). Furthermore, a system such as an organisation, institution, or community is by default a “purposeful system” (Ackoff, 1973) that directs its activities toward its own optimisation.

In a systems theory perspective, context elements and process elements are tightly coupled, i.e., a change in context may decrease or increase the process element that is related to performance. This understanding of systems informs three principal constructs of a framework for understanding performance: (1) context elements, the representation of general physical and general human elements in the system environment, (2) process elements, the social and technological (knowledge) components within the system, and (3) objectives, the intentions that determine purposeful behaviour of the system. It is thus an excellent framework on which to build a corpus of knowledge from research problems that exhibit many complex and interrelated variables. It is also a means for sorting and structuring the socio-spatial realized processes involved with entrepreneurship in a university context.

Considering the above, “the entrepreneurial university” as a conceptual term actually represents a multitude of systems for doing many different (but not altogether unrelated) things. Thus, the objective element is very important in defining the system, defining the context that is best associated with these objectives, and the processes used to achieve objectives. Dependent upon the perspective that many stakeholders exist within the entrepreneurial university system as a whole, there may be more than one objective or objectives that are potentially distinct, not well aligned or even polar opposites of each other. The task at hand is to structure the literature on the entrepreneurial university presented above so that these multiple systems may be identified and framed to best highlight the phenomenon that is to be observed.

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5 This is a more specific interpretation of context that is derived from Hindle 2010 and discussed in Chapter 4
2.3.2 Systems within the entrepreneurial university: context, process, and objectives

The literature review above shows that “the entrepreneurial university” should be regarded not as a precise but as a vague term, embracing a highly complex array of concepts and activities. It is also a loosely used term with no firm, agreed-upon definition. It also was shown to embrace a multitude of different issues that relate to system elements of context, process, and performance (through the optimization of objectives). By adopting a systems approach for structuring these factors, we can now proceed to identify and select a well-defined unit of analysis that fits well with the research problem and focuses on what is important to measure and analyse.

The mandates of an entrepreneurial university were shown above to have four different interrelated domains: (1) commercialization, (2) teaching and research, (3) governance/management, and (4) entrepreneurship education. These findings provide evidence for supporting Hindle’s unpublished hypothesis. Each of these domains may employ the activity of entrepreneurship to create innovation in a variety of ways. They may each be composed of elements that consist of entrepreneurial processes, a contextual environment for carrying out those processes, and a specific objective or multiple objectives. Translating the elements of the mandates identified using systems theory, four interrelated systems emerge. A brief summary of these systems is presented below.

_Entrepreneurial university system_ can be defined as four sub-systems with differing but interrelated objectives, processes, and relevant contexts (as illustrated by the overlap amongst them in figure 2.1). General objectives are defined as regional development and funding independence/sustainability driven by transformational and institutional processes carried out within a socio-spatial context that spans across several levels of analysis.
Systems for teaching and research may be framed as the traditional academic mandate of the university. The specific objectives of this system are to create and disseminate (transfer) knowledge. Processes consist of—but are not limited to—pedagogy and conducting basic and applied research. Entrepreneurship applied to this domain may range from developing classes based on societal or economic need, to conducting research that may positively impact groups or communities socio-economically in new, innovative ways.

Systems for commercialization of research may be framed as a relatively new social and economic mandate of the university (and it is the one as the literature review showed is most closely associated with the use of the loose term “the entrepreneurial university”). The specific objectives of this system are to create and sell new knowledge to generate wealth for the university and contribute to local economic development through commercial processes that consist of—but are not limited to—disclosing, patenting, licensing and directly/indirectly spinning out new ventures from research. The general contextual elements are too many to list.

Systems for organizational management may be framed as typical mandates that involve the governance and administration of the institution. The specific objectives of this system are to manage resources, maintain sustainable activities, and react to social/market demands. Entrepreneurial processes may consist of—but are not limited to—new models of governance, innovative fundraising programs, developing new programs/services that are desired and easily commoditized, and application of entrepreneurial thinking to typical management processes. The general contextual elements are too many to list.

Entrepreneurship curriculum systems may be framed as teaching and researching about entrepreneurship (irrespective of whether the university actually has an entrepreneurship curriculum) and new mandates that involve
the specific actions related to creating entrepreneurial readiness and culture. The specific objectives of this system are to develop entrepreneurial skills and competencies, do research on and assist in the discovery, evaluation and exploitation of economic opportunities by faculty and students, and promote new venture creation as a career path. Processes consist of—but are not limited to—entrepreneurship education, mentorship, business plan competitions, business incubation, and financial assistance. The contextual elements are too many to list here (please see Kuratko, 2005; Menzies, 2004; Vesper & Gartner, 1997 etc.).

Each of these systems contributes to what makes a university “entrepreneurial” and represents a perspective that is aligned with the objectives that best define each system. As well, within each system, entrepreneurial action may be employed to discover, evaluate, and exploit socio-economic opportunities within each that may or may not lead to successful innovative outcomes. For example, within a university’s system for teaching and research, opportunities for new classes or pedagogical methods may be exploited to create innovative programs that generate new revenues for the university and create value for students/industry. Systems for commercialization of research may patent a research discovery, or take an equity position within a spinout company derived from the patent, and then sell the equity if the company succeeds with the yield being revenue for the university and new jobs within the region. Systems for governance and administration may leverage a resource they control, such as land, and thus exploit an opportunity to commercially develop it into a research park, generating revenues for the university and economic development benefits to the region. Systems for building/developing entrepreneurial curriculum may exploit an opportunity for providing skills training in the start-up of online businesses, resulting in revenue creation for the university and the generation of innovative businesses by students or faculty.
Figure 2.1 The four systems comprising entrepreneurship in the university context

*Taken from Hindle presentation, (unpublished address entitled “Dimensional Aspects of Entrepreneurship at University”, delivered at Roskilde University, August, 2008) and enhanced by Moroz.

2.3.3 A specific unit of analysis: university systems for commercialization of research

Of the four interrelated systems of the entrepreneurial university noted above, the focus will be on the research commercialization systems (RCS). By making this selection, a clearly conceived and precisely defined unit of analysis is available. Focusing on this unit of analysis is a means for answering the overarching and broad question: *how does context influence the entrepreneurial process within RCS at universities?* More specific derivations of this question are produced, discussed and answered in the following chapters. In chapter 3, additional literature will be reviewed as part of an examination of the differences between rich and poor universities. Research actions taken will help to reliably and validly classify these two university types into sets so as to address gaps in the literature. A review of
entrepreneurial case studies (see chapter 4) will show that that exemplar (first-tier) universities are the focus of most researchers and that there exists an undersupply of studies on second-tier universities. This prompts the development of the main empirical research question of this thesis (chapters seven): *how does context influence the entrepreneurial process within RCS of second-tier universities?*

**Summary of Chapter Two**

This chapter contains a systematic review of literature relating to ‘the entrepreneurial university’. Examination of ‘the entrepreneurial university’ concept finds that it is not well defined. General systems theory is applied to describe the full range of entrepreneurial activities in the university context as the amalgam of four interrelated systems. Of these, a university’s *research commercialization systems* (RCS) is selected as a clearly, defined and manageable unit of analysis for measuring the phenomenon of entrepreneurship in a university context as a means for answering the core research question posed in this thesis.
Chapter Three  Entrepreneurship at University - Context

Chapter Abstract
This chapter introduces and addresses a second key issue: the need to measure the performance based contextual differences among university research commercialization systems (RCS – see glossary) relevant to the phenomenon of entrepreneurship. First, a review of the literature that focuses on how university context impacts upon commercialization performance was conducted. No suitable contextual typologies were found. There was also a scarcity of studies that classify universities by performance and seek to distinguish between them. Second, research actions are taken to address the identified gaps. A classification of universities based on a well correlated indicator of entrepreneurial performance is developed and labelled ‘total gross revenues from commercialization’ (abbreviated to ‘TGR’, see glossary). The chapter ends with the development of a set of valid and reliable taxonomic rules for classifying universities into two generic sets: first tier and second tier (as determined by commercialization revenues).

3.1 Introduction: Underlying Motivations and Past Research
The key objective of this chapter is to consult the literature to answer the question “How do contextual differences among universities influence the entrepreneurial performance of RCS? This question is motivated by past research that explored the notion that only “rich” universities have high-performing RCS’s (2006). The next logical step is to examine the specific factors related to the activity of entrepreneurship within these contexts. In order to investigate this question, a well defined typology (or typologies) must first be discovered (or failing discovery, empirically developed).

A study that empirically developed performance-based university typologies was one performed by Moroz et al., (2008), who studied North American university commercialization data provided by the Association of
University Technology Managers (AUTM). Initially, they analysed whether there was strong statistical association between the research commercialization performance of universities that had entrepreneurship curricula (expected to be better at forming USO) and those that did not (expected to be worse at forming USO). But no such relationship was found. They next analysed data sorted into top and bottom tiers\(^6\) (rich and poor universities) and analysed performance-based differences. A strong relationship appeared. Specifically: (1) large performance disparities existed between a small number of universities that generated a high level of commercialization performance, and a large number of universities that generated a low level of commercialization performance (based on typical indicators such as disclosures, patents, spinouts and licensing revenues); (2) a small number of top-tier universities (11% of sample) generated the majority of all licensing revenues in the population surveyed; and (3) the differences in performance had nothing to do with whether or not the universities possessed entrepreneurship curricula.

That evidence suggests that the policies and practices used in top-tier universities may be a function of how rich they were. In other words being richer facilitated better research commercialization performance (as it did for every other university task, because an abundance of funds, resources and skills—other things being equal—is better than scarcity). As well, the policies and practices employed by a large majority of second-tier universities were not effective in generating valuable innovations from their commercialization systems\(^7\) (especially if they were using similar policies to those employed by top tier universities). A logical conclusion of this research was that the

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\(^6\) In Moroz et al., 2008, the data came sorted into a high-low range that adequately represented the description ‘top and bottom tier sets’. Thus there is a need for using different types of nomenclature that distinguishes it from the typologies developed in this chapter as they relate to different sets.

\(^7\) As discussed in chapter one, innovation is an outcome of inventive and entrepreneurial processes, where commercialization is the means for introducing products and services into the market that are perceived as innovation. Causally, it is a difficult concept to understand, as innovation and commercialization are two sides of a coin where iterative processes are necessary to deliver (create) value for specific customers within the market place.
contexts of the rich and poor universities were dissimilar in some important way. But determining specifically how the contexts were different was not within the scope of the Moroz et al. study. In an attempt to better understand these findings, further review of the literature led to the development of two propositions that were fundamental to the motivation and conduct of the research reported here.

• First, top-tier universities who do commercialization well may benefit from distinctly different contextual circumstances than bottom-tier universities. This original empirical finding was reported in two studies (Di Gregorio & Shane, 2003; Shane, 2002).

• Second, if the policies and practices employed by bottom-tier universities were developed simply to emulate top tier universities, then these may be the wrong models to emulate. This insight was inferred from another study (Degroof & Roberts, 2004).

In order to investigate these propositions, it seemed important to study and understand the holistic contextual differences among top tier (rich) and bottom tier universities (poor) that might influence or constrain the entrepreneurial process relevant to research commercialisation. That analysis is the essence of this thesis.

In this chapter, the focus is on answering the following questions:

1. What do past studies say about the impact of contextual differences on the entrepreneurial performance of universities’ RCS?

2. What are the sample selection methods and typologies found within the literature that may be helpful in reliably and validly classifying universities into “rich” and “poor” sets?

3. What outcome indicators are valid (based on existing theory and practice) and may be used to classify universities into performance-based sets?

4. Does the outcome indicator that is selected uncover patterns that may be used to identify performance-based typologies?
5. How might an empirically justified, performance-based approach to classifying universities be developed in order to reliably and validly explore the contextual differences among RCS at universities that will be important to both policy and practice?

3.2 Understanding the Contextual Differences that Influence Entrepreneurial Performance among Universities

The entrepreneurship at university literature highlights a wide range of differences among university contexts that explains and predicts performance. Yet there is no detectable framework, definition or conceptualization of what the university context consists of and how to measure it. Although a more specific and detailed treatment of context as a specific type of socio-geographical space may be found in chapter one and chapter five, the literature does not prescribe any clear or uniform means for interpreting what context is and therefore, it is difficult to determine what may constitute a variation from one context to another. Thus much of what the extant literature may provide on the topic of context is not explicit and thus leaves researchers of context in murky waters.

A limited number of studies purposely attempt to classify and compare different “types” of entrepreneurial universities (Shane, 2002). Those that do often rely on normative perceptions of success to study those universities deemed as exemplars of best practice and performance (for example, see O'Shea, et al., 2007). The methods used in these studies are heavily case study based. There were few studies found that classify universities by performance and seek to distinguish between them. Therefore a substantial research gap is apparent. This following section looks at context-related studies from the broader literature with the objective of gaining insights about the generic contextual differences among universities that engage in entrepreneurship, and the effects these differences have on performance.
3.2.1 Past approaches to the contextual study of university entrepreneurship

A comprehensive assessment of the literature demonstrates a paucity of studies that directly look for holistic, multi-level, or multi-dimensional contextual differences among universities as a means to explain the performance of RCS. One common form of study compares and contrasts university technology transfer across different nations (see Agrawal, 2008; Goldfarb & Henrekson, 2003; Henrekson et al., 2001; Klofsten & Jones-Evans, 2000; Mowery & Sampat, 2005; Yencken & Gillin, 2006). These studies focused on the entrepreneurial university phenomenon from a broad perspective, and explore the impact of national policies, nation-based variables, and sometimes industries. These macro level studies are of limited use for understanding the genesis of specific entrepreneurial events and situations within a university context and were much closer aligned to environmental issues (Coenen, 2007; Henrekson et al., 2001; Klofsten & Jones-Evans, 2000; Spilling, 1996). The number of these studies was also rather small in number.

There were also very few studies that attempted to examine different types of university contexts with the goal of linking holistic differences to entrepreneurial related performance associated with an RCS. The most relevant study is Roberts and Malone (1996), which resulted in the development of a conceptual matrix of support and selectivity policies for spinout creation. They found that universities like MIT, Stanford, and Harvard have a low selectivity, low support policy regime as they benefit from existing entrepreneurial and venture capital-rich contextual environments and therefore do not need direct policy support and/or facilitation actions. That is, a culture already exists for these activities to blossom independent of institutional direction. A second set of universities, less well endowed in resources or experience align more with a high support, high selectivity policy regime. The authors argue that universities which have less experience must adopt policies that focus on building internal processes for commercialization,
while those with more experience already have efficient processes developed that involve interactions with market agents to successfully spin out technology. Although limited in scope, Roberts and Malone’s work did support the argument that there are contextual differences among universities that have an effect on entrepreneurial performance. They suggest that these differences be identified and analysed so that the proper policy solutions may be devised and implemented.

There are also four key characteristics of Roberts and Malone’s work that must be noted. First, the indicators used for measuring success were limited to university spinouts (USO). Second, the majority of the universities sampled in the data set represent a narrow range of what many would normatively consider “rich” universities. This potentially limits the scope and explanatory power of the study. It also suggests that a more valid and reliable means for classifying, comparing, and contrasting university performance types is needed. Third, their study did not control for national characteristics (they used a sample set of institutions that consisted of British and US universities). Fourth, the matrix only considered the policy regimes and activities of technology transfer agencies/departments (very important to the function of RCS). A wider contextual perspective beyond just the function of the technology transfer office would be beneficial.

In a study of nine Belgian universities that are framed as having weak entrepreneurial infrastructures (and are thus associated with poor, underperforming or bottom tier commercialization contexts) Degroof & Roberts (2004) only provide tentative supporting evidence for Roberts and Malone’s findings that a high support and selectivity policy setting may be best configuration for producing USO. They conclude that some universities should adopt alternative strategies for commercialization that deviate from the norm (patenting, selling or spinning out research), but that conform to the contextual realities of their experience and resource base. They go so far as to state that the contextual factors of some institutions may not be well suited to produce and support high growth ventures spun out from their research
programs. This interesting conclusion is highly relevant to the research reported here and is deserving of further examination.

An assessment of the literature demonstrates a paucity of studies that specifically focus on identifying the contextual differences among universities to explain the performance of RCS. In most cases, one or more levels of analysis are focused upon so as to examine factors that may be significant to a specific type of outcome. The dearth of studies supports the argument that a taxonomic approach is needed to classify certain types of university contexts based on past performance. In the next section, a review of the relevant entrepreneurial university typologies is presented in order to identify (or exhaust the hope of identifying) a useful pre-existing candidate for further application in this thesis.

3.2.2 Entrepreneurial university typologies
Several studies have sought to classify USO types (Djokovic & Souitaris, 2008; K. Hindle & J. Yencken, 2004; Pirnay, Surlemont, & Nlemvo, 2003), provide different classifications of institutional infrastructures, such as technology transfer offices (Markman, et al., 2005) and develop a taxonomy of commercialization strategies (Clarysse, et al., 2004; Geuna & Muscio, 2009). But there are only a handful of studies that directly tackle the need to classify entrepreneurial universities from a holistic perspective. As noted in chapter 2, the entrepreneurial university concept is rather ambiguous. Categories of the entrepreneurial university have been sorted by Armbruster (2008) into several functional/descriptive variations. These variations include self regulative universities (Hölttä, 1995), adaptive universities (Sporn, 2001), enterprise universities (Hay, et al., 2002; Marginson & Considine, 2000), and vague references to innovative or discovery universities (E. Garnsey & P. Heffernan, 2005; Jian, 2005). Not one of these typologies has been developed enough to be considered as useful. Barring the above, few approaches could be found that provide classifications of entrepreneurial university types based on performance.
3.2.3 A distinguishable pattern: the study of “the best”

Although there is the occasional case that implicitly classifies a “type” of university simply by denoting its size relative to others (see Martinelli et al., 2008), the majority of case studies seek to provide insight without regard to how well these insights may be translated to other universities possessing similar or different contexts. As illustrated in chapter two, no specific parameters have been set as to define what context is outside of the research perspectives taken (ie. regional development with a perceived focus on external environment and transformation with a perceived focus on internal environments, etc.). Perhaps the most notable pattern that has emerged from the literature is the study of universities perceived to be “successful” by either (1) transitioning to an entrepreneurial university paradigm (B. Clark, 1998; B. Clark, R., 2003, 2004), or (2) serving as examples for creating wealth through the commercialization of their research (Armbruster, 2008).

Table 3.1 Overview of entrepreneurial university case studies

<table>
<thead>
<tr>
<th>Country</th>
<th>University</th>
<th>Outcomes Measured</th>
<th>Methods used</th>
<th>Level of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>NETH</td>
<td>MIT</td>
<td>Spinoffs</td>
<td>Case Study</td>
<td>University</td>
</tr>
<tr>
<td>UK</td>
<td>Stanford</td>
<td>Links to industry</td>
<td>Quant</td>
<td>Region/system</td>
</tr>
<tr>
<td>US</td>
<td>Cambridge</td>
<td>Processes</td>
<td>Interview</td>
<td>Individual</td>
</tr>
<tr>
<td>SWE</td>
<td>Berkely</td>
<td>Culture</td>
<td>Narrative</td>
<td>Dept</td>
</tr>
<tr>
<td>CAN</td>
<td>Twente</td>
<td>RED</td>
<td>Patent</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Other</td>
<td>Licences</td>
<td>Human capital</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pubs/Cites</td>
<td></td>
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<td>Disclosures</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Patents</td>
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</tr>
</tbody>
</table>

The study of exemplar cases is an often used methodology that seeks to choose cases that can be held up as models of successful performance or that demonstrate certain characteristics that are desirable or valued (Stake, 2000; Yin, 1994). Studies of exemplar cases usually attempt to draw out best practices, identify antecedents to specific outcomes, and even develop theory.
(K. Eisenhardt, 1991). The entrepreneurial university case study literature is no different: there exists a body of work that represents (what one may rationally describe as ‘exemplar’) case studies of those universities that are deemed to be successful at producing entrepreneurial outcomes. What is problematic is that there are no agreed-upon criteria for determining what a successful entrepreneurial outcome looks like, or what measurements should be used to evaluate success\(^8\). Therefore it would be difficult to use these combined works as an empirically classified “type.” The canon of work that seeks to identify and distil the characteristics of “the best” may only be described as a loose set based on subjective researcher perceptions. An overview of this body of work can be found in table 3.1.

Of the case studies that looked at “the best,” the majority (17) were of universities based in the USA, with UK universities second (8). The most studied university was MIT (8) followed by Stanford (3). While the majority of the papers reviewed used the case study method, there were five which employed quantitative methods to analyse data collected from a single university, and two that just used an unstructured interview method. The most studied unit of analysis was the university (17) followed by the region or system (8). Only 5 studies looked specifically at the individual level of analysis (usually faculty). There was considerable variance in the outcomes measured (when outcomes were measured). USO formation was found to be a key indicator of a university being entrepreneurial. Yet there was scarce emphasis on the importance of determining the survival rates or the revenue/job growth details of these spinouts. Therefore the measures provided little depth with respect to regional impact or innovative outcomes beyond researcher observations. Links to industry appear to be another key outcome, but with little in the way of comparable measures. In summary, it was difficult to ascertain exactly what the net value effect of entrepreneurship was, or how these effects could then be compared. The outcomes that could be associated

\(^8\) As illustrated in chapter two, outcomes may be measured as a degree of transformation or sustainability, the impact upon the local or regional economy, or more typically, the generation of USO, selling licenses and/or through the collection of royalties.
with the commercialization of research were a jumble of tangible and intangible variables ranging from patents, licences, and USO’s to the influence of a university on regional development. This evidence supports the criticisms made by Armbruster (2008) that case studies have very limited value in providing a rigorous assessment of the outcomes attributed to entrepreneurial processes undertaken at universities.

These problems led to the conclusion that no acceptable means for classifying universities based on performance have been identified in the literature. It is therefore necessary to determine which indicators are best suited for classifying entrepreneurial universities so that contexts may be compared and contrasted.

3.3 Measuring the Performance of University RCS

The task of measuring the entrepreneurial performance of a university is beset by several challenges that involve the conceptualization of entrepreneurship as part of many different processes and objectives (Anderson, et al., 2007; Langford, et al., 2006). Many of these issues were clarified in chapter 2 by deciding to focus the current study on a well framed unit of analysis: Research Commercialization Systems (RCS). Yet, even within this well defined area of study, there are still a multitude of measures applied, and determining what measurements of commercialization to use for classifying universities based on performance is not straightforward. This problem is framed by (1) the inadequacy of current indicators for commercialization with respect to understanding the effect of outcomes, not just counts, (2) the institutional environment of the university and the ambiguously framed activity of technology transfer, and (3) the issues attributed to measuring performance when approached from the perspective of organizational theory.

3.3.1 A critical assessment of current indicators

Consider the following observation:

*In general, the process of commercializing intellectual property is very complex, highly risky, takes a long time, cost much more than you think*
it will, and usually fails. (US Congress, Committee on Science and Technology, 1985, p. 12)

While the productivity of university technology transfer offices has increased over the last two decades, the above quotation still holds true (Stevens, 2007). The commercialization of research into marketable technology is difficult and success is often elusive, particularly in a university context. The entrepreneurial university phenomenon is blamed by some academics for increasing the expectations of society with respect to the ability of public research institutions to play a much larger role in the creation and diffusion of innovation throughout the economy (Armbruster, 2008). Although the success of a handful of well recognized universities has galvanized opinion about the positive benefits of the pursuit of both science and profit, it is largely unknown as to how well they are actually performing at an individual systems level. This lack of clarity on the issue of performance is also due in part to the types of indicators used and the value attached to certain proxies (that can misrepresent the impacts of certain measures when they are viewed as desired outcomes by stakeholders who are also influential in shaping policy).

The measures of organizational performance for university entrepreneurship are found to be highly institutionalized and therefore more aligned with operational (such as patents, licences, and start-ups) than with financial measures (Siegel, et al., 2007). Because operational measures of effectiveness are likely to vary across different types of university initiatives (i.e., building incubators, encouraging disclosures, licensing to large companies vs. start ups, etc.), and for different players involved in these activities (scientists, tech transfer officers, the university, government, industry, etc.), the assessment of performance is difficult. The reliance upon operational measures leaves room for subjective interpretation of proxies and in many cases assumes the uniformity of measures, particularly in benchmarking studies published by national and international organizations such as AUTM, UNICO, AURIL, the EU, and OECD (see glossary for acronyms). For example, how may researchers determine if one USO formed
in 2007 at the University of Saskatchewan is equivalent in value to one USO formed in 2007 at the University of Regina? Furthermore, certain indicators, such as patents, may also overemphasize the importance of some activities with respect to their relationship to innovative outcomes (Sapsalis, et al., Pavitt, 1998; 2006; Ziedonis, 2008).

There are a growing number of researchers who are sceptical about the current regimes for evaluating performance. These scholars question the validity of measures, or seek to assess the true impact of outcomes through analysis of the indicators presented. In a study of university spinout performance in the UK, Harrison and Leitch (2010) present evidence that shows the impact from university technology start-ups and licensing is less than impressive (Chapple, et al., 2005). It represents a very small portion of the revenues generated from a host of other activities classified as commercialization (such as collaborative research, contract research, and faculty consultancy). Although some university start-up and licensing activities have more impact on regions than others because of the excellence of their research programs and technology transfer experience (E. Garnsey & P. Heffeman, 2005; Lawton Smith & Ho, 2006; Segal, 1986; Tas & Grier, 2005), these examples are found to be more the exception than the rule.

Harrison and Leitch (2010) suggest that when one takes an entrepreneurial systems approach to understanding regional innovation, the impact of university start-up activities is much smaller than it appears (Harrison, et al., 2007). Golob (2006) suggests that a focus on revenues generated for the university may explain some of the disconnect between university indicators of success and regional development. Golob and others point to the need for both direct and indirect measures of university commercialization (R. Lowe & Quick, 2005). Harrison and Leitch also disagree with other scholars who argue for equity positions in start-ups by the university. They point to adverse selection problems by demonstrating the real effects of start-up strategies and the rare occurrence of high growth.
technology firms (Feldman et al., 2002). Thus university measures such as licences and start-ups are deemed by some scholars as the best (of a poor set of) indicators of the entrepreneurial performance of a university’s RCS. This is particularly so when a regional economic development perspective is the main focus (Bulut & Moschini, 2009; Carlsson & Fridh, 2002).

Continuing with a focus on regional development, cases in Canada involving the University of Calgary and the University of Waterloo suggest that informal entrepreneurial activity that is not captured by what the university measures makes up a much larger portion of the impact on regional development. It is therefore argued that the focus on the university as a supporting player instead of a hub in the local innovation system is a better conceptualization for policy makers (Bramwell & Wolfe, 2008; Chrisman et al., 1995). In support of an entrepreneurial systems approach at a regional level, several other studies find that in comparisons among countries, there is some evidence to suggest that national differences in performance may be related more to the absorptive capacity of environments than to university policies (Agrawal, 2008; D. Siegel et al., 2008; Yencken & Gillin, 2006). Other scholars warn that emulation of the US innovation system must take into account the dynamics involved with specific regions, institutions, and industries (Powell et al., 2007). Thus the measures of entrepreneurial performance cannot avoid the potential for distortion due to the influence of contingency effects from regional aspects of local capacities (Powers, 2003; Powers & McDougall, 2005). While this is an important aspect of context, it once again provides only a limited perspective from a macro-level of analysis.

This review points to the growing need for new measurements of entrepreneurial performance at university. Specific to commercialization performance, operational indicators are viewed as being at best ambiguous, and at worst, overweighted in terms of performance. Other scholars point to

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9 Feldman et al., note that some institutions may be better positioned than others in taking equity positions, due to institutional learning and experience involved in start-ups as well as higher quality research.
financial measurements as a suitable means for determining commercialization performance. Yet, this perspective is limited by the many stakeholders who exist and a growing emphasis on regional economic development.

3.3.2 The institutionalization of university entrepreneurship

The institutionalization of entrepreneurship within a university’s RCS is perhaps best framed through its association with the practice of technology transfer (Moray & Clarysse, 2005). Roessner (2001) elaborates on the many definitions of technology transfer and states that:

*The term has been used to describe and analyse an astonishingly wide range of organizational and institutional interactions involving some form of technology-related exchange. ‘Sources’ of technology have included private firms, government agencies, government laboratories, universities, non-profit research organizations, and even entire nations; ‘users’ have included schools, police and fire departments, small businesses, legislatures, cities, states and nations. . . . Within single organizations such as large, research-intensive private firms, technology transfer has been used to describe the processes by which ideas, proofs-of concept, and prototypes move from research-related to production-related phases of product development* (Roessner, 2001, p. 1).

Due to the heterogeneous nature of universities, the institutionalization of academic entrepreneurship in the form of technology transfer varies greatly in terms of its uptake and implementation by universities across the world. The success of universities in commercializing knowledge has had a significant effect on the processes considered to be best practices. It has also resulted in the blurring of the activities associated with entrepreneurship and technology transfer (O'Shea, et al., 2005). Therefore, technology transfer may
be represented by a multitude of institutionalized processes and objectives that *sometimes* overlap with entrepreneurial processes and objectives:

*Measuring the impacts of transferred technology challenges scholars and evaluators, requiring them to reach deep down into their research technique kit bag. Why? The impacts are usually numerous and they are almost always difficult to separate from other parts of organizational life*  (Bozeman, 2000a, p. 627).

When university entrepreneurship is conceptualized as technology transfer, a wide range of social and economic outcomes—beyond new venture creation—are often considered (again, see Bozeman, 2000a). The indicators used to measure these outcomes have become highly important to how universities set mandates, allocate resources, and ultimately impact society. The choice of metrics employed also significantly shapes practice, regardless of the intended impacts. What gets measured gets done (Langford, et al., 2006). Therefore, if government and industry associations only ask questions pertaining to the number of patents, licenses, and spinouts that are generated, those measurements may then influence what is recorded and ultimately what is pursued as an objective.

One of the unintended consequences of benchmarking is that it can result in the comparison of universities that focus on “rank,” rather than on the efforts, struggles, and costs expended on generating certain outcomes. Furthermore, and relevant to the research reported here, the emulation of metrics developed by top performing institutions (and subsequently adopted by others) may be particularly detrimental to universities that do not share similar environments, resources, or past success (Colyvas, 2009). Simply put, the best practices in one setting may not be convertible into success in other settings due to the differences in context (Mowery & Sampat, 2005; O’Shea, et al., 2007). Determination of what constitutes “success” is therefore an extremely important consideration.
In summary, the consideration of technology transfer when investigating the measurement of commercialization performance further confuses the issue of entrepreneurial performance at university. Nevertheless, due to the nature of institutional benchmarking, the legitimacy of current proxies cannot be ignored when selecting performance measurements.

3.3.3 Measuring organizational (entrepreneurial) performance

Measuring and improving organizational performance is one of the key objectives of entrepreneurship and strategic management research (Gartner, 1990; G. Lumpkin & Dess, 1996; Venkataraman & Ramanujam, 1986). Even so, the connection between entrepreneurial decision making processes, their implementation, and organizational performance is only tenuously discussed in the literature. Carton and Hofer (2006) present a comprehensive breakdown of the organizational performance literature and identify several challenges in establishing a set of useful, general, and valid metrics. First, different types of organizations/stakeholders have different views about which outcomes are valuable. Established and new organizations operate on multiple dimensions of performance, such as growth, profitability, or legitimacy. Tradeoffs between these dimensions occur internally as well as externally based on perceptions of value. Temporal effects on value also pose challenges as present and future outcomes are often perceived, and therefore valued, differently. The validity of research is also made difficult by the extensive rigor required in clearly setting out what is being measured. Proxies can have the unintended result of extending the conceptual authority of measures, sometimes dubiously. Therefore, no one approach has emerged to empirically test a fully generalizable and multidimensional model of entrepreneurial performance.

A review and synthesis of the many perspectives on organizational performance yields several models (Cameron, 1986). These models represent three primary theoretical perspectives: goal based, multiple constituency, and systems based (Ford & Schellenberg, 1982). The goal based model equates organizational performance with the accomplishment of a distinct set of
context specific goals (Steers, 1975). Researchers who adopt this perspective argue that universally designed static measures cannot effectively capture performance because the varied and contradictory goals of organizations make generalization difficult.

The *multiple constituency* view holds that organizational performance is determined by the ability to meet the objectives of stakeholders who control/provide resources. Barney succinctly describes the ensuing problems associated with this approach:

*The answer to the question ‘Will this strategy, improve the firm’s performance?’ will always be ‘Yes and no, depending upon whom you talk to.’ In this context, it is necessary for managers and analysts alike to adopt simplified measures of performance, measures that emphasize a few dimensions of performance over others.* (Barney, 2002, p. 32)

The key to determining the appropriate metrics for an organization to use would be to survey the goals of stakeholders to arrive at cumulative levels of satisfaction. This is often a difficult proposition that ends up being subjectively applied; it is also a challenge to generalize in most cases.

The *systems* approach suggests that overall organizational performance must be examined using a set of multidimensional measures that are appropriate and comparable across a population (Venkataraman & Ramanujam, 1986). Often these measures are not explicitly linked to organizational goals, making it difficult to derive agreement on metrics that represent the best capture of an organization’s effectiveness. A summary of these categories is presented in figure 3.1.

When limited to the perspective of the common stockholder within a for-profit firm (or a single constituency stakeholder perspective) the ability to generalize and thus compare and contrast between organizations becomes a less daunting task. Conversely, a perspective that takes into account a variety
of stakeholders, both for-profit and not-for-profit, is much more difficult to generalize and therefore less easy to compare and contrast among organizations.

Figure 3.1 A systems approach to organizational performance measurement

![Diagram of organizational performance measurement]

*From Carton and Hofer, 2006; Venkataraman and Ramanujan, 1986*

### 3.3.4 Summary of the university commercialization performance literature

There is considerable variance in measures of performance for university entrepreneurship. Current measures of commercialization are also poor. This is due in part to (1) the purpose of the research being performed and the overarching theories that guide it, (2) the many different views of what outcomes are the most desired, effective and/or perceived as the most valuable, and (3) potential conceptual confusion as to what exactly is being measured as the outputs/outcomes of specific processes that may be defined as ‘entrepreneurial’. The organizational performance literature suggests
several models for cutting through the clutter and selecting the most appropriate performance measurements: (1) goal based, (2) multiple constituency based, and (3) systems based approaches. In the next section I make an informed selection of a performance indicator that is simple, easy to compare, and appropriate to the research objective.

3.4 An Empirically Justified, Performance-Based, Taxonomical Approach to the Study of University Entrepreneurship

This section reports action taken to develop a reliable and valid means for separating universities into comparable sets for the study of their RCS. A taxonomic approach can be defined as classifying and/or naming objects or processes with the objective of identifying how they relate to one another. They may be grouped by similarities based on a set of rules for classification. As this approach is hierarchical, it allows for broad classifications to stand on simple rules. Dissimilarities to the main category may be used as means for establishing rules around sub categories that can be separated into class, order, family, species etc ("Collins English Dictionary - Complete & Unabridged 10th Edition," 2009).

For this research project, a systems approach is used to guide the selection of a performance measurement. The variable “total gross revenue” (TGR) from commercialization is selected, since it is relevant to each of the three constituencies mapped out in figure 3.1. As a financial measurement, it is highly correlated with operational measurements that may be narrowly attributed to one key stakeholder: the university. Thus all three components are considered to achieve a functional synthesis of the systems approach for performance measurement. Further rationale behind this decision is that data on commercialization outputs are readily obtainable, accepted as legitimate,
and ultimately comparable. This task would not as easily be achieved by using the goal based or multi-constituency models.

There is significant support for a performance based approach from a small set of studies in the wider entrepreneurship literature. These studies focus on “types” of organizations, particularly those that have growth potential or the necessary performance profiles (Harms, et al., 2007; Storey, 1994). Contextualized studies of types of organizations that are linked to financial performance include research on high growth firms, how they are created, and their impact upon society (Acs & Mueller, 2008; Delmar et al., 2003). They also include economic development policies that seek to encourage and support the development of existing successful firms (Westhead, 1995). This is especially so in the entrepreneurial university literature where the best practices, policies, and contexts of high performing institutions are clearly influential to the field (Shane, 2005). Conversely, (and in support of the objectives of this thesis) Westhead and Howorth (2007) assert that there is a logical rationale for identifying under-performing “types” of firms so that comparing and contrasting them may provide insights for helping them establish processes for moving toward the profile and orientation of higher-performing “types” of firms. In this research, this approach is applied to universities instead of firms.

3.4.1 Testing and evaluation of the TGR performance indicator

It is necessary to test the TGR variable against operational variables to see if it is a good fit. One key stakeholder is selected: the university. Several indicators of university commercialization and technology transfer performance were empirically tested, including the TGR variable. Commercialization measures were drawn from three western countries: the USA, Denmark and Australia. Each nation has pronounced differences in demographics, GERD, innovation policy, and culture. Another rationale for

---

10 Organizations such as AUTM collects data on North American technology transfer indicators, and most western governments in Europe also collect university commercialization data.
choosing these countries was the availability of data and the fact that the countries were well known to the researcher and well suited for comparison with Canada (Lafleur, 2007). Longitudinal data from each country was collected over a four year period. This method was preferred over the single year analysis that focused on a single snapshot. Although there was some overlap in the years reported, the complete period of reporting across all nations was concentrated in the periods 2000-2007.

Bi-variate testing of the data in each country was used to determine if there were any patterns that deviated from the norm. In each of the three countries, TGR’s were highly correlated with each of the following variables selected: (1) total research expenditures, (2) start-ups, (3) licences, (4) disclosures, and (5) patents. The only deviation from this pattern was found in the Australian data, where patents were found to be weakly significant at the .005 level, whereas all other correlations were significant at the 0.01 level (see Table 3.2). These tests confirmed theoretical and empirical observations that state the importance of each of these five variables and establish TGR as a valid correlate.

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11 Rankings taken from a Conference Board of Canada report on National Innovation outcomes showed that in relationship to Canada, the USA is higher ranking, Denmark equally ranking, and Australia has a lower ranking.
### Table 3.2 University Output Bi-variate Correlations

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>TGR</th>
<th>Patents</th>
<th>Startups</th>
<th>TREF</th>
<th>Licences</th>
<th>Disclosures</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGR</td>
<td>1.00</td>
<td>.282**</td>
<td>.268**</td>
<td>.300**</td>
<td>.290**</td>
<td>.307**</td>
<td></td>
</tr>
<tr>
<td>Patents</td>
<td>x</td>
<td>1.00</td>
<td>.846**</td>
<td>.838**</td>
<td>.772**</td>
<td>.856**</td>
<td></td>
</tr>
<tr>
<td>Startups</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.745**</td>
<td>.671**</td>
<td>.751**</td>
<td></td>
</tr>
<tr>
<td>TREF</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.809**</td>
<td>.837**</td>
<td></td>
</tr>
<tr>
<td>Licences</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.771**</td>
<td></td>
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<td>x</td>
<td>x</td>
<td>1.000</td>
<td></td>
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<table>
<thead>
<tr>
<th></th>
<th>AUST</th>
<th>TGR</th>
<th>Patents</th>
<th>Startups</th>
<th>TREF</th>
<th>Licences</th>
<th>Disclosures</th>
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</thead>
<tbody>
<tr>
<td>TGR</td>
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<td>.341*</td>
<td>.825**</td>
<td>.562**</td>
<td>.475**</td>
<td>.678**</td>
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</tr>
<tr>
<td>Patents</td>
<td>x</td>
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<td>.594**</td>
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<td>.664**</td>
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<td>.734**</td>
<td>.635**</td>
<td>.829**</td>
<td></td>
</tr>
<tr>
<td>TREF</td>
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<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.756**</td>
<td>.672**</td>
<td></td>
</tr>
<tr>
<td>Licences</td>
<td>x</td>
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<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.675**</td>
<td></td>
</tr>
<tr>
<td>Disclosures</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>DENMARK</th>
<th>TGR</th>
<th>Patents</th>
<th>Startups</th>
<th>TREF</th>
<th>Licences</th>
<th>Disclosures</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGR</td>
<td>1.000</td>
<td>.987**</td>
<td>.956**</td>
<td>.940**</td>
<td>.963**</td>
<td>.959**</td>
<td></td>
</tr>
<tr>
<td>Patents</td>
<td>x</td>
<td>1.000</td>
<td>.887**</td>
<td>.894**</td>
<td>.920**</td>
<td>.912**</td>
<td></td>
</tr>
<tr>
<td>Startups</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.934**</td>
<td>.978**</td>
<td>.966**</td>
<td></td>
</tr>
<tr>
<td>TREF</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.976**</td>
<td>.979**</td>
<td></td>
</tr>
<tr>
<td>Licences</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td>.991**</td>
<td></td>
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<tr>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.000</td>
<td></td>
</tr>
</tbody>
</table>

*significant at the .005 level; **significant at the .001 level

#### 3.4.2 Scatter plots of TGR measures across nations

Observational analysis and scatter plots of the data from each time series revealed that TGR from commercialization activities in each country followed similar patterns (see figures 3.3, 3.4 and 3.5). Observable shifts in performance were used as differentiation points for each nation and then grouped into “top-performing commercialization universities” and “all others.” Following the advice of Stone and Fawtier Stone (2001):

> The (researcher) is obliged to formulate his categories as best he can, knowing full well that there will always be borderline cases and anomalies, whatever choices he makes (Stone & Fawtier Stone, 2001, p. 7).

Fortunately, the patterns observed removed the necessity for making the separation between sets an arbitrary choice. As may be viewed on each of the
scatter plots, a sharp drop off point in TGR can be seen for each country that resulted in plateaus where the curve flattened out. The bottom plateau (blue boxes) can then be visibly identified from the top plateau (orange boxes). Scatter plots with a higher number of data points were more obvious. There was a nearly uniform distribution ratio of top universities in each nation of approximately 10% of the total university population (see table 3.3). Furthermore, the top 10% of universities in each nation were responsible for producing commercialization outcomes that represented an average of 63% of the total across the three countries surveyed. This figure would most likely be closer to 70% considering the low N of universities in the Danish population. This may have contributed to the lower (45%) aggregate outcomes results (only one Danish university contributed to these outcomes). Nevertheless, the exponential production of the top performing universities (the 10%) over the rest of the university population has confirmed the skewed nature of TGR outcomes observed by others and established this pattern internationally (R. P. O'Shea et al., 2007).
Table 3.3 Statistical analysis of university commercialization performance trends

| University of California System encompasses 10 campuses that are often ranked or measured separately. |
|---|---|---|
| **TGR from commercialization (total sample)** | $4,756,643,025* | $15,161,000 | $151,369,000 |
| **TGR/Population** | $12.19* | $2.76 | $7.25 |
| **Universities in top grouping** | 13* | 1 | 5 |
| **Ratio of top sample / total sample** | 10.1%* | 11.1% | 7% |
| **TGR from commercialization (top sample)** | $3,551,878,479* | $6,894,444 | $109,042,000 |
| **TGR from top sample / population** | $11.68/person | $1.25/person | $5.19 |
| **Percentage of TGR produced by top sample** | 73%* | 45% | 72% |
| **Disclosures** | 11334 (25%)* | 287(25%) | 984 (33%) |
| **Patents** | 3401 (29%)* | 150 (36%) | 403 (29%) |
| **Licenses** | 7016 (28%)* | 89 (27%) | 511 (44%) |
| **Startups** | 306 (17%)* | 14 (31%) | 53 (30%) |

Several other notable patterns were identified in the data (see Table 3.3). The first was that the US produced fewest start up companies (17%) in the top performance grouping in comparison with Australia and Denmark (30% and 31%). The top grouping in Australia was also responsible for nearly half of all licenses generated (44%) as compared to the USA and Denmark (28% and 27%). Disclosures and patents followed similar patterns among the top groupings in all three nations, with very little deviation from the mean with respect to patents (31.3%) and disclosures (27.6%) recorded. Returns from research expenditures (measured by TGR) varied widely in each nation. The USA was dominant, with $12.19 per capita returns on research expenditures and $11.68 per capita TGR from commercialization activities, while outcomes from Australia and Denmark were lower ($7.25 and $2.76 per capita, respectively) with much lower outcomes in the top sample for Denmark as compared to Australia ($1.25 and $5.19, respectively).
Figure 3.2 USA scatter plots

Figure 3.3 Denmark scatter plots
In summary, testing revealed that university TGR in each of the three countries correlated with multiple indicators of operational performance. Thus TGR is, evidentially, a good performance measurement.

3.4.3 Discussion of findings, implications and limitations
The main objective of this section was to determine how entrepreneurial universities may be classified by performance measures so as to compare and contrast contextual factors framed by commercialization performance. This was achieved by empirically identifying observable patterns in the TGR of three international sets of university commercialization data. The findings reveal that there is an observable drop off point in TGR that corresponds with (on average) ten per cent of a nation’s university population. These findings are applied as an inductive rule for separating universities into two distinct and replicable sets: high commercialization revenue universities and low commercialization revenue universities.
From this point forward, the term *first-tier universities* will be synonymous with “high commercialization revenue” (or “rich” universities) and the term *second-tier universities* will be synonymous with “low commercialization revenue” (or “poor” universities). This is done to clearly communicate the fact that the terms are aligned with the outcomes of a university’s RCS, and to avoid any pejorative terminology. The two classifications—*first-tier* and *second-tier*—may now be used as specific performance based “types” of universities.

The following two definitions also act as taxonomic rules:

A *first tier university* may be classified as belonging to a set that is above a cut off point near the 10 per cent mark of an industrial nation’s university population ranked by a measure of TGR.

Conversely:

A *second tier university* may be classified as belonging to a set that is below a cut off point near the 10% mark of an industrial nation’s university population ranked by a measure of TGR.

There is adequate room for developing sub classifications within each set. The classifications are flexible enough to allow insights into the various entrepreneurial pathways and processes that universities may exhibit, as well as the contextual circumstances that are significant. This is an important characteristic for developing theory from the detailed study of universities in each grouping.

There are several limitations to the findings presented in this section that must be acknowledged. First, the U.S. data do not include the entire population. Several universities did not report in the AUTM survey (Stevens, 2007). Second, while the best and most recent data available from each country were used, the time series data were not perfectly aligned. Since the data were analysed with the goal of detecting observable patterns that are not
necessarily time sensitive, error bias should be minimal. Third, there are several controls that must be outlined for this study that have to do with international comparisons; namely, national policy, culture, population size, and university specific characteristics attributed to national contexts (such as total research expenditures). Anomalies may be inherent in national data that consist of a small N. Fourth, there will be grey areas around the 10% mark that cannot be rectified by statistical means.

**Chapter Summary**

Patterns detected in commercialization data in three countries were used to develop two empirically justified university typologies: first tier (top 10% as determined by TGR), and second tier (bottom 90% as determined by TGR). These typologies may now be used as taxonomic rules to reliably and validly separate universities into rich and poor sets so as to examine how context influence entrepreneurial processes relevant to their RCS.
Chapter Four  Analysis of Existing Models

Chapter Abstract
This chapter focuses on answering two core research questions posed in chapter one: (1) how does context influence the entrepreneurial process in research commercialisation systems (RCS) at universities classified as first tier (HCR) and (2) how does context influence the entrepreneurial process in RCS at universities classified as second tier (LCR). The means for achieving this task is to conduct a systematic review of the relevant entrepreneurial literature (predominantly case studies) with the objective of classifying and then examining both sets of universities. Auxiliary sources are also incorporated in order to increase the robustness of this study. Large gaps are found in the knowledge pertaining to contextual models relevant to the RCS of second tier universities (as case studies conducted on universities that are ‘not rich’ and/or that are perceived to have weak entrepreneurial infrastructures are few). Thus question two cannot be answered. This need to fill an identified gap prompts the main empirical research component of the thesis which is methodologically structured in chapter six and carried out in chapter seven.

4.1 Selection of Case Studies
As noted in chapter 3, many studies examine entrepreneurial universities that are considered to be top performing or exemplars among their peers. This literature is mostly case based, focuses on the organizational, regional, and/or national aspects of these universities, and seeks to identify factors, policies, and best practices that contribute to “successful” outcomes across a wide range of measures. Across these studies, no empirically justified means for determining whether or not the university context belonged to a reproducible, performance based “set” within a nation (or across nations) could be
identified. This has limited the ability of researchers to aggregate and compare and contrast the knowledge derived from the study of these universities against other discrete sets. It also limits the ability to answer the core research questions posed in chapter 1.

In this chapter, the performance based taxonomic rules derived in chapter 3 are employed to classify a sample population of first-tier (rich or high commercialisation revenue) and second-tier (poor or low commercialization revenue) universities from the cases of entrepreneurial universities published in the academic literature. The systematic review from chapter 1 is revisited. All 295 papers were examined to identify those studies that (1) focused on entrepreneurial universities, and (2) employed a case study method. Data were collected from this sample using two methods. First, a content analysis was performed on all published entrepreneurial university case studies that could be classified into sets using any and all national university commercialization data that could be found. This resulted in the selection of first tier cases from five nations: the U.S.A., the U.K., Canada, Sweden, and Singapore. Second, data were collected on first-tier universities in the U.S.A., Denmark, and Australia using multiple sources. An insignificant number of useful cases classified as second-tier could be identified. This finding pointed to a large gap in what is known about the relationship between context and the entrepreneurial process at universities belonging to the second tier (poor) set.

4.2 Content Analysis of Case Studies Classified in the First Tier Set

Using the taxonomic rules developed in chapter 3, the case study data from entrepreneurial universities that can be classified as first tier are analysed using content analysis (Krippendorff, 2004). The primary objective is to identify factors that may be used to inform the context– entrepreneurial process relationship within their RCS.
4.2.1 Case study selection and data analysis

Of the three nations surveyed in chapter 3 (U.S., Denmark and Australia), only cases of entrepreneurial universities from the U.S. (and one university from Denmark) could be identified. In order to locate a significant number of case studies to populate the sample, a broader survey of nations was required. Therefore, case studies from all nations where commercialization data could be obtained were included. This expanded the set of nations surveyed to six with the inclusion of Canada, the UK, Sweden and Singapore. Cases from Ireland, Venezuela and the Netherlands were dropped because there was either limited or no public data available which could be used to classify entrepreneurial universities into sets.\(^\text{12}\) They are represented by the bottom section of cases in table 4.1 (dark grey). Those cases that were classified as first-tier in the expanded set of nations surveyed were included and those classified as second-tier (greyed out) were dropped. Of the 36 entrepreneurial university case studies identified, 6 could not be classified (no commercialization data) and 7 could not be classified as belonging to a nation’s “rich” set.

\(^{12}\) Based upon my own research of available public sources.
Table 4.1 International case study sample selection: first-tier set

<table>
<thead>
<tr>
<th>NATIONS WITH UNIVERSITY COMMERCIALIZATION DATA (COULD BE CLASSIFIED INTO HCR AND LCR SETS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sussex University</td>
</tr>
<tr>
<td>Manchester Metropolitan</td>
</tr>
<tr>
<td>Imperial College London</td>
</tr>
<tr>
<td>Newcastle University</td>
</tr>
<tr>
<td>University of Surrey</td>
</tr>
<tr>
<td>University of Warwick</td>
</tr>
<tr>
<td>Cambridge University</td>
</tr>
<tr>
<td>University of Lund</td>
</tr>
<tr>
<td>Chalmers University</td>
</tr>
<tr>
<td>Linköping University</td>
</tr>
<tr>
<td>University of Copenhagen</td>
</tr>
<tr>
<td>University of Waterloo</td>
</tr>
<tr>
<td>Calgary University</td>
</tr>
<tr>
<td>University of Toronto</td>
</tr>
<tr>
<td>Utah University</td>
</tr>
<tr>
<td>Berkeley University (UCS)</td>
</tr>
<tr>
<td>Stanford University</td>
</tr>
<tr>
<td>MIT</td>
</tr>
<tr>
<td>Yale</td>
</tr>
<tr>
<td>Duke University</td>
</tr>
<tr>
<td>John Hopkins University</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NATIONS WITHOUT UNIVERSITY COMMERCIALIZATION DATA (COULD NOT BE CLASSIFIED INTO HCR AND LCR SETS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Einhoven</td>
</tr>
<tr>
<td>University of Twente</td>
</tr>
<tr>
<td>ICD Dublin</td>
</tr>
<tr>
<td>National University of Singapore</td>
</tr>
<tr>
<td>University Simon Bolivar</td>
</tr>
</tbody>
</table>

White= those universities classified as first tier  
Grey= those universities not classified as first tier (and therefore by default were second tier)  
Dark Grey=universities that could not be classified due to lack of data (thus were dropped from the study)

Each of the 23 cases are scrutinised in two ways. Data collected from the content analysis produced a set of primary factor codes (directly related to answering the core research question) and secondary factor codes (indirectly related to answering the core research questions). This task was aided by NVIVO software (Appendix A). Following Lincoln and Guba (S. Lincoln & E. Guba, 1985), these codes were then synthesized into general factors which are described in section 4.4.

4.2.2 Narrative findings from content analysis of the first-tier set

General descriptions of the universities examined in the case studies are presented in narrative form below under country headings.

United Kingdom

The study of Imperial College London takes a process based perspective and focuses directly on an organizational level of analysis. In this case, the author
effectively states that the processes illustrated are specific to the university she is studying and that much heterogeneity exists between contexts (Birley, 2002). She identifies several underlying issues that are common across all university contexts, such as the need for establishing proof of concept (POC) and proof of market (POM) processes that are overlapping, yet differentiated by the stage of commercialization. The author also points out some issues that are general to all universities: (1) the different roles an inventor may take in entrepreneurial ventures, (2) influence by multiple stakeholders with various conflicting logics, (3) allocation of value from innovation, and (4) the requirement to warranty intellectual property (IP) to mitigate risk associated with legal challenges to ownership.

The theme of heterogeneity of context is also reflected in the Cambridge cases where Segal (1986) discusses the complex environment from which success has emerged:

_a fascinating amalgam of long term and preconditioning factors, the involvement of people of outstanding quality and a multiplicity of particular events and decisions (Segal, 1986,p190)_

Especially in regard to the Cambridge experience (which is discernibly focused upon a more regional level of analysis using social capital and networking theory as its conceptual foundation), the blind application of best practices and policies to other institutions is cautioned by the authors (Elizabeth Garnsey & Paul Heffernan, 2005). They also suggest that other events, phenomenon and pathways are possible.

Kirby (2006) focuses upon processes necessary for change and bases his conceptual interpretation of university entrepreneurship upon theories of “intrapreneurship.” Using a framework by Pinchot (1985), he provides a set of actions and activities for instituting entrepreneurial change. The University of Surrey is used as a case example, and the conclusion is made that change is not easily established, and that it is a long term process of whittling down
barriers and altering well established routines and organizational structures through a “culture of enterprise.”

The UK set illustrates that the methodologies and underlying goals of the case studies are varied, with authors displaying a focus on different objectives and the use of different levels of analysis. This makes them difficult to compare and aggregate. As well, the authors of these cases are not directly focused on the relationship between context and the entrepreneurial process. Nevertheless, it can be established that the university case studies are contextually linked by their classification as being in the first tier set. Thus, valid conclusions may be drawn from the findings of these case studies in regard to identifying contextual factors and patterns.

**Sweden**

Chalmers University is a private institution\(^{13}\) that can trace its entrepreneurial roots back to the 1970’s. A number of initiatives set the foundation for the commercialization of research produced from its academic programs. In this case study, Jacobs, et al., (2003) provide a clear and concise explanation of university based entrepreneurship and a definition of the entrepreneurial university. They state that it:

*Encompasses both commercialisation (e.g. custom made further education courses, consultancy services, extension activities) and commodification (e.g. patents, licensing, faculty or student owned start-ups). Similarly, the concept of academic entrepreneurship is used to describe the variety of ways in which academics go about commercialising the knowledge they produce... the working definition of the term entrepreneurial university that will inform this paper will be a university that has developed a comprehensive internal system*

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\(^{13}\) Privately established in 1829, turned into a state institution in 1836, and then structured as a private foundation in 1994.
for the commercialisation and commodification of its knowledge
(Jacob et al., 2003, p. 1556).

These definitions serve to further link the importance of these “systems” to each other (as conceptualized in chapter 2), as well as distinguish between them (especially those processes related to RCS). The goal of the case study was to provide a “bottom up” view of the internal processes of the university that could be contrasted against a much larger backdrop of changing environmental factors. These factors included national policies that over time have moved from funding research through various small and scattered sectoral research councils, to a science system that placed universities in a central position, and consequently indicates targeted restructuring so that priority could be given to research that had the potential to directly impact Sweden’s economy through innovation. This restructuring took the form of refocused and streamlined external funding institutions and new mandates passed on to universities that required collaboration with specified industry and government stakeholders. This resulted in the redefinition of strategic research to include an economic development mandate aside from research and education. Specific interpretation of this mandate was left in the hands of the universities themselves with a set of governmental agencies created to support their initiatives.

Canada
Chrisman et al., (1995) present a case study of the University of Calgary (U of C) that seeks to identify the frequency and types of entrepreneurial activities that take place and how they impact regional economic development. The contextual data collected illustrates the role that universities may play in contributing to local economic development in an environment of significant reductions in public funding. The method used in this case starts with questionnaires and then moves to follow-up interviews with key informants.
who feel that the innovation value attributed to entrepreneurship at the U of C is substantial, yet is formally underreported and measured.

The second case study reviewed confirms these findings, as Bramwell and Wolfe (2008) posit that the contributions of universities to local and regional development are much more vast and substantial than is often reported. They find that the University of Waterloo is a good “community player.” They also argue for a shift in theoretical and methodological perspectives by showing that the linear methods of measuring innovation performance through licensing and start up formation are being replaced by social network analysis.

The last paper is a pair wise comparison and quasi case study of the University of Toronto (U of T) and the Massachusetts Institute of Technology (MIT), with a sub case involving a Canadian academic entrepreneur (Agrawal, 2008). Rich descriptive detail is not one of its key yields, but some of the key differences between US and Canadian technology transfer productivity are presented, namely, the certainty of IP title at US institutions via Bayh-Dole, greater proclivity towards commercialization, a supporting culture, greater access to resources (both government research funding and VC), and proximity to high tech corridors replete with anchor firms necessary for the development of early stage technologies over that of Canada.

**U.S.**

The bulk of the usable cases for this study are derived from the U.S. set of first tier universities. They encompass thirteen studies of five universities. The most detailed and robust of these is Shane’s (2005) historical study of spinoff creation between 1980 and 1996 at MIT. He uses a mix of quantitative and qualitative methods to achieve six goals; one that is very close to the focus of the research reported here:

*The book aims to describe how four major factors – the university and societal environment, the nature of technology, the industries in which
spinoffs operate and the people involved in the spinoff process – jointly influence spinoff (entrepreneurial) activity. (Shane, 2005, p. 3)

As compared to Shane’s focus on how spinoffs are created, Krueger et al., (2008) concentrate on describing bottom up entrepreneurial approaches over top down bureaucratic mechanisms for commercializing innovation from the University of Utah. Jong (2008) takes a distinctive institutional theory based approach to understanding how the social environments of two highly different communities (Stanford and Berkeley) adapted to societal and scientific change. Adams (2005) uses the region as a unit of analysis to describe Stanford’s anchoring role in the Silicon Valley experience and presents findings that support a human capital approach through the importation of star scientists, the development of high quality research, and the eventual spill over of new knowledge to industry in the region. Data from John Hopkins University is used to develop a framework for university/industry relationships critical to the flow of knowledge to the market. They provide evidence of institutional change over time from that of a stated mission where commercializing research was not consistent with academic culture to one with a more applied research focus. The case also shows how a spectacular failure of commercialization activities may instil a cultural reluctance to pursue entrepreneurial pursuits that may impede growth in development of an environment for technology transfer for many years (Bercovitz & Feldman, 2003).

The remainder of studies collect their case data from MIT. Evidence for the importance of human capital and quality research is bolstered by another case study of two departments at MIT where findings show that patents are only the tip of the iceberg with respect to the entrepreneurial process (Agrawal & Henderson, 2002). Looking specifically at the performance of university spinouts, Shane and Stuart (2002) establish linkages between the commitment of academic entrepreneurs and the beginning resources they contribute as highly significant to their success.
while Hsu et al., (2007) use alumni data to look at the rates of new venture creation over time. They find that critical mass, a growing entrepreneurial culture, and the external climate for business are important factors. Taking a more systematic approach to understanding the success of an entrepreneurial university, O’Shea et al., (2005) combine several dimensions often studied in isolation and develop an integrative framework for predicting spinoff productivity. They emphasize the importance of history to context and the impact of past commercialization success that attributes importance to past experience from a local environmental perspective. Most importantly, they recognize that these contextual factors may hinder efforts at replicating elements of the MIT framework at other universities due to their uniqueness. The regional theme is furthered in Breznitz et al., (2008). They advocate for university tech transfer policies to be examined within the context of the surrounding environment for spinoff activity. The research conducted used a comparative case study approach of Yale and MIT and investigated the notion of how different policies for different entrepreneurial contexts at universities may help to fit the right kind of policies for the right kind of environments.

Although the thirteen studies that focus on exemplar universities provide a great deal of information, only a few take a focused approach to the study of the relationship between entrepreneurial process and the context in which it is carried out. Again, much like the other studies, a hodgepodge of qualitative and quantitative methods are used, with little focus on the contextual attributes of these top performers and how they may be differentiated from other universities that are less successful in the commercialization of research.

**Singapore**

Unlike the cases reviewed in the previous four nations, Singapore may be better described as a newly industrialized economy. This is a key difference in the nation level environment that impacts upon the context of the National University of Singapore (NUS) with respect to all others in the survey.
Defining features of the national environment are best described by Wong and Singh (2007) as a “transition from an investment-driven economy to an innovation-driven economy, emphasizing the building of intellectual capital and its commercialization to create value and jobs.” This lone case is thus uniquely qualified as a means for comparison of a first tier university in a country that is not part of a well defined group of industrialized nations.

The case study yields a great deal of rich content data that covers the history, strategies, institutional structures, programs and resources available to the university that produces a highly graphic representation of NUS’s capabilities. Perhaps the most interesting aspect of this example—the NUS “model” if such it may be called—is that there is a highly structured set of policies and clear objectives to increase human capital through global competency development. These strategies use international, institutional, and industrial boundary spanning within newly created educational programs to meet objectives. The indicated import-export strategy of human capital development, entrepreneurial capacity development, and innovation targeted network establishment illustrates the ability of the community to evaluate its weaknesses and specifically design policies to strengthen certain areas required for paradigm shifting. Assessment of the NUS suggests that while national environmental contexts are rapidly shifting, the entrepreneurial university model presented in the case study shows very few local or national factors that are significant constraints. This is especially so due to the university’s policies that seek to compensate for regional disparities through their global model. Importantly, local industry is shown to be significantly impacted by the outcomes of NUS’s activities. While distinctions can be made between the Singapore case and cases in other western countries, its classification as a first tier university appears valid based on analysis of the case content provided and a similarity in the general patterns observed.
4.2.3 Limitations, implications and issues distilled from the content analysis

The majority of the case studies reviewed were not directly focused upon answering the core research objectives of this thesis. Therefore, several limitations of the content analysis must be noted. First, the bulk of these papers used common economic boundary conceptualizations (organization, region, and nation). While the term community could be found within several of the cases, it was not cast in a central conceptual role nor was RCS used as an explicit unit of analysis (see chapter 5 for an explanation of the guiding conceptual framework and the importance of the term community to the study of context used in this project). Only a few of these works used a perspective that could be viewed as closely associated with community or context, such as social capital, or social networks.

Second, there was a considerable amount of variance in the objectives, scope and methods of the papers used. This makes aggregation difficult and may decrease the level of validity when used to inform a different set of research questions, especially when contextual factors and alignment to the unit of analysis measured in this thesis must be inferred from the data.

Third, some of the papers were not full case studies but presented evidence of cases from individual activities, new venture processes and other general examples from the universities in question. As well, quantitative methods that incorporated both university case specific data as well as aggregate data from sets that were not compatible with my taxonomic approach were included.

Fourth, many of the works were temporally focused. Therefore, historically rendered cases of change over time were presented while the majority only produced snapshots of the current contextual factors observed. Finally, the use of the terms “commercialization,” “technology transfer,” “innovation,” and “entrepreneurship” were found to be highly overlapping throughout all the works reviewed.
However, there were some cases that were more aligned with the research objectives of this thesis than others. Due to this, in some cases, data were slightly more robust with ample description of contextual factors presented and their relationship to entrepreneurial processes discussed. For example, Shane reproduced interviews from key stakeholders at MIT as evidence to support assertions made. Nevertheless, the yield from the content analysis conducted is broad in scope and general in description.

There are also several limitations due to the international perspective (sampling) employed. Case study data suggest that there are several areas of differentiation between national sets at a macro level of analysis. First, there is some variance in how intellectual property (IP) rights are assigned across countries and geographic nation blocks (namely the custom union of the EU). The Bayh-Dole Act in the U.S. effectively assigns all rights to publicly funded research to the universities in which the research took place, not to the researchers who performed it. Other countries have a wide range of policies with respect to who receives the IP rights for technologies and ideas. For example, Denmark and Belgium have passed legislation that is very similar to the U.S. The UK has no formal legislation, yet strictly assigns rights of research to the universities and not the inventors. Sweden and Germany assign IP rights by default to the inventor while Canada is a hybrid system where 55% of universities have instituted policies where IP rights are assigned to the university, 30% assign the rights to the inventor, and 15% have joint ownership arrangements (Wright et al., 2007). Policies that deal with disclosure, patenting, and allocation of revenues from IP are left to individual administrations. This makes institutional based policies that focus on stimulating knowledge transfer or entrepreneurial activity much more susceptible to influence from national policies that govern innovation, education, and economic development in general.

Second, there are differences in the amount of funding available for research universities, the density of researchers to population, and the

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14 In 2003, Germany moved to a system much more similar to Bayh-Dole.
structures for how public research is organized and funded. Table 4.2 illustrates the substantial gap between the U.S. and the EU when comparing research and development (R&D) expenditures to gross domestic product (GDP) ratios. This, combined with work completed by Caracostos and Muldur (1998), shows the productivity rate of academics is higher in the EU, yet patenting data reveals a substantial innovation gap with all EU countries lagging behind the U.S. This gap is commonly referred to as the “European innovation paradox.” The evidence suggests that there may be differences in national business environments, regulations, culture, laws, and policies that make aggregation of general data on top-tier universities across a wide range of U.S. and non-U.S. nations potentially problematic.

Table 4.2 Economic indicators

<table>
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<tr>
<th></th>
<th>Gross domestic expenditure on R&amp;D Volume (Billion $) (2002)</th>
<th>Gross domestic expenditure on R&amp;D evolution % (1997/2002)</th>
<th>Gross domestic expenditure on R&amp;D as % of GDP (2002)</th>
<th>% of GERD carried out by the public sector</th>
<th>% of GERD carried out by the private sector</th>
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</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>6.4</td>
<td>+33</td>
<td>2.24</td>
<td>26.7</td>
<td>73.3</td>
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<tr>
<td>France</td>
<td>37.9</td>
<td>+17</td>
<td>2.26</td>
<td>36.7</td>
<td>63.3</td>
</tr>
<tr>
<td>Germany</td>
<td>54.2</td>
<td>+19</td>
<td>2.53</td>
<td>30.8</td>
<td>69.2</td>
</tr>
<tr>
<td>Sweden</td>
<td>10.2</td>
<td>+36</td>
<td>4.27</td>
<td>22.4</td>
<td>77.6</td>
</tr>
<tr>
<td>UK</td>
<td>31.1</td>
<td>+19</td>
<td>1.87</td>
<td>33.0</td>
<td>67.0</td>
</tr>
<tr>
<td>EU</td>
<td>202.0</td>
<td>+21</td>
<td>1.86</td>
<td>36.2</td>
<td>63.8</td>
</tr>
<tr>
<td>US</td>
<td>277.0</td>
<td>+20</td>
<td>2.66</td>
<td>28.0</td>
<td>72.0</td>
</tr>
</tbody>
</table>

Table reproduced from Wright et al., (2007)

Third, the economic status of nations may also play a role in explaining some of the differences in contextual factors among the cases examined in this set. The population of a country, its geography, and to an extent, its national culture (complex social patterns that are often difficult to ascertain beyond general conceptual categorizations that are not uniformly
agreed upon) may also play a mediating role in performance (see Hofstede 1980). These issues are carefully considered when developing the general framework of first-tier universities after secondary data analysis has been completed in the next section.

These limitations showcase the need for research that is both conceptually and methodologically appropriate with respect to the study of university context across nations. Not only are better controls necessary, but a perspective that focuses upon the activity of entrepreneurship within a defined social space may provide insight into the context process relationship that has not been to date, an objective of researchers.

4.3 Auxiliary Data Collected on the First Tier University Set

This section uses secondary data on first-tier universities from the countries of particular interest to this thesis: Australia, Denmark and the U.S. This approach is used to enhance the robustness of the data collected on this specific typology under investigation.

4.3.1 Secondary data collection, analysis and findings

Data were collected on the first-tier cohort of entrepreneurial universities in the U.S., Denmark, and Australia using secondary sources such as published rankings, survey data, web site content analysis, and NGO studies. The objective was to produce as many complementary factor patterns as possible that would be useful in framing the general context of first tier universities. Findings are presented in table 4.3. Universities are arranged across the top of the table by nation and coded by shade in this order from left to right: U.S., Denmark, and Australia. Reports on the various factor groupings identified specific underlying variables and their limitations. A short discussion of the overall findings is presented at the end of the section.

1. Prestige, science production, and quality

The first six categories represent institutional prestige, research/knowledge production, and quality rankings of specific research fields. Data from the QS
World University Rankings website were drawn from their latest survey (QS, 2010). The variable “university prestige” was based on rankings of the best universities in the world. Eleven of the thirteen universities in the first-tier group in the U.S. were ranked in the top 100 universities overall. The single Danish university was ranked in the top 200, and one of the three Australian universities also achieved a top 100 ranking, with the other two in the low end of the top 200. Therefore institutional prestige based on university quality rankings appears to be quite high in this cohort, relative to each nation’s peers.

Citations per faculty member are a second ranking category used to convey research productivity. Again, a high number of U.S. universities (8 of 13) were ranked in the world’s top 100, with all but one included in the top 200. Danish and Australian universities were ranked in the low to mid 100 areas, except for one Australian university, which did not receive a ranking in the top 500. Knowledge productivity is thus also highly correlated with the universities in this set. The last four categories reflect university research strengths in the areas of engineering, life sciences, natural sciences, and the social sciences. These categories indicate research quality within disciplinary silos associated with commercialization. Only one of the U.S. and one of the Australian universities did not achieve a ranking in any of the categories while the rest had solid but varied rankings across all four categories; this suggests that these universities are highly regarded in the quality of the science they produced.
Table 4.3: Characteristics of the top performing set

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<tr>
<td><strong>1. PRESTIGE, SCIENCE &amp; QUALITY</strong></td>
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<tr>
<td>Prestige*</td>
<td>7</td>
<td>106</td>
<td>5</td>
<td>32</td>
<td>90</td>
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<td>35</td>
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<td>Prof/Research*</td>
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<td>71</td>
<td>3</td>
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<td>166</td>
<td>107</td>
<td>186</td>
<td>145</td>
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<td>Life Sciences*</td>
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<td>8</td>
<td>55</td>
<td>79</td>
<td>4</td>
<td>194</td>
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<td>Natural Sciences*</td>
<td>24</td>
<td>x 2</td>
<td>12</td>
<td>136</td>
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<td>x</td>
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<td>63</td>
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<tr>
<td>Social Sciences*</td>
<td>10</td>
<td>203</td>
<td>12</td>
<td>22</td>
<td>21</td>
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<tr>
<td><strong>2. ENTREPRENEURIAL PERFORMANCE</strong></td>
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<td>Cash in Equity</td>
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<tr>
<td>HICs highest royalties 1 year (in $m)</td>
<td>35,543</td>
<td>174,111</td>
<td>120</td>
<td>110,463</td>
<td>168</td>
<td>122,212</td>
<td>154</td>
<td>118,216</td>
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<td>64</td>
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<tr>
<td>Total Research Exp’s (in $m)</td>
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<td>4,5</td>
<td>0,99</td>
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<td>12</td>
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<td>Top Performer Long</td>
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<td>Y</td>
<td>N</td>
<td>N</td>
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<td><strong>3. GEOGRAPHIC VARIABLES</strong></td>
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<td>High technology Corridor</td>
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<td>Y</td>
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<td>Incubator</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
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<td>City Pop (in $m)</td>
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<td><strong>4. INSTITUTIONAL EE &amp; CAPITAL</strong></td>
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<td>RTO size***</td>
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<td>Graduated entrepreneurship</td>
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<td>Startup funding/investing partners</td>
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<td>EE Program Rank</td>
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*QS rankings
***A=20+, A=15-19, B=10-15, C=5-9, D=0-4 employees
+Columbia only reports one year and Stanford only three in the 2004-2007 period

2. Entrepreneurial performance

The next five categories are classified as secondary measures of entrepreneurial performance. They come in the form of (1) equity cashed in from start-ups, (2) single year bests for running royalties from licenses, (3) total gross revenues reported across the four year period, (4) the amount of funding received into their research programs, and (5) long term historical performance. The majority of U.S. first-tier universities had cashed in stakes in start-up companies created from their research programs. This is compared with only one of three in Australia. No information on the Danish university could be retrieved in this category. This pattern dovetails with empirical evidence that suggests the facilitation of high growth spin out companies through university equity positions is more important than

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15 In the USA, revenues derived from cashed in equity were modest compared to revenue derived from other licensing activities. The University of Melbourne cashed in 50 million in equities in 2000 that was in comparison to licensing revenues, very substantial.

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licensing strategies (Bray and Lee, 2000). Although further investigation is required, this finding does draw attention to the fact that this strategy appears to be significant to commercialization performance within this cohort. As well, each of the U.S. institutions reported at least double digit million dollar running royalty years in the period from 1996 to 2008. MIT, NYU, and NWU reported single year royalty revenues topping $800 million. Unfortunately, data in this category could not be found for Denmark or Australia although the next category, total gross revenues (TGR) from licensing, shows that the overall licensing revenues of universities in Denmark and Australia paled in comparison to those of the U.S.\textsuperscript{16}

Explanations for these outcomes may be extrapolated from the next category, total expenditures on research, which illustrates the funding gap between the US and Australia in the first tier set. This evidence suggests that research expenditures (from a contextual point of view, that they are rich) are obviously significant in the first tier set, confirming past findings (P. W. Moroz et al., 2008). Several documents, academic publications, and historical archives were used to determine whether or not the university in question had a long and stable history of being a top performer over the last thirty years. Four of the thirteen U.S. universities have only recently moved into the first tier set over a period of ten years (Zacks, 2000). In Australia, two of the universities boasted commercialization successes in the early 1990’s in the form of a cervical cancer treatment (Gardicil) at the University of Queensland (UQ) and the cochlear implant device at the University of Melbourne (UM). In Denmark, the lone university, Danish Technical Institute (DTU), did not demonstrate any relevant historic patterns in performance from any of the archival data reviewed (but the data were limited). Therefore empirical evidence shows that long term historical performance is a static characteristic and that there is very little movement within the U.S. and Australian sets.

\textsuperscript{16} While the data show that licensing revenues outweigh revenues from cashed in equity of start ups, Bray and Lee (2000) have provided evidence that suggests otherwise: that the average value of equity held by universities is greater than average annual licensing income. There are of course several problems with measuring held equity as these figures may rise or fall over time with the success of the venture in which they are held.
3. Geographic variables

The following four categories could be defined as “geographic” variables. Data from the Milken Institute were used to determine whether or not the university in question benefited from the presence of nearby high technology corridors (DeVol, et al., 2009). Universities across all nations but one were within 100 miles of a high tech region. Further research on the anomaly, the University of New England (UNE), revealed that the majority of its patents and revenues from licensing came from livestock related software programs and that its rural location was very much analogous to the findings of the rest of the set due to its close association with a specific industry (agriculture). As well, data taken from their websites showed that each of the universities owned, operated or had partnerships with business incubators and science parks. Lastly, there was considerable variance in the population base of the cities where each of the universities in this set were geographically located, ranging from eight million to two hundred thousand. Thus population was not significant beyond a specific threshold while basic correlation with research parks, incubators, and high technology corridors was observed to be significant.

4. Institutional history, entrepreneurship education programs and financial capital

The last six categories are institutional characteristics broadly relevant to entrepreneurship at university and consist of institutional history, entrepreneurship education, and financial capital. Only five of the thirteen U.S. universities were classified as public institutions with the remainder being private. Universities in Denmark and Australia were all public. Using AUTM and national data, the size of technology transfer offices (which are cited by many authors as significant to the entrepreneurial process: see Rothaermel, et al., 2007)—in the first tier set range from over 60 employees, such as in the University of California (UCal) system in the U.S., to as few as
3 at UNE in Australia. The average age of a tech transfer office in the first tier set in the U.S. was calculated to be approximately 32 years, with MIT boasting a 70 year history and Stanford 40 (although the informal technology transfer activities at Stanford go back even further: see Etzkowitz, 2008). Data for the other two countries in this category were difficult to find although secondary analysis shows that in Denmark, formal technology transfer infrastructure does not go back further than 15 years while in Australia, evidence could be found that suggests UM and UQ have had formal TTO structures from as far back as the early 1980’s, with the first being set up in 1959 at the University of South Wales (Harman & Stone, 2006).

A subset of the institutional characteristics found to be relevant from the literature reviewed was the prevalence of university based entrepreneurship education programs, centres, and funds for start-ups (see Galloway & Brown, 2002, among others). The category “graduate entrepreneurship education” shows which universities in the set have a graduate level entrepreneurship program or formal specialization. The category has purposely been left as very broad based due to the variance in entrepreneurship education programs reviewed across these nations (D. Kuratko, 2005; Vesper & Gartner, 1997). Identified programs were located within the business school, attached to MBA programs, and within faculties of hard sciences. Others were cross institutional in design (involving many of the above and more). Single courses were not considered as constituting a “program” (K. G. Hindle, 2001).

Evidence could be found for the existence of entrepreneurship education programs in the Danish university and all U.S. universities but one17. There was no evidence of graduate level programs in entrepreneurship to be found in the Australian set. The Forbes-sponsored entrepreneurship rankings in Entrepreneur magazine were used to provide evidence of excellence in entrepreneurship education programs. Of the thirteen U.S. first

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17 The existence of a graduate entrepreneurship program correlated 100% with the existence of an entrepreneurship centre in this set, thus the decision to not include it as a category.
tier universities, seven were ranked as having either a top 25 graduate or undergraduate entrepreneurship program in 2007, 2008, or 2009. There were no rankings of entrepreneurship programs to be found in Australia or Denmark. Yet in Denmark, entrepreneurship education is now legislated to be delivered within all universities and the International Danish Entrepreneurship Academy (IDEA) established in 2005, operates as a partner organization within some of the universities to provide entrepreneurship education, mentoring, links to business, and resources for entrepreneurs in the area, student or otherwise (Bager, 2006). This points to a potential connection between entrepreneurship education programs and commercialization performance, but there is little hard evidence to support its statistical significance.

The category “start up fund/investing partners” reflected a broad range of institutional and non-institutional constellations that served to provide research grants/funds for helping to move an idea or technology through to proof of concept or seed capital for new ventures. Universities that only hosted a business plan competition that provided an award of seed capital to a winning new business development team was not considered as part of this category’s definition. Two of the Australian universities have entered into a partnership with VC companies to form Uniseed (Uniseed, 2011), while DTU in Denmark has developed its own seed capital fund through a quasi governmental organization called DTU Innovation (SymbionInnovation, 2011). In the U.S., for example, the University of Washington in partnership with other stakeholders has established the Washington Research Foundation (WashingtonResearchFoundation, 2011) to be an early stage investor in technology based start-up companies. Eleven of the thirteen U.S. universities have some type of clearly identifiable structure, joint venture, or external partnership that functions to provide funds, training, and/or capital to university inventors, either directly or indirectly. Unfortunately, no data related to their efficacy could be readily found outside of their disbursements. As well, the data may have gaps within it and therefore, several researcher
errors may be attributed to missing investment funds at work (that could not be found) within the U.S. universities that did not correlate with this variable.

### 4.3.2 Summary of secondary data findings

Entrepreneurial universities within the first set in the U.S., Denmark, and Australia reflect high levels of academic prestige and excellence in research across many fields of study. They also benefit from geography in that all are located near high technology corridors. Other patterns reveal that they have established infrastructure in science parks, business incubators, technology transfer offices, access to start-up capital, and on average, receive a large amount of research funding from government and industry. There are also several differences between nations that were identified. The U.S. clearly provides greater levels of funding when comparisons of total research expenditures (TRE) are made with Australia and Denmark. This potentially explains why the U.S. reaps greater returns in the form of research licensing revenues. The U.S. also has a larger contingent of universities operating as private institutions, where in Denmark and Australia, all major universities are publicly operated. Australian universities show little proclivity for developing entrepreneurship education programs at university while the U.S. and Denmark weight their importance on a much greater level based on their observed emergence in both nations. Scarce data could be found to help evaluate how entrepreneurship education may impact the commercialization of intellectual property. No definite patterns in city size, emphasis on start-ups and equity positions, or the impact of technology transfer office size can be inferred from this data (although the U.S. set of universities does show a pattern in equity positions and a proclivity towards USO generation). Finally, the set is populated by institutions that have performed well over time in the area of commercialization with relatively few new entries into the first tier set over a twenty year period. This suggests that there is very little churn within national sets.

These findings are limited by the nature of the secondary data sources used and are only meant as a complementary means for filling gaps and
improving the overall level of richness to the data (Appendix A) used for generating the conceptual framework that is presented in section 4.4.

4.4 First Tier Universities: A General Framework

In this section, evidence from the content analysis of extant case studies and also from secondary data collection is used to develop a general model (first-tier general or FG-1) of the relationship between context and entrepreneurial process at “rich” universities.

4.4.1 Explanation of how general factors were synthesized

Coded descriptions of general contextual factors and processes are presented. These factors are synthesized from codes in table format (not included due to size) using four strategies proposed in Miles and Huberman (1994) and that have been offered by Lincoln and Guba (1985): (1) filling in (adding new codes based on insights that emerge from analysis), (2) extension (returning to old code and recoding after a new theme or relationship has been detected), (3) bridging (seeing new relationships in code that call for new configurations or categories), and (4) surfacing (identifying new categories). Codings that were too specific were generalized into broader categories, resulting at times in a mismatch of levels of analysis. For example, the category of human resources was coded using cognitive orientations, individual classifications, and broader classifications of general roles that are relevant to entrepreneurial activity at university.

4.4.2 Overview of FG-1 and general factor definitions

The general framework (First tier general or FG-1) functions as a map for viewing the relationship between context and process. Therefore it may be viewed as an abstracted model of how the context of first-tier universities influences the entrepreneurial process within their RCS. The codings have been distilled into general factor categories that represent common patterns across the case studies and secondary data analysed. The default movement of processes moves from left to right with arrows clearly indicating the reversal
of flows. Illustration of the factors is provided in figure 4.1 followed by explanations of each by heading.

**Figure 4.1 FG-1: Context-process map of first tier universities**

Ovals=resources; Rectangles=structural components; Open dashed rectangles=higher level issues, factors or concepts

**High Total Research Expenditures:** One consistent factor with all HCR universities is that they receive high levels of grant and research dollars relative to their peers from both federal and industry sources.

**Twin Skills Inventory:** A key concept that emerged from the data is the proclivity of faculty, students, technology transfer staff, champions and surrogate entrepreneurs (and the interactive teams that form from these groups) to exhibit twin skills\(^{18}\) (Hindle and Lansdowne, 2005). This allows the doers, supporters, and facilitators to manage the necessity of working

\(^{18}\) Hindle and Lansdowne used this term to describe the necessity for having the capability to move between worldviews framed by western capitalism and Indigenous culture to create new businesses. The concept appears to fit well within the context of university entrepreneurship and adequately describes the phenomenon.
within two distinct and often conflicting worlds with highly different logics that frame their activities and objectives: academics and business.

**High Quality Science:** Important to the facilitation of new ventures and innovation is the necessary process of high quality knowledge generation. This is often driven by star scientists or scientific teams that strive for excellence in basic and applied research. These researchers overwhelmingly consist of individuals within hard science disciplines.

**Cross-disciplinary Specialized Centres and Units:** First-tier universities across all nations boast cross disciplinary research that is often housed within specialized centres with clear roles and mandates (B. Clark, R., 2004). These mandates are often tied to applied science or industry research collaboration.

**High Support for University Spinouts (USO):** Roberts and Malone (1996) define support as “the level of managerial and financial assistance given to a spin-off venture by the R&D organization.” They broadly assess support mechanisms as internal funding sources in trade for equity, management involvement, and the presence of dedicated units that have a pro-active mandate for commercializing technology. It was difficult to assess a high or low support context across the international sets. Therefore the conceptualization of high support for USO in this study is characterized more by a wide range of favourable policies/incentives that were supportive or helped to facilitate commercialization that included but were not limited to: specialized managerial support, royalty allocation strategies, flexible teaching and research duties, non restrictive rules for use of labs, and professional empowerment (researchers and faculty were allowed to make decisions about venturing that were not overly constrained).

**Well Resourced and Experienced TTO:** Of the universities investigated, the presence of a well structured and staffed TTO with a history of success was
consistent across the set. This represents the capacity/experience of the TTO, not its policies (as in the support category above).

**Patent Protection:** Evidence shows that the patenting of IP, derived (on the majority) from hard science disciplines, was the key focus of most RCS. This mechanism was used to lower the risks involved with commercialization and was often costly.

**Infrastructure:** The first-tier cohort examined was consistent in that advanced labs, incubators, and research parks were the norm.

**Grants and Seed Capital:** This factor overlaps with the high support for USO construct. It exemplifies the geographic and network ties to angel investors, venture capital funds, institutional funds or equity mechanisms for proof of concept and proof of marketing stages. It also signified a community or regional abundance of capital or grants targeted at the USO process. In short, there were resources available to drive the entrepreneurial process forward across a variety of complex stages.

**Strong Business Community:** This factor represents the presence and involvement of a strong local/global business community/industry/government (also an overlap to the above) that is important to resource gathering and legitimizing. It is differentiated from “grants and seed capital” due to its focus on the human capital side of driving the entrepreneurial process forward. Because of the global nature of high technology spin out networks (surrogates, financiers, and academics), this open community environment reflects an inflow of specialized and experienced individuals within the community.
**USO’s Primary Outcome:** The most common outcome is the creation of a USO, but this is also a complementary output to licensing technology and research partnerships with industry.

**National Characteristics:** The data sources used to build this model are international in scope, so there are specific controls that are necessary to consider: population, economic status, IP assignment policies, national culture, and R&D to GDP ratio.

**Prestige, History and Success:** Case studies and secondary data show that prestige, a long history of formal commercialization functions, and several past winners (successful USO) create legitimacy and reinforce entrepreneurial processes as cultural norms within the community. This construct is best illustrated as an evolutionary process where the context for facilitating new ventures has emerged over a long period of time.

**Porous Boundaries:** a wide range of boundary spanners are necessary for creating two way information and knowledge flows between the university and a wide range of stakeholders that benefit from innovation. This factor illustrates the depth, diversity, and strength in ties across formal and informal social networks that are useful in facilitating entrepreneurial or technology transfer activities. It represents individuals, teams, departmental structures, and management looking outward into the community/marketplace.

**Low Selectivity for USO’s:** Roberts and Malone (1996) define a low selectivity for USO as institutional agents or units taking a passive role in pursuing and supporting new ventures so that selection decisions may be dictated by markets through external agents (specialized consultants, angels, VC funds). In other words, they do not have a distinct strategy for specifically generating USO from their research programs. Rather, USO just happen. Roberts and Malone’s construct is heavily influenced by the quality and
quantity of disclosures. Evidence from secondary data does not clearly address the relationship between quantity, quality, and selectivity but findings from case study data point to a low selectivity construct being predominant. Therefore, a low selectivity is conceptualized in this study by a lack of university administration involvement in decision making on specific IP exploitation processes: market agents drive these decisions and technology transfer personnel play a complementary or supportive role. Issues in regard to confusing high and low selectivity positions with quantity, quality, and yield reductions are beyond the scope of this research (Mowery, 2002).

**Coupled IP disclosure and evaluation techniques:** While selectivity is conceptualized by an overt “strategy” to convert research efforts into generating USO, this construct differs in that it focuses upon the commercialization process itself to determine at an early stage whether or not an invention is “valuable.” This is accomplished by creating a mechanism whereby a single entity, department, or organization is responsible for both discovering (proactively through scanning departments or reactively through receiving disclosures of intellectual property) and evaluating its market potential.

**Virtuous Circle of Resources from Commercialization:** The success of entrepreneurial endeavours through the commercialization process generates additional revenues for the university, and over time, policies and structures that seek to provide optimal incentives for further facilitation of commercialization. This creates a virtuous circle of funding to be directed back into university research and commercialization activities. The mechanisms for this often take the form of new public (often associated with the university) or private organizational structures. Therefore, revenues do not just return to the general revenue fund of the university or privately to the researcher (team) or department of origin, but flow through structures that are
set up to build infrastructure, increase capacity, and create programs for doing more of the same.

**Alignment of (Multiple) Logics:** Perhaps the most important and complex concept that informs the contextual nature of first-tier universities is the alignment of several mandates that are potentially conflicting: teaching, research, and commercial activities. The first two are traditional university functions and are defined by academic logics. The third function is defined by commercial logics where entrepreneurship is actively facilitated. There are three processes identified for the management of competing or multiple logics: (1) alignment of compatible logics within current structures, (2) shielding of non-compatible logics within current structures, and (3) the development of new logics (that break down old logics) that often involve the creation of new institutional structures within the community.

### 4.4.3 Implications and limitations of the FG-1 model

Using an empirically justified, performance based taxonomic approach for examining a set of first-tier universities across several nations yielded several findings. First, total research expenditures (TRE) and high research quality were positively correlated with total gross revenues (TGR) from commercialization. These findings support past research and suggest that being rich does play a role in commercialization success. This combined with evidence that shows little churn in the cohort points to a long term evolutionary process that result in the creation of virtuous circles for doing commercialization. This factor may be a significant barrier for other universities that do not belong to this set (i.e., they are not rich).

Second, contextual factors are aligned with patenting IP from hard science disciplines and spinning out technology supported by strong social networks exemplified by specialized market agents, entrepreneurs, firms, and financiers that represent a set of local and globally accessible set of resources. The USO appears to be the most important outcome, in line with respect to its
logics, worldviews, and norms associated with entrepreneurship as a legitimate activity.

Third, individual and team level characteristics such as those exemplified through the twin skills inventory concept appear to be highly important in facilitating entrepreneurship within the university context. Findings suggest that it is more than just understanding, managing and sometimes separating the often conflicting worlds of business and academia. It also requires incorporating and aligning entrepreneurial activities with the goals of academia, namely, the generation of greater amounts of funding for research projects that fuel scientific discovery.

Fourth, the support and selectivity constructs (adopted from Roberts and Malone, 1996) offer some insight on specific policy based factors that drive the entrepreneurial process at universities. The set of universities investigated reflect a high TTO support (favourable policies and managerial assistance) of commercialization activities while they are observed to have a low selectivity for USO. While the high support factor runs counter to Roberts and Malone’s findings (that first-tier universities should have a low selectivity, low support coupling), their study compared and contrasted sets of “high-performing” universities. This may explain the differences in findings between this study and theirs as the goal of this study is to compare “rich” and “poor” universities, not “rich” and “less rich.” From the relative perspective of poor universities, the support mechanisms observed at first-tier universities are thus framed as “high.”

In line with Roberts and Malone’s findings, low selectivity patterns suggest the context of these universities reflects a stronger reliance on the market to determine what the best process for exploitation should take. And, due to the resources, experience, quality of research and logics aligned with commercial worldviews, USO are generated even if there isn’t a “push” from the administration. This policy setting (or lack thereof) is appropriate for a community with a greater tendency to work with market agents over that of having less experienced or knowledgeable internal agents (managers)
mandate spinout processes. It represents “getting out of the way” rather than “getting in the middle” of exploitation strategies.

Other community-based factors that are found to be important include the existence of formal and informal social networks, specific mandates for commercialization, specialized cross disciplinary structures, and legally incorporated units for facilitating and combining inventive processes with entrepreneurial processes. The presence of incubators, research parks, and experienced technology transfer offices were observed to be the logical outcomes of a unique combination of other more important contextual factors. In simple terms, the systems for commercialization of research are very well defined, structured, resourced, experienced, and supported. They are therefore more prominent as normal activities within the community due to their perceived legitimacy and success.

The remainder of the findings are intuitive and summarize much of the work to date, especially in the areas of capital and financing (particularly those that are targeted to overcome proof of concept and proof of marketing gaps), the heavy reliance upon a staged commercialization process, the creation of new specialized units for applied or collaborative research, and the all around importance of technology transfer offices.

The framework illustrates the factors that are important for understanding the context of top performing commercialization universities. Unfortunately, the data provide only broad descriptions of these factors and their interaction with each other. Several limitations must therefore be acknowledged. First, the framework is highly generalized and reflects some of the challenges inherent in the methods used. There are limits that secondary data collection methods impose on the study of contextual factors. Furthermore, the case studies that represents the HCR set use a wide variety of methods that are not aligned with the primary research questions of this thesis and are also limited by their own methodologies. Combined, the two methods (content analysis and secondary data analysis) represent the best
tools available and not the tools that are most well suited and aligned to the research questions asked. (What tools are most suited?)

Second, there are certain limitations that exist as a result of aggregating sets across nations which demonstrate a great deal of variance of nation-level factors. It is difficult to gauge the weight of these variables and their potential significance. For example, how does one evaluate and measure national cultural conditions? Although data are available on demographics, GDP, GERD and investment capital, it is a challenge to weight the importance of these measurements from a community based ontological perspective.

Finally, data interpretation is open to researcher error, especially when attempting to translate research findings from other studies into potential answers for different research questions.

These limitations once again point to the need for research that is directly focused on the study of socio-spatial factors that are relevant to facilitating and constraining the appropriate entrepreneurial processes necessary for improving performance. The model FG-1 is simply the best tool that can be derived from the literature that currently exists: an enhanced model is required.

4.5 Identification of a Gap in the Literature: Second Tier Universities

One of the most important yields of this review is what was not found. As indicated in chapter 3, the case study literature was overwhelmingly populated by studies of universities that are considered to be exemplars. Only seven of the cases were not classified as first-tier and, by default, could be defined as belonging to the second-tier set. Of these, two did not even consider RCS and instead focused on the operations of the business school and the processes for starting an entrepreneurship centre. Another one was considered an “Ivy League” school (and consequently was treated as an exemplar case, even though it did not meet the strict requirements of the taxonomic rules
A fourth study concentrated on a macro level analysis of the regional impact of an entrepreneurial university (although it did address the relevant issue of operating within regions of weak innovation capacity). This left only three university case studies that were potentially suitable, yet largely inadequate. Due to the scarcity of cases in the literature, this represents a large gap in what we know about the context/entrepreneurial process relationship within the RCS of these universities. Research is required to empirically study this set and answer the primary question introduced in this chapter that could not be satisfied by the extant literature. This task becomes the primary empirical research component of this thesis and is the focus in chapters 6-8.

4.6 Conclusion

This review has provided a general context-process map of first-tier universities derived from content analysis of case studies and the employment of secondary data sources. There are five key findings:

1. Relative to their peers, first-tier universities are indeed rich: not only do they benefit from greater resources from public and industry funding of research, but the outcomes generated by RCS have also provided them with new revenue streams that may be reinvested back into these systems to create more of the same.

2. The majority of the systems for commercialization of knowledge have evolved over time and benefit from the development of a strong entrepreneurial infrastructure. This infrastructure includes social (business, industry and regional stakeholder networks), institutional (technology transfer offices and specialized units) and spatial (incubators, research parks and laboratories) factors.

3. Geographically, these universities are consistently located near high technology corridors and thus benefit from regional infrastructure in the form of high technology firms, industry associations, and the right mix of people (specialized consultants, entrepreneurs, angel investors,
and VC capital groups). In other words, the capacity for enacting commercialization within these communities is much greater than pertains in those communities who are not located close to these resource corridors.

4. The processes for facilitating entrepreneurship are well known/charted, highly coupled (discovery and evaluation), and influenced/driven by entrepreneurial agents and market demand. Entrepreneurial processes are ultimately based upon spinning out knowledge that is best suited for technology ventures that have a higher propensity to achieve growth and therefore generate substantial equity or license based revenues (the rich get richer).

5. The scarcity of research on the second-tier or “not rich” set requires research action to address this significant gap in the literature.

**Chapter Summary**

In this chapter I have synthesized extant case study literature and secondary data to produce a general framework of the relationship between context and entrepreneurial process within a set of universities classified synonymously as ‘first tier’, ‘rich’ or ‘HCR’. The culmination of the work in this chapter is presented in illustrated form and is presented as model FG-1. There are few case studies of universities that could be classified as ‘second tier’, ‘not rich’ or ‘LCR’. This gap is the rationale for the primary empirical component of this thesis: to explore the relationship between context and entrepreneurial process in RCS at second tier universities.
Chapter Five  Developing a Guiding Framework: Context and Process

Chapter Abstract
The issues of context and process analysed and addressed in chapters two and three, and the content analysis of entrepreneurial university case studies in chapter four can now be used to inform and select the appropriate foundations upon which to guide this research project. A layered set of lenses for viewing the research problem is produced. They are: (1) systems theory; (2) a general model of the entrepreneurial process; and (3) the concept of ‘community’, diagnosed from an entrepreneurial perspective. Using these bases, I synthesise a theoretical and analytical framework which will subsequently be use to guide the primary empirical component of this thesis.

5.1 Selecting a General Theory for Framing the Research Problem
One theory that is potentially useful as a foundation for explaining the differences between university types is general systems theory (L. von Bertalanffy, 1960). Two other theoretical foundations—organizational ecology (H. Aldrich, 1990; Carrol, 1984; Hannan & Freeman, 1989; Singh & Lumsden, 1990) and institutional (evolution) theory (P. DiMaggio, 1988; P. DiMaggio & Powell, 1983; North, 1990)—were also considered, but systems theory aligned best with the canonical development of the literature relevant for this research project (K. Hindle, 2004).

Introduced by von Bertalanffy in 1947, general systems theory (and its many subsets) evolved from a philosophical belief that problems such as the order and goal-directedness of living systems could be better understood if component parts are viewed as parts of a whole (Bertalanffy, 1951). A system is a set of related components that work together in a particular
environment. Von Bertalanffy formulated the notion of General Systems Theory orally in the 1930’s and then in various published forms after the war:

There exist models, principles and laws that apply to generalized systems or their subclasses irrespective of their particular kind, the nature of the component elements, and the relations or “forces” between them. We postulate a new discipline called General System Theory. General System Theory is a logico-mathematical field whose task is the formulation and derivation of those general principles that are applicable to “systems” in general. In this way, exact formulations of terms such as wholeness and sum, differentiation, progressive mechanization, centralization, hierarchical order, finality and equifinality, etc. become possible, terms which occur in all sciences dealing with “systems” and imply their logical homology (L. von Bertalanffy, 1955).

Systems theory has become known as a “skeleton of science.” It is as a way to build around content that links theory development to the world around it through the recognition that knowledge is not something which exists and grows in the abstract, but is a function of human social organization (Boulding, 1956). The idea was used to criticize positivistic conceptions of ideation as “social physics,” and offered a solid epistemological alternative to reductionist viewpoints on how human social systems really worked (L. von Bertalanffy, 1960). It is thus an excellent framework on which to build a corpus of knowledge from research problems that exhibit many complex and interrelated social variables. Von Bertalanffy was also one of the first scholars to write about the principle of equifinality by stating that “a particular outcome can be reached by different paths from the same starting condition and different starting conditions may also lead to the same outcome” (L. von Bertalanffy, 1960).
In the area of organizational and entrepreneurial studies, Katz and Kahn (1966) used a general systems model to legitimize studies in organizational theory by discussing the properties of open systems that included the notion of equifinality. Miles and Snow (1978) developed business level typologies of strategy and performance by conceptualizing organizations as complete systems. Thus general systems theory has a well pedigreed history of usage within past management studies. With its emphasis on viewing process as a multi-faceted set of possible pathways and starting conditions for reaching a specific outcome (Jennings & Hindle, 2009), it is an excellent epistemological form to study the heterogeneous, socio-spatial realized processes involved with entrepreneurship. The key weakness derived from a systems theory epistemology is its generality. Thus, further specification is required use of the concepts of entrepreneurial process and context so as to develop a unifying and binding perspective for viewing the research problem as put forth in chapter 1.

5.2 Positioning the Current Study in the Field of Entrepreneurship Research

The research reported here is anchored in the field of entrepreneurship research, and includes a discussion of the history, trajectory, recent research approaches, and definitions used within this vast, eclectic, and growing research domain. As the field of entrepreneurship research is multidisciplinary, theoretically unsettled, and characterized by several key debates surrounding its legitimacy and objectives, a fundamental challenge is to be concise in the presentation of material. The goal is to draw on the literature to develop a specific focus for this thesis. This includes a statement of biases, choosing definitions, and outlining the relationships critical to this study.
5.2.1 Defining entrepreneurship: Making sense of a convoluted, burgeoning, multidisciplinary field

*Note: I recognise that one of the most tedious tasks of a reader of any PhD thesis in entrepreneurship is to encounter the inevitable section – this one in my case – where the candidate ‘trots out’ his or her potted review of everything ever written in our vast, messy and discordant field. Thus I am particularly grateful to Professor Kevin Hindle for working closely with me to help make this overview and its wording both succinct enough and distinct enough to constitute a relatively fresh coverage of this well-travelled area.*

An overview of the history of entrepreneurship research illustrates its complexity, dynamic nature, and growth as a field. It also highlights some of the challenges that are significant to its current trajectory. If the history of the study of entrepreneurship is traced from, say, 1700 A.D. onwards, several eras can be clearly identified: (1) classical, (2) neoclassical, (3) Austrian, (4) multidisciplinary, and (5) the “distinctive domain.”

The roots of the *classical* era can be traced back to the writings of Cantillon (1755) and Say (1803), who discussed early concepts of entrepreneurship such as arbitrage and modes of production. Scholars from this period emphasise the directing role of the entrepreneur in the marketplace. The *neoclassical* era is characterized by the contributions of neoclassical economists such as Menger (1871) and Marshall (1890) and their desire to simplify the chaotic and complex social elements of entrepreneurship and apply them to the optimization of economic models. In the *Austrian* era, economists aligned the concept of the entrepreneur with alertness to asymmetric information and the role of knowledge, the management of uncertainty and risk, and the disruptive effects of innovation on markets (Hayak, 1945; Kirzner, 1973; Knight, 1921; Schumpeter, 1912/1934).
In the multidisciplinary era, the research focus shifted from economics to embrace a multidisciplinary approach. The concept of the entrepreneur was framed using human and environmental factors by embracing and applying theory from psychology, sociology, political science, and most notably, management studies to inform the field (Gnyawali & Fogel, 1994; Shaver & Scott, 1991; Simon, 1957). During this period, the identity of the field and the definition of entrepreneurship become more and more frayed. With the growing realization that there are more differences among entrepreneurs than between entrepreneurs and non-entrepreneurs (Mitchell et al., 2004), the pursuit of individual traits-based research was effectively abandoned, and scholars have sought new ways to integrate multiple factors and concepts (Low & MacMillan, 1988; MacMillan, 1991; McClelland, 1961).

The search for a distinctive domain of entrepreneurship research is ongoing. Some of this work has culminated in a renewed focus on the nexus of individual and entrepreneurial opportunities (Shane, 2003; S. Venkataraman, 1997a). Unlike the socio-spatial theorists, most researchers on the genesis and development of entrepreneurial opportunities have largely and wrongly (Zahra, 2007; Hindle, 2010a) neglected context as a secondary issue. Equally unfortunately, the quest for establishing a unifying theory has not gained much ground, and the field continues to suffer from conceptual divergence, a lack of agreement on definitions, and a growing disconnect between scholarly theory development and the actual practice of entrepreneurship (Aldrich & Baker, 1997; Davidsson, 2000; Hoy, 1997). This impasse between philosophy and method is evidenced by a sizeable corpus of literature that explores the growth and trajectory of entrepreneurship research. Its significance and implications extend across several other areas pertaining to the field that involve issues of legitimacy, purpose, and differentiation (Cornelius, Landström, & Persson, 2006; Davidsson, 2001; Gartner, 2001; Gartner, 1990; MacMillan, 1991; Phan, 2004; Schildt, Shaker, & Antti, 2006; Shane & Venkataraman, 2000; S. Venkataraman, 1997b).
As a result, there is considerable disagreement between scholars as to the nature of entrepreneurship as an academic discipline. Several questions need to be answered. Should entrepreneurship be an applied management field—where research is driven by a problem solving agenda that consists of practice-based theorizing and pedagogy—or should the rules of social (or even natural) science govern research mandates with the emphasis on exploratory theory building (Katz, 2003; Phan, 2004; Whitley, 1984)? Should there be a greater push for conceptual convergence (or unified theory), or can strength be derived from an interdisciplinary, novelty driven approach that incorporates theory from other fields (Amit, Glosten, & Muller, 1993; D. Grégoire, Noël, Dery, & Béchard, 2006; Shane & Venkataraman, 2000)? Is there a need to differentiate entrepreneurship research from other closely related domains in the management sciences (for example, strategic management), or is there fruitful cross-fertilization that may be achieved (Hitt, et al., 2001; Shane & Venkataraman, 2001; Zahra & Dess, 2001)? All these questions will continue to provoke debate and discord among scholars in the field.

5.2.2 Six key themes in the current development of entrepreneurship as a discipline

Notwithstanding the debates noted above, there is evidence to suggest that there are signs of conceptual convergence within the multidisciplinary field of entrepreneurship research that now stands as the predominant paradigm (D. Grégoire, A., Martin, Richard, & Jean-Pierre, 2006). Aldrich (2005) highlights four main approaches that have emerged in entrepreneurship research: (1) the creation of innovative products and markets through transformation of resources (Leibenstein, 1968; Schumpeter, 1934), (2) the nature of high growth firms (P. Davidsson et al., 2006; P. Davidsson & Henrekson, 2002), (3) the emergence of new firms, (Gartner, 1985; Gartner, 1988; Low & MacMillan, 1988), and (4) opportunity pursuit through an alertness to asymmetric information and risk taking (Kirzner, 1997; Knight,
1921; Shane & Venkataraman, 2000). Of these perspectives, the most promising appears to be the opportunity perspective; it continues to gain significant emphasis in a variety of works across the many sub-fields of the entrepreneurship research domain (S. A. Alvarez & Barney, 2007; Baron & Ensley, 2006; Haynie, et al., 2009; Ucbarasan, et al., 2008).

A fifth strand has recently been added to the weave—the phenomenon of entrepreneurial process (Gartner, 1985; Steyaert 2007, Moroz and Hindle 2012, and Hindle 2010a). Moroz and Hindle evaluated 32 extant models of entrepreneurial process, and Hindle then harmonized the discord into a generic model of entrepreneurial process based on a key philosophical question concerning the nature of the entrepreneurship research field:

*What is both generic and distinct about entrepreneurship as a process?*

*This is the ‘double-barrelled’ question which Hindle (2007; 2010) believes may hold the key to resolving many contentious issues about the nature of entrepreneurship as a field of both practice and theory. To determine whether entrepreneurship is genuinely different from any other extant and well studied phenomenon (thinking particularly of management) this question penetrates many layers of interest, meaning and approach to understanding the nature of entrepreneurship by seeking to determine what always happens in every set of activities classifiable as constituting an ‘entrepreneurial’ process that never happens in any other type of process. Unless what we call ‘entrepreneurship’ involves a process that has at its core something simultaneously generic and distinct, we are either talking about an eclectic set of activities that have no mutual coherence or a coherently connected set of activities that could just as well be classified with a label other than ‘entrepreneurship’. (Moroz and Hindle, 2012: 1-2 following Hindle, 2010a: 98).*

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19 Such are the exigencies of academic publishing that the ‘prequel’ paper (Moroz and Hindle 2012) will be published nearly two years after the sequel paper (Hindle 2010a).
Moroz and Hindle (2012) examined entrepreneurial process models to discover whether there were any generic core factors and relationships that were strongly supported by evidence and/or strongly believed by researchers to be significant for the entrepreneurial process and distinct to entrepreneurship. Hindle went on to synthesise and extend this work by producing and testing a “harmonized” generic model of entrepreneurial process from which his and this thesis’s definition of entrepreneurship is derived (Hindle, 2010a). More detailed treatment of this model is provided in section 5.3.

A sixth strand has also emerged and is accelerating in influence. It stresses the vital importance of entrepreneurial context. This sub-field and its attendant emphases are so critical to this thesis that an entire section of this chapter (section 5.4) is devoted to this issue.

Taking into consideration all six of the above perspectives, it seems that the most expeditious way forward is to determine which approach is best suited to the substantive area of interest and to the research problem. In accordance with published work in entrepreneurial process (Moroz and Hindle, 2012), the following definition of entrepreneurship is adopted for this thesis:

> Entrepreneurship is the process of evaluating, committing to and achieving, under contextual constraints, the creation of new value from new knowledge for the benefit of defined stakeholders. (Hindle, 2010a: 100)

This definition is an extension of the perspective adopted by Shane & Venkataraman (2000), which views the scope of the field as being about “the scholarly examination of how, by whom, and with what effects opportunities to create goods and services are discovered, evaluated, and exploited.” This is a cutting-edge perspective from which to view the phenomenon of
entrepreneurship, and is therefore adopted as the general position. This viewpoint argues that researchers in the field should focus on (1) how, why, and when opportunities exist, (2) the processes of discovering, evaluating, and exploiting opportunities, and (3) the importance of the individual entrepreneur and the emphasis on creating new means-ends relationships (emphasis added with respect to the importance of process).

The objective of this thesis project is to understand the relationship between context, entrepreneurial process, and the performance of RCS at university. Therefore the “extended opportunity perspective” developed by Hindle appears to be well suited for usage in this dissertation. First, entrepreneurship can be evident without the emergence of a new organization (for example, licensing technology to entrepreneurial firms without the emergence of a new organization). This is an important consideration because this research involves large communities where a requirement for the emergence of new organizations may be constraining. Second, definitions comporting with this school of thought are invariably concerned with three issues at the heart of this thesis: (1) the “how” of entrepreneurship is a primary consideration, (2) the creation of new value through innovative means is the key outcome, and (3) context is important, yet currently underweighted in the literature (this issue will be addressed in greater detail later in this chapter).

5.3 Entrepreneurial Process

This section briefly reviews the extant models of entrepreneurial process, borrowing heavily from work already published in Moroz and Hindle (2012).

5.3.1 Identifying and synthesizing conceptual models of the entrepreneurial process

The language of change, action, and novelty are hallmarks of a process orientation (Moroz and Hindle, 2012). Events are framed by terms like flow, creation, and “becoming” (Aldrich & Martinez, 2001; Steyaert, 2007; Van de Ven & Poole, 1989). This perspective fits well with the study of
entrepreneurship, which is fundamentally an action-based phenomenon that involves a highly interrelated set of creative, strategic, and organizing processes (B. Bygrave, 2004).

Moroz and Hindle sought to determine what always happens in every set of activities classifiable as constituting an “entrepreneurial process,” but that never happens in any other type of process20. Their approach to investigating this research problem was to review the extant literature on models of entrepreneurial process and ask the double barrelled question “What is both generic and distinct about entrepreneurship as a process?” They found that only 4 of 32 models that were analysed were potentially useful for answering this question. The four models are (1) Gartner’s (1985) dimensional framework for investigating the emergence of organizations, (2) Bruyat and Julien’s (2000) dialogical model of new value creation, (3) Sarasvathy’s (2001) concept of effectuation, and (4) Shane’s (2003) theory of entrepreneurial opportunity.

While each of these models provides some insight into what may be both generic and distinct about an entrepreneurial process viz a viz every other kind of process, none of them unequivocally passed the acid test of the “double-barrelled” question. In other words, none of these models provided an adequate description of entrepreneurial process. Neither did they possess the capacity to act as a theoretical framework for a wide range of research, or as the practical basis for pedagogy or practitioner action. Each model demanded that its users adhere, a priori, to a limited or highly prescribed perspective of what entrepreneurship is all about. There is thus an urgent need to derive and test a “harmonizing” model of entrepreneurial process, a task taken up and executed by Hindle (2010a).

20 Based on a question posed in Hindle (2007)
5.3.2 A general harmonized model of the entrepreneurial process

Based on the consideration of all extant models examined by Moroz and Hindle (2012), Hindle (2010a) developed, described, and tested a general model of the entrepreneurial process. The model attempts to harmonize many of the divergent theoretical approaches that address the entrepreneurial process. In so doing, a detailed conceptualization of entrepreneurship emerges as “the process of evaluating, committing to and achieving, under contextual constraints, the creation of new value from new knowledge for the benefit of defined stakeholders” (K. Hindle, 2010).

Hindle adopts a pragmatic approach to conceptualizing “opportunity” by simply stating that it exists in the mind of the entrepreneurial protagonist and that whether it is created or discovered is moot (Rorty, 1979). Following a process worldview, Hindle states that getting from input to output embraces three distinctive but interrelated domains of activity: (1) the strategic, (2) the personal, and (3) the tactical. It also involves the utilization of three distinct but interrelated individual capacities: (1) entrepreneurial capacity, (2) psychological capacity, and (3) managerial capacity (see figure 5.1).

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21 Due to the nature of the academic publishing process, the product of the 2012 paper was actually published first.
Within the sub-processes belonging to the *strategic* domain, the activity of evaluation is the most important and requires high levels of entrepreneurial capacity (the ability to expertly evaluate an economic opportunity under contextual constraints). Evaluation is distinct to the entrepreneurial process and “includes any regime whatsoever for assessment of merit, worth and significance using any criteria whatsoever via any set of standards whatsoever—with some specific concept or philosophy of evaluation” (Hindle, 2010a). Evaluation includes a multitude of forms that may encompass causist, bricolage, effectual, or other logics (K. Hindle & Sendorovitz, 2010). The evaluation process is iterative, may be formal or heuristically based, is culturally influenced, and context dependent. The outcome of this sub-process is an articulated business model: a portrait of how the entrepreneur could create value from an evaluated opportunity.

The *personal* domain is driven by an individual’s psychological capacity and is argued by Hindle to be a pivotal concept. Without
commitment, the entrepreneurial protagonist(s) will not proceed forward with the exploitation of an opportunity. Commitment is defined as “the pledged willingness of defined actors to undertake obligations and their consequences,” and is viewed as one of the ways that individuals infuse roles and social structure with self motivated behaviours that link them to a particular social structure. The act of commitment is essential; without it, the entrepreneurial process will not result in the exploitation of an opportunity. Either the entrepreneur who evaluated the opportunity, or someone else, must commit to it.

The *tactical* domain is where managerial capacity is applied for the successful exploitation of value from an entrepreneurial opportunity. Hindle explains that:

> ...exploitation of an opportunity involves moving from commitment to pursue the opportunity (as embodied in the evaluated business model) to the actual achievement of value... Once actual value, (positive or negative, adequate or inadequate), which may differ from the new value postulated in the business model, is achieved, the entrepreneurial protagonists can consider the efficacy of the exploitation regime they have chosen and implemented and begin a process of re-assessment (working back through the model). The entrepreneurial process can thus either replicate itself or transform into a process of managing a now established system (whether that be as a newly developed venture or through some other system of value creation postulated in the business model)(K. Hindle, 2010, p. 15).

Managerial capacity is thoroughly discussed in the vast literature of management. It can be performed by the entrepreneur or handed off by the entrepreneur to another individual or team to actually implement the business model.
The MEP thus represents a pre-eminent model that builds upon past work to harmonize discordant perspectives into one highly general but non-discriminatory approach to viewing the entrepreneurial process. It features three different capacities and three different domains to fully carry out a highly non-linear (or as Hindle states, not iterative but jerky) and messy unfolding of the evaluation-commitment-exploitation trinity.

5.4 The Significance of Context to the Study of Entrepreneurship

5.4.1 The context of entrepreneurship: the sixth key theme
For any model of entrepreneurial process to be meaningful, it is vital that the study of context be both discursive and integrative of three domains of research—organizational, sociological, and environmental (J. Katz & Steyaert, 2004; P. H. Phan, 2004; D. Ucbasaran et al., 2001). Zahra (2007) is one established entrepreneurship scholar who is adamant that understanding context is fundamental to understanding entrepreneurship:

*By understanding the nature, richness and dynamics of their research contexts, entrepreneurship researchers can offer more creative and insightful explanations of important issues and why they matter to the discovery, creation and exploitation of opportunities that give birth to independent or corporate new ventures. Entrepreneurial decisions and actions center on novelty and creating variety. These decisions are messy, a quality that should prompt us to delve deeply into the psyche, mental models and inner souls of entrepreneurs. (p. 452)*

This position is echoed by Schoonhoven and Romanelli (2001), who press for a greater understanding of the conditions conducive to the creation of new ventures. Birley (1985) suggests that research focused on the entrepreneurial process “requires greater precision about the way in which the potential entrepreneur seeks to use the environment in creating the optimum
business format out of his product idea.” There are also authors who state that
the study of context must escape the gravity of objects of interest with
boundaries drawn purely around business and economic spaces. By doing so,
they may concentrate upon new settings which researchers are not as familiar
with, thereby creating new boundaries, or as Steyaert and Katz (2004) state:
“(to) alter the current hierarchy between focusing upon nations versus let’s
say neighbourhoods.”

The following quotation emphasizes the importance of incorporating
new ways of viewing and analysing the realities of context that are significant
to entrepreneurship:

...New organizations do not emerge de novo from the
idiosyncratic and isolated invention of individual entrepreneurs.
Their ideas for new organizations, their ability to acquire capital
and other important material and human resources and their new
organization’s likelihood of surviving derive from contexts in
which individuals live and work. Context, even assuming a
special and broad influence of distinctive and uncommon
individual inclinations, must exert a constraining influence on
rates and kinds of organization creation at the same time that it
motivates organization creation (Schoonhoven & Romanelli,
2001, p. 2)

There is a need for conceptual tools that allow for the analysis of context from
a perspective that is not overly focused upon the specifics of a pure business
environment, an organizational form, or typical set of boundaries. It also
points to the need for finding a means for understanding the push and pull
between entrepreneurial agents and the contexts in which they operate
(Shapero & Sokol, 1982).
5.4.2 Context as “environment”

Several researchers focus on environments and the factors which have differential effects on the entrepreneurial process, a firm’s financial performance, and consequently on economic development (Gnyawali & Fogel, 1994; Harper, 2003; S. Zahra, 1993). Zahra’s research interests in the early 1990’s led him to begin asking questions about the nexus of context (environment), entrepreneurship (corporate) and performance:

A multidimensional definition of a firm’s environment was essential to unravel the interplay between the environment, corporate entrepreneurship activities, and financial performance (Zahra, 1993, page 319).

Some of Zahra’s early findings pointed to the relationship between (corporate) entrepreneurship and its significant effect on performance in hostile environments (S. Zahra & Covin, 1995), in industries with greater technological opportunity (S. Zahra, 1996), and in international hostile environments (S. Zahra & Garvis, 2000). This pioneering focus on the environmental aspects of context was influential, and was also consistent with studies conducted by many researchers in the entrepreneurship field who displayed interest in other aspects of context. Some of these authors concentrated on macro-economic levels of analysis—such as regions or nations—and focused on a range of cultural, economic, technological, and regulatory issues (D. B. Audretsch & M. Keilbach, 2004; Cooper, 1970; Feldman, 2001; Shane & Kolvereid, 1995). National studies attempted to determine the effect of national environmental factors on start-ups (Box, 2008; Fogel, 2001). Others focused on the environmental differences between emerging and established nations (El-Namaki, 1988; Luthans, Stajkovic, & Ibrayeva, 2000). There were also studies that focused on the environment from the perspective of a firm or industry (D.B. Audretsch & Feldman, 1996; G. T. Lumpkin & Dess, 2001; Saxenian, 1994). Of those studies that assess
environmental conditions and their influence on the entrepreneurial process, 
three are particularly useful: Gartner (1985), Gnywali and Fogel (1994), and 

Gartner (1985) proposes the dimensional area of the environment as a 
means to better understand the activity of entrepreneurship. Using work taken 
from Bruno and Tyebjee (1982), Gartner outlined twelve environmental 
variables that may impact upon the formation of a new venture:

1) Venture capital availability
2) Presence of experienced entrepreneurs
3) Technically skilled labour force
4) Accessibility of suppliers
5) Accessibility of customers or new markets
6) Governmental influences
7) Proximity of universities
8) Availability of land or facilities
9) Accessibility of transportation
10) Attitude of the area population
11) Availability of supporting services
12) Living conditions

For Gartner, these are all key factors representative of the environment for 
entrepreneurship that emerging firms must perceive, utilize, and/or overcome.

Gnywali and Fogel (1994) identified the environmental influences that 
were significant to entrepreneurship in a specific country or region. Two key 
categories were identified: (1) the overall economic, socio-cultural, and 
political factors that impacted upon the decision of individuals to start new 
ventures, and (2) the availability of programs and support for developing the 
capacity of individuals to identify and successfully exploit opportunities. 
They distilled out five dimensions as essential to the creation of an 
entrepreneurial environment:

1) Financial assistance
2) Non-financial assistance
3) Entrepreneurial education
4) Socio economic conditions
5) Supportive policies

They also identified patterns that relate to general influence of the environment on entrepreneurs. First, a supportive environment for entrepreneurship will be conducive to the emergence of new firms. Opportunities are identified and/ or created by individuals who have a greater capacity and confidence to exploit them. These findings are partially bolstered by recent studies on the decision making processes of entrepreneurs and the importance of the perceived feasibility for starting a new business based on environmental variables (N. Krueger, M. Reilly, & A. Carsrud, 2000; Shepherd & Krueger, 2002). Second, positive environments have the potential to greatly moderate entrepreneurship in emerging countries more so than in developed countries (Al-Shanfari, 2011). Third, the influence of the environment has a greater effect on small businesses than large businesses (Covin & Covin, 1990). This is predicated on the capacity of larger businesses to use various means to exert more control over the environment in which they operate, such as having the slack resources to scan, conduct market research, develop dynamic capabilities, and influence institutional structures (Dean, Brown, & Bamford, 1998). This influence may be used to buffer environmental shocks (Helfat et al., 2007).

Holcombe (2003)—taking a purely economic approach to the importance of the environment on new venture formation—elaborated on how economists viewed the knowledge economy as radically changing the nature of the environments that are conducive to entrepreneurship. Holcombe pressed policymakers who wish to make entrepreneurship more conducive in specific environments to consider three important points: (1) policies must nurture entrepreneurship over investment (creating private incentives to invest), (2) the creation of effective institutions, efficient property rights laws, and minimal disruption from regulation or redistribution policies, and (3) the support of a strong and dynamic private sector.
While it is important to recognize the importance of external environmental forces on the intentions of entrepreneurs to start new ventures and the impact upon their success, the it must also be recognized that the environmental approach to understanding context does have a limitation. It is either explicitly or implicitly tied to geographical boundaries (or distance) or industries/markets, and does not properly address the temporality involved with individual accumulation of knowledge and the resulting social change that may be produced (Wennekers & Thurik, 2010). This is part and parcel of its grounding in macro economic theory.

Although spatiality and location is an important aspect of context, Andersson (2005) warns against a disconnect between theory on entrepreneurship that focuses on the social and relational structure of opportunities and the understanding of economic development from a purely regional or national perspective:

*Conventional spatial economics in essence consists of unexplained snapshots. These snapshots may be of that imaginary and utopian equilibrium which is the mainstay of orthodox spatial theory. Or they may be snapshots of the spatio-temporally unique deviations from equilibrium which constitute the subject matter of a great deal of empirical urban and regional economics. But snapshot economics can neither serve as a foundation for understanding the market process nor for analysing its spatial implications. (Andersson, 2005, p. 32)*

It is understood and advocated by many researchers that the processes used by entrepreneurs to start new businesses and/or introduce new products or services into the market cannot be viewed in the absence of context, both social and environmental (H. Aldrich & Martinez, 2001; Carree & Thurik, 2005; J. Katz & Steyaert, 2004). Once again, tracing back the work developed by Zahra, a parallel shift to an increased awareness of, and interest in, the
internal (social) environmental context of the firm is identified. Hornsby, Kuratko and Zahra (2002) measured the key internal organizational factors that influenced middle managers to initiate corporate entrepreneurship activities while Zahra & George (2002) opined on the internal environment through the concept of absorptive capacity. Alongside these works, a growing emphasis on the social environment became strongly evident as Zahra explored the effects of culture at the firm and national level (George & Zahra, 2002; Hayton, George, & Zahra, 2002). In aggregate, these papers were crudely interested in the processes of firms and the socio-contextual nuances that allowed for the facilitation of entrepreneurship. This culminated in an invigorated push towards separating content from process and leading to:

*a reassessment of the outcomes in CE research, which becomes particularly salient with the increasing importance of social, human, and intellectual capital in creating competitive advantages and wealth in today’s knowledge economy* (Dess et al., 2003).

This change of focus is not surprising, considering the exchange between Zahra and Dess (2001) and Shane and Venkataraman (2001) on the nature of the individual and opportunity (first-order forces) and the relegation of the study of the environment (defined as external, market or industry factors) to second-order status (context was important, but not just externally to organizations, but internally as well). This suggests, within the corporate entrepreneurship literature in general and to Zahra in particular, that a realization of the importance of understanding entrepreneurship as social and spatial factors began to emerge. This set the stage for a new movement in the study of entrepreneurial context that Zahra (2007) re-asserts in his paper on contextualizing entrepreneurship. It also pointed to a paradigmatic shift in thinking about context and process, reflected in Zahra’s work, as even he was eventually bent to a more deliberate focus on the entrepreneurial opportunity, and how researchers have overlooked “the importance of the contextual
variables that stimulate, shape, and define the entrepreneurial act” (S. Zahra, 2008). This arc in Zahra’s exploration represents a general picture or “touchstone” of how many authors in the field of entrepreneurship have implicitly and often unknowingly explored the interface of context and process to eventually arrive back where they had started, “and know the place for the first time,” as T.S. Eliot so wonderfully elocutes. In the next section a review is presented of this paradigmatic shift in thinking; it explains how authors who explicitly study context as socio-spatiality integrate individual, social and spatial forces to better understand context and its influence on the entrepreneurial process.

5.4.3 Context as socio-spatiality

There are a wide range of issues and a high degree of complexity evident when contextualizing the socio-spatial interactions that are at the heart of entrepreneurship. Entrepreneurial scholars have acknowledged that the new venture process involves more than just individual actions and that entrepreneurship is more accurately framed as a socially constructed concept that is fundamentally understood through the nexus of opportunities, groups, and modes of organizing within the wider environmental context (Busenitz et al., 2003; Sarason, Tom, & Jesse, 2006). Katz and Steyaert (2004) discuss the implications of conceiving entrepreneurship as a social rather than purely economic phenomenon:

First, the true measure of entrepreneurship in a society as a whole needs to sample across multiple sectors, domains and spaces. Second, current measures of entrepreneurship are too coarse-grained, looking only at business creation or even limiting itself to high growth business creation, and missing the myriad fine-grained forms of entrepreneurial interaction taking place in any society (J. Katz & Steyaert, 2004, p. 193).
The entrepreneurial process is thus argued to be essentially embedded in a local context in which meaning and value are collectively decided (D. B. Audretsch, Thurik, Verheul, & Wennekers, 2002; Schoonhoven & Romanelli, 2001; Sirolli, 1999). Yet, viewed from a socio-spatial perspective, context and its role in the entrepreneurial process has not been fully or even deeply appreciated or explored (S. Alvarez & Busenitz, 2001; J. Katz & Steyaert, 2004; S. Venkataraman, 1997) until Hindle’s recent groundbreaking paper (Hindle, 2010a), which will be explored in more depth shortly.

Because entrepreneurship may be viewed as a socially constructed concept, multi-dimensional approaches that incorporate both social and economic realities provide a much more robust understanding of entrepreneurship (A. H. Van de Ven, 1993). Contextual factors such as culture, availability and access to natural resources, the presence of economic supports or barriers to employment, levels of social capital, access to financial resources, and individual situations such as age, motivation, skills, and opportunity costs of alternatives all shape the type of entrepreneurial processes engaged in, and moderate the frequency with which they occur (Miner et al., 2001).

Minnitti and Bygrave theorize that the decision to engage in entrepreneurship is a function of three interrelated and simultaneous levels of social space: (1) the subjective initial endowment (entrepreneurial capacity) of the entrepreneurial individual or team, (2) institutional and economic circumstances of the economy (the environment), and (3) the perceived level of support for entrepreneurship within a community. Building on Minniti and Bygrave, the macro environment is conceptualized as two different elements: (1) the domain that may be influenced by the entrepreneur (moderated by the capacity of the individual and the success of the venture), and (2) the domain that cannot be influenced by the entrepreneur (P. Davidsson, 2004; G. Markman & Baron, 2003). Therefore, a need for the study of a meso (or intermediate level) of the entrepreneurial phenomenon that incorporates the above within a dialogical perspective of context and process is required.
(Bruyat & Julien, 2000). This focus of enquiry requires both theoretical (conceptual) and methodological tools to guide it.

Of the socio-spatial approaches to studying entrepreneurship, social network theory offers much promise as a means for escaping the bounded mentality of geographic space (Granovetter, 1985). For instance, early research by Birley (1985) identified the catalytic role that networks play in the emergence of new ventures, while Aldrich and Zimmer (1986) considered the activity of entrepreneurship as embedded in networks of social relations that are dynamic, culturally regulated, and maintain their own histories. Social network perspectives are now commonly used to define the nature of relationships and the governance of resources acquired by entrepreneurs embedded within a socio-spatial structure (Hoang & Antoncic, 2003). Emphasis on the life cycles of networks and their impact upon the entrepreneurial process (and vice versa) has naturally emerged from this flow of research (Jack, et al., 2008). Further growth in this area of study includes greater focus on integrating levels of analysis, multiple views of process, and a more comprehensive view of how networks are conceptualized and their relationship to other perspectives of entrepreneurship (Slotte-Kock & Coviello, 2010).

Based on the evidence in the preceding review, there is an identified need to develop multi-dimensional frameworks in order to understand the role of context with respect to how entrepreneurial opportunities are perceived, evaluated, and exploited. The multi-dimensional approach is mandatory for conceptualising, operationalising, and articulating the relationship between process and context. While mainstream researchers in entrepreneurship (e.g., Zahra) have slowly been moving towards an ontological perspective that embraces the impact of context on the entrepreneurial process, recent studies illustrate that “the entrepreneur's socio-spatial contexts in which they operate on a daily basis are still absent from much of the entrepreneurship debate”
Yet, there are researchers that have developed skills in qualitative methodologies that have advanced the field by recognizing that the key to a better understanding of entrepreneurship lies within the “human milieu,” and less so in the industry, market, or environment (Julien, 2007; Hindle, 2010b; Somerville & McElwee, 2011). The next section presents a review of the literature concerned with modelling entrepreneurial context to provide a comprehensive approach for understanding context as it applies to the entrepreneurial process. The review looks at theories, models, and tools that may help to frame and focus this study.

5.5 Models of Socio-Spatial Context: Choosing One

As a means for studying the socio-spatial context, scholars argue that the concept of community is an important area of future research (L. P. Dana & Dana, 2005; J. Katz & Steyaert, 2004). Yet, the use of the concept of community as a level of analysis has been rare over the years since it first appeared in the entrepreneurship literature (Bengt Johannisson & Nilsson, 1989) and has not been developed into a strong analytical/diagnostic framework until very recently (Hindle 2010b). An emphasis on the importance of context in the conduct of entrepreneurship has been used in previous studies as a means to examine the new venture process within collectively oriented, impoverished or depleted regions (Johnstone & Lionais, 2004; Peredo & Chrisman, 2006). It also has provided frameworks for better understanding the interrelationship between non-profit and for-profit entrepreneurs involved in local value creation within a mixed economy (Borch, Forde, Ronning, Kluken, & Alsos, 2008; B. Johannisson, 2007). This concept has also been used to model how entrepreneurship may revitalize specific rural economies (Haugh & Pardy, 1999; Korsching & Allen, 2004).

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In this section, the concept of community will be defined and its treatment in the literature discussed. How it aligns with the subject of this study will be elaborated upon and a rationale presented for its use as a specific lens for viewing the research problem.

5.5.1 Defining community and why it is important
Hindle (2010b) shows that the concept of community is a “multidimensional matrix” that is most useful in explaining the interactive human and institutional context that influences entrepreneurial process. Institutions (such as governance and property rights regimes) are human artefacts. Community context is thus distinguishable from ecological, locational, and other non-human contexts that might affect process.

Minniti and Bygrave have posited that the decision to engage in entrepreneurship by any individual will be impacted by:

three simultaneous elements: (1) the subjective initial endowment, which is personal; (2) the institutional and economic circumstances of the economy, which are objective and community specific; and (3) the existing level of entrepreneurial activity in that community as perceived and evaluated by the individual (1999: 43).

The simultaneous nature of these determinants suggests that any attempt to facilitate entrepreneurial activity will not be very effective if each of these domains is addressed without concern for the others. Bygrave and Minniti view entrepreneurship as a self-reinforcing activity that is path dependent. Therefore, the history of any community will have a significant impact on entrepreneurial proclivities of the individuals associated with it through social and spatial connections. They conclude that there are threshold effects of entrepreneurship and that strategies that fail to raise the equilibrium level of entrepreneurship in a community will most likely not be successful. Building on the work of Crane (1991), Minniti and Bygrave state that “the longer and
more stable the entrepreneurship history of a community is, the harder it is to bump that community away from its growth pattern” (1999:49). Conversely, the historical, resource, and cultural characteristics of a defined community may serve as obstacles to entrepreneurship (L. P. Dana, 1995; Holt, 1997; Peredo & Chrisman, 2006).

There are many definitions of community (S. Dasgupta, 1996). It is therefore important to define it and/or frame it as a concept. Community has been found to involve nine interconnected ideas:
(1) a body of common people,
(2) an organized political, municipal, or social body,
(3) a body of people living and holding goods together,
(4) the state of being shared or held in common,
(5) common character or identity,
(6) social intercourse,
(7) commonality,
(8) life in association with others, and
(9) a group living or acting together (OED, 1989).

From an ecological perspective, communities are simply defined as a local area or habitat wherein individuals of all species interact to affect rates of change across a multitude of activities (Kneitel & Chase, 2004). However, much of formal community theory in biological disciplines has moved from a focus on local communities that are closed and isolated to ecological processes involving species interactions that occur at other scales (Hubbell, 2001; McCann, Hastings, & Huxel, 1998).

Because definitions emphasizing the ideas of shared, static, self contained space are inadequate for understanding the meaning of community, some authors take an interdisciplinary approach that views community as imagined reality, social interaction, and a historical process (Walsh & High, 1999). Scholars working within the classic sociological paradigm of modernization have sought to uncover insights on the transition from pre-
modern community (*gemeinschaft*) to modern society (*gesellschaft*); how it actually occurred, how it unfolded, and what legacy it left (Little, 1997). The definitions of community used in these arenas is closely aligned with economics and capitalism, especially industrial capitalism, and the emergence and regulation of powerful western market economies through local vs. hegemonic struggles (Hirst & Zeitlin, 1992).

Taylor (1982) provides one of the more widely used definitions (with over 500 citations), which views community as a means for maintaining social order and defines community as a small, stable group of individuals who:

1. Hold beliefs and values in common;
2. Have relations with each other that are direct as opposed to being mediated by the state or some other bureaucratic institution;
3. Have relations that are many-sided as opposed to specialized (there is no clear distinction between economics and politics); and

The core conceptual ideas of community are thus intuitive with respect to the usage of selective incentives to alter expectations or secure cooperation in the face of potential retaliation or withdrawal of support for actions taken.

Closer to the field of management in general and entrepreneurship in particular, sociologists understand communities as social spaces, portraying them as networks of people that are more loosely tied to localities than they are to commonalities through embeddedness (Granovetter, 1985). From an organizational perspective, a community can be defined as “a set of co-evolving organizational populations joined by ties of commensalism and symbiosis through their orientation to a common technology, normative order, or regulatory regime” (H. Aldrich, 1999, p. 302).

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23 A German term that refers to the “quality of the relationship of people in a particular place or locality or belonging to a particular group” (see Plant 1974).
Beyond this, and more directly relevant to the direct focus of this thesis, there are some notable early studies that correlate community characteristics with the level of entrepreneurial activity (Birley, 1985). Building on these studies, Schell (1983) proposed a framework for community entrepreneurship founded upon the role of both formal and informal networks that represent a level of encouragement by the community for entrepreneurs and multiple levels of government working in conjunction. The two most important research issues emerging from this work centre on the relationship of local entrepreneurs to power elites and the role of the informal venture capitalist in linking entrepreneurs to power elites.

Research that attempts to incorporate the concept of community as a meso-level unit of analysis is scarce. The next section presents the outcomes of a review of three models that are relevant to understanding community as a level of analysis for gauging the success of specific entrepreneurial processes.

5.5.2 Conceptualizing context as community
Three key authors are identified who are concerned with the practical issue of community as a guiding framework for studying the conduct of entrepreneurship (whatever their principal approach to entrepreneurship, a process perspective or otherwise). These authors have developed conceptual and analytical frameworks for understanding how context may influence the emergence and development of entrepreneurship within social and geographical “spaces” using closely aligned but objectively different approaches. The authors and consequent models reviewed in this section are (1) Spilling’s (1996) entrepreneurial system, (2) Julien’s (2007) framework for local entrepreneurship in the knowledge economy, and (3) Hindle’s (2010b) “bridge,” which is a diagnostic framework for assessing how community factors are likely to affect proposed entrepreneurial projects. In the interest of brevity, the first two models are briefly summarized and the major emphasis is on the third model.
Spilling’s model of the entrepreneurial system

The term “entrepreneurial system” is used by Spilling (1996) to describe a conceptual framework for analysing successive economic processes within a region. He states that “entrepreneurial processes take place within the framework of existing economic and social structures” and that “entrepreneurial activity is based on knowledge, competence, and role models embedded in these structures” (Spilling, 1996, p. 92). The entrepreneurial system is thus synonymous with the capacity of a region to facilitate entrepreneurial events through various elements. These elements, such as the role of specific actors, institutions, and environmental factors (are critical for catalysing and organizing the capacities of multiple actors to exploit opportunities. Key to Spilling’s framework is his treatment of entrepreneurship, entrepreneurial events, and the life cycles of these events (see figure 5.2).

Figure 5.2. The entrepreneurial system.
The framework emphasizes the influence of context on the entrepreneurial process. The concept of role is used to distinguish a person from an entrepreneur, and the framework focuses on process. But there are several potential problems. First, while the focus on the entrepreneurial event aligns well with process and systems theory, the nature and size of the event is at the regional scale. This may pose challenges to investigating community across multiple levels of analysis where entrepreneurial events may take place at a micro scale. Furthermore, the emphasis on the event being externally triggered also proves problematic for non-linear and innovative endogenously occurring events that in Schumpeter’s own words are “the perennial gale of creative destruction” (Schumpeter, 1934, p. 84). Second, the entrepreneurial system is aligned with the economic rationale underpinning regional economic development and tied to a geographical area. While economic development is indeed an outcome of entrepreneurship, it is only a subset of a list of indicators that represent value creation for a diversified group of
stakeholders. It cannot be, by itself, the main consideration of researchers focusing on the phenomenon of entrepreneurship at university. Third, Spilling fails to operationalize the evaluation of the contextual aspects of an entrepreneurial system beyond a highly general level, focusing more on the processes of evolution within the system and the entrepreneurial processes at the community level that are specific to the implementation of a large event.

**Julien’s framework of local entrepreneurship in the knowledge economy**

Julien (2007) provides an in-depth analysis of the role of “local entrepreneurship” in the knowledge economy and uses it to explain why some regions or communities and not others form an enterprising culture. He achieves this through the conceptualization of the “milieu,” which he defines as a locality that provides a “minimum provision of population and resources” within a medium sized city that can be made available to entrepreneurs. It is neither context, nor constraint, but serves as a measure of dynamism. Julien’s entrepreneurial pyramid defines the main variables (actors of local entrepreneurship and the factors that encourage it) upon which his ontology is founded (see figure 5.3).

Figure 5.3 Julien’s pyramid model
Julien’s theory incorporates several important community factors into his framework that are found to be important in any context, such as entrepreneurial culture, infrastructure, and social and economic networks. From the perspective of entrepreneurship at university, Julien’s framework over-specifies many of the sufficient conditions of the milieu, such as the need for a medium sized city, the economic rationality that underpins the boundaries of the framework, and a slight overemphasis on geographical localities.

**Hindle’s Bridge: A diagnostic tool**

After careful consideration of the other frameworks, Hindle’s diagnostic system (sometimes referred to as “Hindle’s Bridge” for convenience of expression) was chosen as the tool most suitable for guiding the study of entrepreneurship at university from a process and community perspective. It aligns well with the research objectives set out in this thesis. Several observations about Hindle’s framework should be noted. First, is not a “model” of a community or a process or anything else; rather, it is a
diagnostic regime. Second, it is not anchored solely by economic rationale, but is suitable for investigating any research problem from many different value-based perspectives and allows for the incorporation of multiple conceptual domains and an assessment of their interrelationships. Third, it is grounded in many of the conceptual areas found to be relevant to the current research. Fourth, it neither over-specifies nor under-specifies the concept of community. This makes the diagnostic system flexible and applicable to a wide range of study areas and provides the necessary structure for comparison and contrast between different “types” of communities. Finally, as a conceptual framework, it is not founded on any unique or exclusive epistemological viewpoint and therefore can be used by scholars who adopt a range of positions.

5.5.3 Assessing the influence of community factors on entrepreneurial process: crossing Hindle’s Bridge

Applying a community-contextual perspective to the study of entrepreneurship at university aligns well with scholars who advocate that entrepreneurship is a socially constructed phenomenon that may be conceptualized beyond the boundaries of economic rationality to produce new, relevant, and valid insights on the phenomenon (J. Katz & Steyaert, 2004). This is the task performed by Hindle’s diagnostic regime and why it is appropriate as a device for analysing research commercialisation systems in universities. Universities are communities, first and foremost. This thesis is focused beyond a phenomenon that is purely economic in nature and moves beyond typical approaches used to date. Compared to other frameworks investigated (that are found to be descriptive and general), Hindle’s Bridge offers an approach that is systematic, analytical and appropriately focused on the objectives of this thesis. Hindle’s Bridge:

- brings to bear a theoretically grounded diagnostic tool that provides step by step instructions for evaluating how context impacts the entrepreneurial process for both specific and general entrepreneurial processes
• provides sufficient explanatory power for articulating the key issues involved that are directly relevant to the research questions posed here, and
• is structured in a manner that allows researchers to compare and contrast findings with other contextual areas (delivering specific practical results and the capacity for contributing to the development of general theory on entrepreneurship).

Hindle’s Bridge offers a well aligned, unique, and action-oriented perspective that fits well with both the narrow and broad research questions posed in this thesis. Through the use of this regime, it is possible to examine the entrepreneurial potential of any given community. As Hindle states:

\[\text{It may well turn out that a particular community, systematically and dispassionately analysed...is so bereft of requisite physical, human and institutional resources that it is not, in its current state, a suitable context for any viable entrepreneurial initiatives. The deficiencies of the context thus defined, will then become the focal impediments that any programs aimed at enhancing entrepreneurial capacity in that community must address (Hindle, 2010b).}\]

At the maximum level of generality, it is designed to provide to a researcher:

(1) a general assessment of the entrepreneurial potential of the whole community in its current state;
(2) a specific assessment of the technical and contextual viability of any proposed entrepreneurial initiative by any set of community actors given the current status of community development;
(3) the ability to articulate the foundations for design and execution of entrepreneurial projects (physical, institutional and educational) that are both feasible and desirable for a range of entities who are community members (this also importantly implies the opposite: the
ability to recognize and reject inappropriate entrepreneurial initiatives before resources are wasted in pursuing them); (4) the ability to identify the focal areas where facilitation of programs of varying kinds might be created to enhance the existing resources and skills of various community members and institutions so that desired initiatives, which are not feasible at present, may become feasible in the future (Hindle, 2010b: 24).

In effect, there are multiple “moving parts” that at any one time can work to constrain or support the capacity of a community in pursuit of specific entrepreneurial objectives. Consequently, no initiative designed to enhance entrepreneurship within a community can be successful unless a systematic and dispassionate analysis of the entrepreneurial status and potential of that community is first performed (Hindle, 2010b). The diagrammatic depiction of the diagnostic regime is provided in figure 5.3.
Hindle’s model contains six principal domains: three under the headings of “generic structural factors” and the other three under the heading “generic human factors.” These domains form the pillars that hold up the bridge: a metaphorical pathway(s) for movement between understanding the specific factors that define the community context to entrepreneurial process(es) emphasizing that success is contextually grounded to that community. These six domains and the theoretical foundations upon which they are based define the community context supporting entrepreneurial processes. The cross braces of the model strengthening the pillars of the structure are programs and facilitation exercises designed to strengthen human resources as required, and tools needed to augment required physical resources. Hindle provides a highly structured method of analytical procedure that is advanced after first specifying the nature of the entrepreneurial process being contemplated within the community and proceeds across 11 stages (please see , 2010b for a full accounting). As no single entrepreneurial action is being evaluated, these steps are superfluous to the purpose and use of the tool in this research.
5.5.4 Synthesis: A suitable tool for guiding the examination of context

The theoretically grounded analytical framework developed by Hindle (2010b) captures many of the general issues relevant to entrepreneurship. In essence, communities may be viewed as socio-spatially framed systems for achieving specific objectives. It is a highly suitable model for guiding the study of how a university context influences the entrepreneurial processes enacted within its RCS. Not only may the concept of community be used to aptly define a specific “type” of university, but it may also be further applied to the many potentially distinct sub-communities that exist within. The elements that make up the pillars of the model are all relevant to university entrepreneurship. A researcher may then expertly and uniformly analyse any patterns detected within the system.

5.6 A Synthesized Guiding Framework: Context and Entrepreneurial Process

We have now arrived at the point where a theoretical, analytical framework can be constructed that is suitable for guiding the empirical investigation needed to answer the key research question of this thesis:

*How does context influence the entrepreneurial process in RCS at universities classified as second-tier (not rich)?*

As articulated in considerable detail to this point, the following items are combined:

• an over-arching systems approach (von Bertalanffy, 1960);
• a generic approach to understanding entrepreneurship that stresses the importance of process (a focus, as discussed in Hindle 2010a and Moroz and Hindle, 2012 that emphasizes the “what” and very much the “how” questions of the entrepreneurship phenomenon);
• a community diagnostic approach to analysing the way in which particular entrepreneurial processes now and in future are likely to play out in particular community (university) contexts (Hindle, 2010b).

Figure 5.5 The guiding theoretical/analytical framework of this thesis

Chapter Summary

The main output of this chapter was the synthesis of a conceptual framework that is well suited for exploring the main research problem(s) of this thesis. The synthesis of system’s theory (Von Bertalanffy 1956), Hindle’s bridge (2010) and Hindle’s model of entrepreneurial process (2011) provides a detailed conceptual foundation for viewing the research problem. As well, Hindle’s bridge serves as a methodological tool for structuring and analysing data.
Chapter Six  Methodology

Chapter Abstract
The chapter presents a research design that involves the study of six second tier universities across three nations using a qualitative case study methodology. An overview of where this study fits into the objectives of the thesis project is provided and is followed by a detailed narrative on the exact procedures used, the rationale for the study and a guide for assessing academic rigour.

6.1 Overview
This chapter presents the methodology of the primary empirical component of this thesis: in essence, It is the star of the show. It consists of six in-depth case studies of university RCS using a qualitative method, that is well matched to the primary research question that is being asked:

What is a succinct and testable framework that illustrates the factors that are essential to fostering the most appropriate entrepreneurial processes and objectives for improving innovation performance within all university contexts?

To get to this point, chapters 2-5 dealt with a series of necessary hurdles and issues. The first issue encountered was the need to specifically frame a unit of analysis to be used in this study—university research commercialisation systems (RCS). The second issue arose from the lack of suitable typologies for studying university RCS based on performance. Research action was taken to formulate a taxonomic regime germane to RCS that culminated in producing a reliable method for sorting a nation’s university population into two cohorts: first-tier and second-tier. Using this taxonomic regime, the extant canon of entrepreneurial university case studies was classified and examined using content analysis. This investigation
showed that the cases used to inform the context/process relationships were mainly first-tier universities and that a gap in the literature existed with respect to second-tier universities. Finally, an analytical framework that consisted of three lenses (systems theory, entrepreneurial process, and context) was developed to guide the methodological and empirical component highlighted in this chapter.

The following sections explain the details of this methodology (how the research was done), the rationale for the study (why the research was done) and the quality of the study (the rigour of the research actions that were taken).

6.2 Procedure

This section is devoted to explaining the detailed methods that were used to conduct the primary qualitative empirical research for this project. The specific research question to be answered is:

How does context influence the entrepreneurial process in RCS at universities classified as second-tier (poor)?

As indicated in chapter 4, this question addresses a gap in the literature that must be closed in order to satisfactorily answer the full set of questions and objectives that drive this research project.

6.2.1 Qualitative research

At a broad level, it is believed by many scholars that the “holistic, dynamic, unique, and potentially discontinuous nature of entrepreneurial activities and processes” are aligned well with the methodologies of a qualitative approach (W. D. Bygrave & Hofer, 1991). To this effect, Steyaert describes entrepreneurship as:

A process written on a daily basis, with many actors on multiple scenes simultaneously searching to move existing realities through
creative actions into new worlds…enacted through every day practices: It is never done, and always going on, a journey with more surprises than with predictable patterns’ (Steyaert 1998, 15).

Bonoma, Kodithuwakku and Rosa (2002) state that “qualitative research is the major or perhaps the only valid knowledge accrual device for studying human behaviour.” As noted earlier, the study of social networks is a prime example of where the advantages of qualitative research may be applied. Jack and Anderson (2002), for example—who were interested in the effects of embeddedness on the entrepreneurial process—used a qualitative research design to better deal with “soft issues” that are extremely difficult to quantify when “searching for the meanings behind the actions” (Jack & Anderson, 2002: 473). Qualitative research allows for the examination of a phenomenon that are characterized by complex relationships.

6.2.2 Case study approach
The core of the empirical research featured in this thesis is derived from a multiple case study, mixed methods approach to investigating the second-tier set of universities in each of the three nations selected. This is a methodology that is well aligned with a qualitative research perspective. The objective is to develop a context/process map from case-based empirical evidence on a set of universities that has not received much attention in the literature (Eisenhardt, 1989). Case study research is an inductive empirical method that offers descriptions of a phenomenon based on a variety of data sources (Yin, 1994). Case studies “emphasize the rich, real world context in which phenomenon occur” (Eisenenhardt and Graebner, 2007). This method is appropriate for the task at hand, since very little is known about the context/entrepreneurial process relationship in second-tier universities. This method is used to identify patterns in relationships among and across international cases, and to provide logical arguments for how context influences the entrepreneurial process. A secondary objective is to compare and contrast generalizations
found in the second-tier set with the research findings from case studies in the first tier-set.

**6.2.3 Sampling**

The second-tier set of universities is very large compared to the first-tier set, so it is not feasible to incorporate all of them into the research using qualitative methods. Therefore, a purposive sampling method is used to identify six universities (two in each nation) for study. As the term implies, purposive sampling is a technique that is used with a “purpose in mind” (Trochim, 2005). It selects cases on the basis that they are accessible to the researcher, provide for replication, and allow for the utilization of theoretical relevance (K. M. Eisenhardt & Graebner, 2007). Universities were chosen that provided a good mix of strengths, weaknesses, and performance levels and limited with several key criteria in mind (Kuzel, 1992; Patton, 1990):

- Must be a chartered university according to national legislation
- Must be active in performing research in the hard sciences
- Must have an entrepreneurship education program or teach courses in entrepreneurship
- Use identifiable strategies for moving the university toward an entrepreneurial paradigm
- Are not in a nation’s first-tier set as defined in this thesis
- Are actively involved in knowledge transfer, commercialization of research, industry partnerships, consulting or any other types of activities that may be considered “entrepreneurial” using the Shane and Venkataraman (2000) definition of entrepreneurship.
- Was not in the “grey zone” in scatter plot assessments close to the performance drop off points identified. A rule of thumb was used to select universities near the middle to bottom half of the set.

As this empirical component is comprised of multiple case studies in three different nations, the use of what Eisenhardt and Graebner (2007) refer
to as an “extreme/deviant case selection” provides an opportunity to examine cases that best illuminate issues central to the focus of the study (Kemper, Stringfield, & Tedlie, 2002). Due to the variance in national N of each population, and the extremely heterogeneous nature of these populations, the cases selected were limited in terms of their capacity to represent the entire population beyond general characteristics. In countries with a large number of institutions belonging to the second-tier cohort, the limitations may be more pronounced. Theoretical and replication logic used in a multiple case study research design does mitigate some of the concerns with respect to generalization of conclusions (K. M. Eisenhardt & Graebner, 2007; M. B. Miles & Huberman, 1994; Yin, 1994). Each of the nation sets followed a structure where one university was selected as a nascent or emerging case (where the commercialization outputs were limited) relative to the second university.

6.2.4 Chosen methods
A mixed methods approach for data collection was used; primary data were generated by semi-structured key informant interviews (SSI). Secondary sources consisted of published or archival data collected on site, provided by interview subjects (where subjects would suggest or point to what they believed were relevant secondary sources of data), or found on line through the respective university websites. The SSI interviews were conducted by the author or by a graduate student trained in interview techniques and project methods. The use of graduate researchers was necessary given the international travel involved and the limited time that was available on site to conduct interviews (within a one- to two-week period). Graduate researchers selected to interview subjects were privy to at least two interview sessions where they sat in on interviews as they were conducted.

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24 The cases were also selected for characteristics that were considered unique by the researcher with the indirect objective of finding new patterns/variables that could lead to further classifications.
The methods used for sampling interview subjects for each case were influenced by criticisms of Clark’s (1998: 2004) influential work on entrepreneurial universities. Clark reported that interviews conducted for his case studies were limited to university administrators. Therefore, he did not include a wider range of perspectives that could be associated with a variety of worldviews, logics, and functions of relevant individuals and stakeholders. To build on Clark’s work and to mitigate criticisms of sampling bias a strategy following Hofer and Bygrave (1992) was developed:

...multiple data gathering methods should be employed whenever possible to provide “triangulation” on the entrepreneurial processes and phenomenon involved in order to generate more accurate and complete descriptions of what has occurred. One type of triangulation is to gather the same type of data about a phenomenon from several different sources. Another approach is to gather different types of data, and then to see if the descriptions generated by these data are internally consistent with each other (Hofer & Bygrave, 1992: 96).

Triangulation was achieved by interviewing three groups of key informants:
1) University employees: administrators, department heads, researchers,25 commercialization managers, and all other individuals that received a salary directly from the university or indirectly from a university owned organization
2) External experts: industry, government, VC/angels, and other relevant stakeholders that did not receive a salary from the university
3) Entrepreneurs: individuals that were either internal or external to the university, and who had a stake in the commercialization of university

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25 Researchers of two types were interviewed: those who had not participated in commercialization, or had little interest in entrepreneurship of any kind, and those who had. This was done in order to balance out perspectives from two potentially very different types of research faculty.
research through research collaborations, ownership of firms, or as a result of reliance on university resources.

These three areas produced highly knowledgeable informants across a spectrum of hierarchical and functional areas, groups, and geographies. Informants who were stakeholders and not associated with the university community were selected because they provided an external perspective and they would not likely be involved in impression management (Eisenhardt and Graebner, 2007). Sampling across these three populations was conducted using a respondent driven or “snowball” method for hidden populations. This strategy is often incorporated when no formal sampling frame exists (Heckathorn, 1997). This involved first contact with a colleague at each university who was asked to identify key informants who might be relevant to the study. This process was then repeated.

6.2.5 Ethics

The process for gaining individual university approval was to contact a known key informant who then took the request to university administration internally. Each university had a different process for gaining consent, some more rigorous than others. All six universities then provided written or verbal (when the process was more informal, approval from the Chancellor or President was given to the researcher verbally). As well, each key informant read and signed a consent form that outlined his or her rights and responsibilities. A copy of this form was provided to each interviewee.26

6.2.6 Data collection

In-depth, semi-structured interviews (which lasted from one to 1.5 hours each) were conducted with a total of 125 key informants. Interviews were digitally recorded. The average time spent on location for each case was 8

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26 As the empirical component involved human beings, ethics approval was sought and approved from the Human Research Ethics Committee (HREC) at Swinburne University of Technology. After the candidacy was transferred to Deakin University, the Swinburne ethics approval was also transferred and approved by the Deakin ethics committee with no changes. This explains why ethics documentation attached has Swinburne letterhead.
days. Data were collected during 2008 and 2009. A minimum of 15 and a maximum of 25 interviews were conducted for each case. Preliminary data summarizing and organizing was conducted immediately after the interviews and notes made for each key informant. This provided a general summary of the interview for each subject and any other issues that might not be caught on tape. The interview process depended upon the interviewer’s skill to pursue areas opened up by the interviewee through either verbal tone, body language, or answers that suggested the interviewee possessed more knowledge than indicated by the initial verbal responses. Other sources of evidence included informal data gathered while in the community or on campus, direct observation, touring the community and a wide range of published materials that included university reports, studies, or website information.

Interviews were conducted using a ten question open ended survey (see Appendix B). The fifth question involved the use of a technique known as mental mapping. Mental mapping describes a methodology for key informants to produce illustrations that represent their own cognitive maps and then how they reflect and act upon those thoughts in their everyday behaviours (Downs & Stea, 1977). This technique relied upon the subject generating a hand-drawn and labelled sketch map of both real and/or imagined spaces and places relevant to the “research commercialization system” (Kitchin, 2000). In simple terms, the key informant was asked to illustrate from his or her perspective, the system and/or processes for entrepreneurship, innovation, or commercialization within the university community (see Appendix C for examples of these mental maps). The final question involved a process of discovery through narrative story telling whereby the cognitive schema related to how the individual evaluated productive opportunities (Hindle, 2010a).

6.2.7 Data analysis
Data analysis is the process of bringing order, structure, and meaning to an otherwise loosely collected and often messy data set (C. Marshall & Rossman, 1995). As qualitative analysis is less constrained by rules than quantitative
analysis, guiding frameworks, models, or structures are important in sorting data in a systematic way, but one that still allows a researcher to use common sense and intuition to interpret the data (Walker, 1985). The data collected were entered into the Nvivo8 software package to assist with analysis. The modified structural framework (consisting mainly of Hindle’s Bridge) provided the analytical structure necessary to identify, organize, define, and categorize the properties of coded data. The formulation of key factors and models relied on guidance from the Nvivo software using the node system (open coding). Open coding is defined as interpretation rather than summarization (Robson, 2002). Miles and Huberman’s (1994) advice was heeded on the conduct of axial coding, or the establishment of relationships between the codified interpretations that had emerged. The detailed procedures that were used to analyse the data are provided in section 6.3.

This process yielded six individual context-process maps of the RCS of second tier-universities studied (see Chapter 7). The factors that are represented in the context-process maps provide a set of touchstones with which to compare and contrast with other cases in the cohort. Factors that are found to be common amongst them were then aggregated to provide general insight into the set as a whole (see Chapter 8). The aggregate context-process map of the second-tier university set is illustrated as SG-2. This model is then used to compare and contrast with the general insights aggregated from the case study literature that represents the first-tier set (denoted as FG-1) to answer the remaining questions set out in Chapter 1.

### 6.3 Rationale

Edmondson and McManus (2007) emphasise the importance of establishing a good fit between the culture of inquiry and the research problem so that rigorous research is conducted. They note that the literature does not provide researchers clear principles in matching a research question to a methodology. Although Edmondson and McManus provide three archetypes for dealing with this issue, the suggestions are broadly posed and of little direct help.
Therefore, the appropriate literature was reviewed to select three key works for guiding this thesis: Hindle’s (2004) “canonical development approach,” Zahra’s (2007) guide to theory building in entrepreneurship research, and Eisenhardt and Graebner’s (2007) work on how to generate theory from case studies. This answers the question “Why were the techniques used in this research chosen?”

6.3.1 Philosophical positioning and alignment with methodological and empirical methods

The selection of methods is dependent upon how the researcher chooses to understand phenomena that are encountered. This selection process is influenced by the body of paradigmatic work (or canon) that exists on the substantive matter to be investigated or the field of research to which it belongs (Kuhn, 1962). A researcher may use this canon to assist in structuring the phenomenon under study so that facts, values, and relationships may be properly distinguished (Easterby et al., 1991; Hollis, 2006; Kemper et al., 2002; Trochim, 2005). But selecting a philosophical perspective of knowledge is fraught with many pitfalls. Schools of thought may offer differing ontological and epistemological beliefs. Sorting through these beliefs and stating a forthright and clear indication to the reader of the stance taken is thus highly important to eliminating philosophical confusion. Therefore, the canonical development approach (CDA) developed by Hindle (2004) was selected to navigate through any paradigmatic debates. The CDA will help a researcher philosophically anchor his or her study and provides a structure for selecting the most adequate methodology appropriate to research objectives.

Cutting through the jargon rich and complex instructions packaged into the CDA, what Hindle really states is that the research question should be the main focus of any attempt to achieve methodological fit. It (the research question) influences and is influenced by the domains of philosophical context and methodological content (Leedy, Newby, & Ertmer, 1997). The research questions asked are an extension of the literature (or canon) that informs the research problem under contemplation and is a natural
progression of the actions required to structure, make sense of, and identify gaps in the literature to bring new perspectives to light (chapters 2-5).

In this empirical study, perceptions of key informants are relied upon to answer the primary research questions. If well executed, this is a valid means for empirical examination of the relationship between context and the entrepreneurial process (Tsai, MacMillan, & Low, 1991). Bruno and Tyebjee argue for the validity of this approach when dealing with contextual issues (1982: 306):

Research methodologies that link objective environmental characteristics to organizational start-ups ignore the crucial role of the entrepreneur’s subjective interpretation. Research must address the terms in which the entrepreneurs assess the environment, the relative weight they give to its different aspects, and the information they use for evaluation.

This research is clearly in the interpretivist paradigm, defined by Holloway (1997) as “a direction in social science that focuses on human beings and their way of interpreting and making sense of reality.” Interpretivism contrasts with the positivist school of thought, which considers the fixed rules and laws of causation as governing the phenomena it studies (Hughes, 1976). By taking an interpretivist approach, the researcher acknowledges the intimate relationship between the researcher and the data that is collected and frames it as a necessary and valid element of the study of any social process (W. Gartner, 2007).

6.3.2 Selection of method(s) and techniques
The general objective of academic research is to provide a clear conceptual argument and expertly tie together all of its components to yield an aggregate insight into the research problem encountered. Therefore, the research question(s) posed must fit well with the methodology employed to answer them (Edmondson & McManus, 2007). The literature does not provide clear
guidelines for matching research questions to methodology, but Zahra (2007) provides an overview of the challenges and effective strategies that cover the development and use of theory in the field of entrepreneurship. He proposes a 2 x 2 matrix that categorizes theory as established vs. emerging and the phenomenon as established vs. new (see Figure 6.1). The four scenarios that emerge are used to discuss the major shortcomings in each scenario as well as effective strategies for matching the research question with an appropriate method.

Zahra’s work acts as an adequate guide to help determine exactly “what is being done and why it is being done,” “how it is being done,” and “what is to be achieved” (from the perspective of producing acceptable scholarly results). At the core of this research project is the desire to make a theoretical contribution (in the form of a testable conceptual framework) as a result of empirical observation of complex entrepreneurial phenomena within a relatively unexplored context: second-tier universities (i.e., those that are not blessed with abundant resources). This objective best corresponds to scenario four in Figure 6.1. Zahra equates this scenario with the development or application of new theory to explain new phenomena in a rich setting. This type of study often focuses on ascertaining the differences between well documented phenomena and identifying patterns in those that are not well documented. Case studies and qualitative research are appropriate for answering a variety of questions like these.
Exploratory studies must cope with the twin problems of lack of theoretical anchors to provide clear focus and meaning to the task and vagueness with respect to describing the phenomena (S. A. Zahra, 2007). Zahra also offers guidelines and suggestions for achieving sound results from the task of contextualizing theory. He suggests clearly defining the boundaries of the phenomenon, establishing the uniqueness of the phenomenon, positioning the arguments advanced as to highlight their newness (and importance), and discussing the conditions under which the theoretical findings may be generalized to other phenomena. As indicated earlier in this chapter, all these points have been addressed in chapters 2-5.

### 6.4 Quality

The quality and rigor of any academic study is best judged through the merits of a thoughtful, transparent design and its execution by skilled researchers.
Determining what constitutes “good science” means evaluating the credibility and quality of a study. In the case of qualitative research methods, the researcher must elaborate on the process and protocols of study design, data collection, and analysis (Trochim, 2005). Lincoln and Guba (1985) state the importance of four factors of trustworthiness: credibility, transferability, dependability and conformability. The most simple and powerful way for communicating the rigour of a study is to plainly provide a detailed narrative of what was done and how (Ryan & Bernard, 2000).

The analysis and interpretation of each case in this study began with the verbatim transcription of interviews from key informants. The next step in the process entailed a review of the transcripts that were produced. Ideas suggested by Miles and Huberman (1994) and Lincoln and Guba (1985) were used to guide the data analysis. The following process was used: (1) filling in (adding new codes based on insights that emerge from analysis), (2) extension (returning to old codes and recoding after a new theme or relationship had been detected), (3) bridging (seeing new relationships in code that call for new configurations or categories), and (4) surfacing (identifying new categories). This process was assisted by using the analytical framework developed in chapter 5. Codings produced from the transcripts based on issues, variables, or factors of relevance to the research problem were sorted into the six categories of Hindle’s Bridge and the three domains of the MEP.

The generation of initial codings from the primary data were then analysed again after a review of the field notes (the Nvivo8 software allows the researcher to make notes on the codes developed) and evaluation of the mental maps that each of the key informants had drawn. Mental mapping describes the methodology of participants artistically representing their own cognitive maps—how humans think on and about space and then how they reflect and act upon those thoughts in their everyday behaviours—through hand-drawn and labelled sketch maps, composite maps of sketch maps, surveys, and/or interviews of both real and/or imagined spaces and places.
The mental maps helped to give insights into the data produced by the key informants (such as the depth and detail of the mental map, or its lack of depth and detail).

Secondary data was incorporated by proceeding through the four steps presented above from Lincoln and Guba (1985). Based on this data, factor codes were augmented, changed or moved accordingly. After a time of reflection away from the data, they were re-analysed. This reflection led to several intuitive insights that were once again recorded using computer input into the nodal categories that had been devised. This action resulted in the synthesis of coded areas into general factor areas. These general factor areas rested on the foundation of a secondary level of codes that had been distilled out of a third level of highly specific codes.

After the distillation of key factors reached a saturation point, several in-depth discussions with key informants took place to get feedback on the outcomes of preliminary data analysis (K. M. Eisenhardt & Graebner, 2007; Y. S. Lincoln & E. G. Guba, 1985). The findings were discussed with peers and colleagues familiar with the area of study. These sessions were recorded or notes taken to provide additional reflective material. Many were informal meetings at conferences and discussions with the dissertation supervisor. This precipitated a great deal of reflection on some of the issues, themes, and general factors that emerged. One of the most daunting tasks was to eliminate any redundancies within the coded factor areas while still acknowledging and managing the interrelated nature of the findings. Audit trails within the Nvivo8 software allowed for these processes to be recorded over time with reflections and personal thoughts annotated and filed. Proper accounting of where and how findings emerged from the data (such as “eureka” moments) we also logged in the notes sections of each node set.

27 Simply, no other new factors could be derived from the combination of factors or the combination of secondary factors into primary general factors.
Summary of Chapter Six

In this chapter, I have discussed the research design employed. An overview of exactly how this empirical component fits into the thesis is provided and special consideration is given to the exact procedure used, the rationale for using this procedure and the academic rigour of the procedure undertaken.
Chapter Seven  Case Study Data and Specific Models

Chapter Abstract
The main objective of this chapter is to present the empirical data for the set of second-tier universities in a manner that is replicable, manageable, and robust enough to allow for ample comparison and contrast among the six cases selected. The findings suggest that there is a considerable variance among the six cases, but also unobvious patterns. Each case provides an illustrated view of the relationship between a particular context and the entrepreneurial processes observed. Nevertheless, many similarities and tangencies exist: they have fewer resources dedicated to their RCS, less experience in commercialization and face a wide range of socio-spatial barriers that are framed by their unique contexts. These patterns will be explored in greater detail in chapter 8.

7.1 Overview of the Empirical Investigation
The main empirical component of this thesis is presented as a multi-case study investigation of how context influences entrepreneurial process at second-tier university research commercialization systems (RCS). The need for focused and structured research action has been established previously in chapters 2-5, and the methodology clearly outlined in chapter 6. The work leading up to this point has illustrated that contextual typologies classified as “rich” predominantly inform theory and practice in this subfield. More importantly, these studies have not provided a clear ontological perspective of “context” and “entrepreneurial process.” This study seeks to address both issues to develop an enhanced framework for understanding this phenomenon.

7.1.1 Sample, case reporting and rationale
The selection of the sample cases was guided by the simple necessity of identifying typical and accessible universities across three nations that presented the widest range of relevant complexities associated with RCS. The so-called “deviant sampling” technique suggested by Eisenhardt (1989), led to
the identification of second-tier universities that were different across and within countries. For example, the University of Southern Denmark (USD) has attempted to clone elements of the North American commercialization system (university officials studied and visited several U.S. and Canadian universities and based their own strategy on what they saw). On the other hand, Roskilde University (RUC) has had a long history of providing innovative educational programming (particularly in social entrepreneurship) with very little in the way of quality hard science being produced. Yet, RUC is responding to government mandates by establishing commercialization infrastructure without fully assessing their aligned resources and competencies. In Australia, two similar sized Melbourne area universities with comparable academic research strengths in engineering have embarked on highly divergent pathways to achieve innovative performance (one has a well defined commercialization infrastructure and the other does not). In the U.S. cases, two similar universities (public land grant) on opposite ends of the country are also on opposite ends of the commercialization performance spectrum (one is in transition with respect to personnel and policy directly involved with RCS and the other is well established but potentially underachieving).

The cases—which are offered as a representative sample of second-tier universities—provided a good sample for detecting unobvious patterns across a wide variety of contextual circumstances in each nation. As will be shown in chapter 8, there are many patterns found across all the cases investigated; this allows for an effective amalgamation of the most important contextual factors into a representative model of second-tier universities in all three nations. But it is also clear that these cases demonstrate the heterogeneity of second-tier universities; each presents a unique context-process map that could be framed as a distinct model for doing entrepreneurship at university relevant to their RCS.

In the interest of conciseness, a full narrative is provided for only the first case study. The remaining five case studies are presented in précis, using
a short introduction and overview that highlights the key issues, elements, and factors that are significant. (Full narratives of the other five case studies can be provided upon request.) Tables, figures, and an illustrated conceptual model of how context influences entrepreneurial process in each case are also provided in order to illustrate the richness of the data, following recommendations by (Eisenhardt, 1989, p. 26). All other tables (analysis and coding) are provided in the appendix.

The objective of this chapter is designed to answer the second core question:

*How does context influence the entrepreneurial process in RCS at universities classified as second tier (poor)?*

At this point, analysis is limited to recognizing patterns and relationships among identified factor constructs within each single case (K. Eisenhardt, 1991). As stated by Eisenhardt (1989), “building theory from case studies is replication logic… this is, each case serves as a distinct experiment that stands on its own as an analytic unit.”

### 7.2 Case Study A: The University of Southern Denmark (USD)

The methodology and the research methods employed in this case study (and others) are provided in chapter 6, as is the rationale for choosing the methods utilized.

#### 7.2.1 Introduction and overview

Case study A encompasses an empirical examination of one of Denmark’s regional research universities: the University of Southern Denmark (USD). Established in 1966, the university has expanded to include six campuses after government restructuring of the post secondary education system over the period 1996 to 2006. The campuses are at least 50km apart in six small cities that vary with respect to size, industries, and geographies. The USD is the first comprehensive university with a decentralized campus structure in Denmark. The largest city with a campus, Odense, has a population of 167,000 residents. The entire regional population base that USD serves is one half million people. The university provides services to 19,000 students a year
with a staff of over 2200, nearly half of whom are research and teaching faculty. Due to the many campuses that exist, some of the faculties and schools are concentrated in only one location.

Figure 7.1 USD campus locations and cities

USD has a wide range of disciplinary departments and produces research from almost 40 research centers. Due to the wide breadth of research centers and research programs at USD, there is a considerable flow of basic and applied research that may have commercial potential. Key research areas are in robotics, nanotechnology, and biotechnology. Not one of the disciplinary areas in the hard sciences is found within the top 500 of the QS world university rankings, although social sciences is ranked at the 351-400 level. During the period of 2007-2010, USD was ranked in the top 500 university world rankings at 302.

Between 2005-2008 there were approximately 100 research disclosures made that led to the successful filing of approximately 30 patents. Over this same period, 50 licences, options, or assignments were made and 12 university spin outs (USO) were reported. The 12 USO’s reported is the most by any university in Denmark during this period, yet they generated very little in the way of revenues. For example, the impact of these 12 USO’s was much less than the impact from spinouts generated at DTU and/or Copenhagen University, as measured by licensing revenues. Nonetheless USD was viewed as one of the better performing second tier universities in Denmark.
Table 7.1 Key commercialization input/output indicators

<table>
<thead>
<tr>
<th></th>
<th>Disclosures</th>
<th>Patents filed</th>
<th>Licenses</th>
<th>Spin outs</th>
<th>Technology Transfer</th>
<th>Full time Equivalents</th>
<th>Commercialization costs (in 1,000's)</th>
<th>Licence revenues (in 1,000's)</th>
<th>Total Research Expenditures (in 1,000's)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USD 2005-2008</strong></td>
<td>102</td>
<td>30</td>
<td>51</td>
<td>12</td>
<td>3.8</td>
<td>1,234</td>
<td>1,896</td>
<td>424, 416</td>
<td></td>
</tr>
<tr>
<td>RUC 2005-2008</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0.125</td>
<td>122</td>
<td>0</td>
<td>1,424</td>
<td></td>
</tr>
<tr>
<td>Deakin 2001-2004</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>x</td>
<td>x</td>
<td>222,560</td>
<td></td>
</tr>
<tr>
<td>Swinburne2001-2004</td>
<td>117</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>2.5</td>
<td>1,624</td>
<td>1,113</td>
<td>112,725</td>
<td></td>
</tr>
<tr>
<td>LSU 2004-2007</td>
<td>57*</td>
<td>26*</td>
<td>27*</td>
<td>7*</td>
<td>2.5</td>
<td>382*</td>
<td>6,079*</td>
<td>115,338*</td>
<td></td>
</tr>
<tr>
<td>ISU 2004-2007</td>
<td>486</td>
<td>87</td>
<td>?**</td>
<td>12</td>
<td>6</td>
<td>4,964</td>
<td>31,010</td>
<td>968,931</td>
<td></td>
</tr>
</tbody>
</table>

x denotes an absence of indicators within the data
*this data only represents years 2004-2005
**total licenses not given but there are 251 active licenses earning income and two licenses that are generating more than 1 million dollars per year. (Data extracted from the Association of University Technology Managers STATT database, the Danish Agency for Science Technology and Innovation, and the Australian National Survey of Research Commercialization)

Interviews with technology transfer managers and entrepreneurs revealed that some start-ups were created with IP given back to inventors by the university. Others were spun off from companies in the area that worked with or had linkages to the university. These were not recorded as part of the spinoff totals generated. Some of the outcomes of USD’s knowledge outputs are the establishment of a small research park (that will be expanded after 2010), one joint collaboration between industry, government and the university to create a robotics/electronics cluster (Robocluster), and a Center for Entrepreneurship (CESFO) that collaborates with local industry through a faculty/student consulting group to provide solutions for emerging and established firms. Although there is space at the research park for new start-up firms, it is not technically defined as an official university technology business incubator (UTBI) since it does not offer a full range of services.
Review of the partnerships, projects and major research joint ventures at USD show a high level of collaboration with government and non-government agencies, but a relatively low level of collaboration with firms and industry partners.

7.2.2 Key Informant Sampling at USD
Qualitative researchers often use triangulation—gathering data from multiple sources—to improve the quality of the conclusions that are drawn. The approach increases validity because it helps to overcome biases inherent in just one source of information (Miles and Huberman 1994). In this study, triangulation was used in drawing data from three key community stakeholders groups: university employees, regional experts and entrepreneurs. These groups are broken down further relevant categories when possible. In sections 7.2.3 to 7.2.9, findings are presented based on data gathered using methods that include key informant interviews, mental mapping, observations, and other secondary public sources of information. The analytical framework developed in chapter five is used as the primary tool for structuring the data to enhance the efforts of sense making. The findings for USD are synthesized in section 7.2.10.

7.2.3 Baseline human resources
There are four categories in this domain that were deemed relevant for understanding the specific context for facilitating entrepreneurship: (1) facilitators, (2) entrepreneurs, (3) faculty, and (4) students.

Facilitators
Facilitators are those individuals who act as champions and leaders to facilitate entrepreneurial activities within the community. Formal facilitators often act in leadership roles as part of their line managerial duties. Informal facilitators are those individuals who do not fit into the above classification, and who do not have a formal role in the university. As a whole, the facilitators at USD had on average, few real entrepreneurial skills or business experience. The effectiveness of facilitators was found to be weak, especially
within the technology transfer domain. The aggregated comments described TTO staff as formal facilitators. They were viewed to be under–resourced and bureaucratically and legally focused. Seen as gatekeepers, they often lacked the proper skills (such as evaluating or selling), and did not control the necessary resources or provide the proper leadership necessary to perform their roles effectively. One expert informant commented:

Part of the reason for that is that the people leading these technology transfer groups at the university – they are not experienced business people - They are academics (expert informant.)

Individuals within the technology transfer domain reflected this sentiment and added:

this activity is very low on management part of the organization... we are on the same level as people with travel accounts, invoices and payments and this, but right now we don’t even have a department head, we had one for about a year and he ran away screaming because he couldn’t stand this, they were trying to put too many tasks on him but he was basically a lawyer he came with a point of view that he was here to make sure the contracts were in order but he was also responsible for commercialization which he knew absolutely nothing (university employee).

Other individuals in top administrative positions were found to be mostly supportive of entrepreneurial activities, but one informant believed that this was not enough:

we should have another pro rector responsible for interaction with society information foreign students with the local government and for our technology transfer and general interaction with society (university employee).

It was not difficult to find facilitators in direct formal roles around the university, such as department heads, directors, and deans. These line
administrators were often overtaxed with teaching and research mandates, and found that their ability to work towards a third mandate with no new resources was challenging. The most impactful group of facilitators were found within the International Danish Entrepreneurship Academy (IDEA) units loosely attached to the university. Some of these individuals had direct business experience, had a mandate for facilitating entrepreneurial activities, and had good political knowledge of the university community. Yet they had few ties to faculty and were not directly plugged into the system for commercialization. The director of IDEA also had a dual role as a faculty member.

Informal facilitators were not difficult to find either, but these individuals were often only loosely attached to the community and could be best described as providers of support and promotional services. They often were bereft of any deep personal investment in the community. Examples of these types of supporters were a body of international entrepreneurship experts that only met a couple of times a year to provide advisory services to the IDEA board, government innovation consultants from the region and state, and business plan promoters attached to programs such as Venture Cup (a national business plan competition). One informant relayed how some of these supporters were not only loosely attached to the community, but heavily invested in protecting their own turf to the point of being negative nodes in the system.

**Entrepreneurs**

The data from key informants of all types showed that there was very little entrepreneurial capacity within the community. Yet some rich findings were evident with regard to the skills and capacities required by entrepreneurs who attempted to operate within the USD context. For most entrepreneurs or industry agents, experience dealing or working within a university environment was found to be highly important. Further analysis of the data showed that for entrepreneurs who worked within the university community,
experience in dealing with industry and external markets was also important. As well, entrepreneurs who successfully developed special skills for coping with the multiple logics that exist between the university environment and the market environment were found to be highly influential and effective, but small in number. Lastly, it was emphasized that while having business experience was important, tacit or specialized knowledge of the specific IP that was being commercialized was more valuable, particularly at the earlier stages of the entrepreneurial process:

> You cannot rely on general people – it’s very important of course to have business knowledge, and I’m aware that I don’t have that much, but you need to have a key understanding of the business and also some understanding of the science behind it in order to be successful in my opinion. If you look at the successful biotech companies, they are all run by very clever people – who are educated about (biotech) it (entrepreneur).

Notions such as commitment, entrepreneurial drive, and a passion for transforming science into practical value for society were associated with successful community entrepreneurs. Another key finding was that there was a great need for experienced business people to work with researchers as surrogate entrepreneurs. The most common way to engage in this process for most faculty researchers was to write grant proposals that had industry partners. Thus emphasis on team dynamics was found to be important. This combination (academic and entrepreneur) often translated into the ability to operate within an institutional environment to successfully commercialize a technology or product.

**Faculty/Researchers**

The overall quality of research at USD as a whole ranked within the top 300 universities worldwide by QS University Rankings. Nevertheless, key informants and secondary data analysis suggest that there are only a few key sub-communities of faculty that had an affinity for applied practical research, a good understanding of commercialization processes, and were specialized or
recognized as some of the top academics (research centers) in the world. These faculty members were very rare. They tended to share similar behaviours such as collaborating with industry to fund labs and PhD students. These individuals actively sought projects with businesses. Others scientists were not opposed to collaborating with industry, but only if value could be demonstrated to the academic’s research program. Within the engineering department, one key informant suggested that between 15 and 20 researchers from a pool of 200 had exposure to innovation, or were currently working in areas that had market potential.

Yet, there were themes that emerged suggesting that even the areas of strength within the faculty were very fragile. The absence of even one researcher could result in a significant drop in research productivity. There was also a sense that researchers participating in innovative projects had very little business experience. As well, very few researchers were ready to commit to spinning out USO’s from their work. One of the key issues raised was the impossibility of achieving objectives that were based in the realm of the third mandate with the limited amount of time and resources provided. Due to this, some faculty members interviewed were unsupportive. They did not want to become involved in commercialization and resisted efforts to push them in that direction. Others had not considered it, but understood its significance. Key informants from all three groups indicated that the latter two groups represented the majority of faculty researchers. Nevertheless, a growing core of younger faculty and students existed that suggested a slowly expanding capacity and culture for producing innovation through entrepreneurship.

**Students**

Two main issues were often found to be in operation when the topic of students was raised. Some informants believed that students were a resource for firms. That, together with the fact that the region had trouble providing jobs for highly trained students, meant that students were viewed as being in
the labour pool category. In spite of that, regional industry often stated that the main reason for collaborating with universities was to cultivate student relationships that would help with recruitment of new employees. Other informants saw students as raw resources or as an entrepreneurial pool that could be used to help evaluate and exploit current opportunities within the community, as well as within external firms not related to the community directly:

To have some of the professors, the Ph.D. students, take part in this process and do projects, do research that were also within the research of this new company – the spinoff. (faculty member)

What was universally agreed upon by most informants who discussed the role of students was that students were a resource that was more often than not very underutilized with respect to systems for commercialization of knowledge.

7.2.4 Baseline non-human resources
Of the data analysed, this category was perhaps the most commented upon, but yielded the fewest coded variables. There were three key issues expressed from all categories of informants: the nature and levels of research funding/limited resources, time allowed (necessary) for commercialization and tangible capital assets.

Research Funding
There were two main issues identified: a lack of funding/time in the form of dedicated resources for both commercialization and for research and, who should get the funding that was available. The majority of research funding for USD is still based on knowledge productivity: the number of papers published and their citation impact. The amount of research funding acquired from industry was stated by one informant (administration) as being near 3%. The demands of applied research often required researchers to approach specialized government bodies for research funding, or collaborate with industry to fund labs and PhD students. But applying for grants and working
with industry requires a great deal of time. As stated by the informant below, is not often an efficient way to acquire new sources of funding:

*we are forced to look into innovation and entrepreneurship and commercialization from a project point of view. We do not have any free money to run the business and that means that we are using too much time on thinking on projects instead of looking on it more as the whole (faculty member)*

Furthermore, as departments are run like small organizations with their own budgets, funding of projects is very difficult, especially cross disciplinary projects, unless external funding could be found. Observations and data from key informants pointed to the emphasis on smaller teams, communities, and departments as the key drivers for seeking funding outside of line budgets. Line budgets were disseminated based on teaching and research based mandates that more often than not disregarded good projects in favour of egalitarian policies, internal politics and funding priorities that placed commercialization behind that of teaching and basic research priorities.

**Commercialization – resource limitations**

Due to the mandates of teaching and research being heavily weighted compared to that of commercialization activities of any kind, respondents suggested that there would always be a constant battle to fund commercialization activities. *Limited direct funding* for programs, infrastructure, grants, and seed capital to move early stage inventions through the commercialization process were difficult to acquire. This was also one of the major problems raised when discussing *capacity building* processes such as entrepreneurship education and bridging activities between industry and academia. Although there were budgets in the social sciences to develop and teach entrepreneurship education courses, there was little incentive within natural science departments to develop the programs themselves (where they were potentially most needed).

**Tangible capital assets – infrastructure: labs and research parks**
USD has a considerable amount of assets in buildings, infrastructures, and labs spread across six campuses. While these are basic and necessary components for innovation, they were hardly mentioned by any of the informants as being important. Several researchers pointed to key sub-communities that worked upon specialized equipment and had access to expensive lab facilities, clean rooms, and materials. But there were very few scientific equipment assets reported as “essential” to innovation activities. As well, there was no real incubator infrastructure to be found anywhere, other than limited office space within a small research park. Although there were IDEA growth houses in two of the campus cities, there were no formally run new venture incubators run explicitly by USD.

7.2.5 Worldviews and social networks
This domain contains several different coded factors that are related to personal and community based attitudes, worldviews, and opinions on how to make the university a more hospitable environment for entrepreneurial activities. There is also a category specifically associated with the type of networks that exist, their usage, and potential deficiencies. Axial coding produced six different categories that reflect a wide range of viewpoints, perspectives, and attitudes gleaned from each type of key informant. They are as follows:

Mixed community views on success
Viewpoints on what constituted “success” for an entrepreneurial university were highly varied and dependent upon who was asked and what role the individual played within the community. Administrators mentioned the selling of patents or referred to it in financial terms. Researchers stated the birth of new ideas, or building value for businesses where social networks were crucial for success. Individuals involved in commercialization or entrepreneurial consulting roles felt that commercialization only made money by chance and that there should be a greater emphasis on contributing to society. Industry experts viewed success as institutional change that resulted in a culture of greater risk taking, while department heads were more
concerned with success stories of any kind that emerged from their own sub-communities. Spin offs or new firm creation were rarely mentioned.

**Network types and usage**

Codings in this area are used to determine the types of networks that are important to the entrepreneurial process, how they develop within the university context, their usage, and how they are valued. Two major subcategories emerged: the importance of *academic social networks* (to get things done within an institutional setting), and the importance of *entrepreneurial social networks* (to evaluate and exploit the value of research). A key informant who worked in the technology transfer area stated that networks were important to innovation, but very difficult to establish, especially for faculty members who do not have business experience. Several top administrators indicated that the usage of more formalized institutional networks for discussing new technologies and understanding industry demand was the norm. Board members and their personal social networks were offered as one means for establishing formal social networks that may be helpful in facilitating innovation. Building formal networks as a substitute for informal networks was viewed as positive and helpful, but not effective in terms of getting quality information or resources.

Entrepreneurs generally confirmed the importance of informal social networks with businesses and industry groups:

* I think it’s important for innovators and also business entrepreneurs to be part of networks with good experienced business people and other entrepreneurs so that they can learn from them, otherwise it’s a very long way to have a new company and to have weekly deadlines (entrepreneur).

The diversity of a social network was also seen as an important asset when commercializing research, especially for communicating vision, helping to evaluate market potential, and developing further trust and legitimacy with industry. Observation and key informant data revealed that very few informal entrepreneurial networks existed and therefore the ability to gain necessary
resources outside of formal networks was also limited. Some contrary viewpoints from entrepreneurs suggested that social networks may be important to some entrepreneurs and in some processes, but not all.

It was also pointed out that there is a lack of internal networking within university departments and a dearth of cross-disciplinary networks for establishing projects with industry, especially between social science and natural science disciplines. The lack of cross-disciplinary and industry-based networks is also cited as a disadvantage to students because they typically do not have the resources or contacts to establish the types of networks required to start businesses. Rather, they must depend on formal institutional networks, or informal networks controlled by others within the community.

**Perspectives on/by students**

Students were viewed as a potential resource for facilitating entrepreneurial behaviour at the university. Students are viewed as having lower opportunity costs for starting businesses, are less adverse to risk, and are viewed as significant catalysts for change. Several faculty members discussed the global attitudes that many students possess. Due to opportunities as a result of living within the EU, they were better positioned to exploit international markets and benefited greatly from satisfying their curiosity for travelling abroad. These appear to be potentially positive traits that are associated with entrepreneurial behaviour, but several informants also noted that, especially at USD, students were much more academically focused than students at other universities in Denmark.

**Perspectives on/by sub-communities**

A pervasive theme found throughout the interview data was the emphasis on communities within communities and the significance of *sub-communities as key drivers* of the entrepreneurial process. Coding produced several insights on the worldviews of sub-communities, the diversity of these worldviews, and how sub-communities contribute to the understanding of the contextual make up of the university with respect to entrepreneurial behaviour. Attitudes and perceptions were predominantly driven by smaller communities such as
research teams and small units or groups. As an example, faculty members were found to relate better to their department than the university as a whole, especially when they were asked for their perspectives on issues:

_Do you want me to see it from the university or institute because it's difficult for me to relate to all of the university, I can relate to my own institute (university employee)._ 

It was actually quite evident after several interviews that one group had little tradition in commercialization. In other groups it was easier to identify well known key entrepreneurial faculty who had much more positive perspectives on entrepreneurship, although this was still rare. At times, even at the departmental level, there were substantial differences in the aims and goals found among sub-communities as each offshoot within a disciplinary field developed. As an example of the differences in worldviews even within “disciplinary” groups, one faculty member provided some interesting insights into the engineering community:

_In the field of engineering we have quite a problem these days, in the sense that we have a huge group of old engineers... who do not accept that engineers of the modern times are people who are more broad in the education... they now are interfacing in education more courses on business, business finance, on innovation, on HR skills and things like this and not this very deep specialist knowledge which we were taught on mathematics, physics, mechanics, and all these kind of specialty type of fields. So I think to make people accepting this, to somehow convince youngsters that they should select these more modern engineering educations we need to add some acceptance, and I think the community of engineers will have to accept that young engineers are quite different than the education but still they are a member of the engineering family, at least in this country there's an ongoing question about this (university employee)._
Examples of specific sub communities were numerous. In many cases of non-entrepreneurial sub communities, informants could usually render a conceptual understanding of an entrepreneurial system, but could not state any actual processes or practices that applied to the RCS of the specific university to which they belonged. One of the natural science researchers had difficulty answering questions on innovation and offered up the idea that researchers in his area might not be the right type to answer these questions because they thought in a linear way.

Contextual social norms
Findings suggest that USD is in the midst of building a new culture for applied research, entrepreneurship, and innovation. Key informants have raised several issues. The first is that there is a submersed culture (the elephant) that is extremely difficult to change. Therefore the elements of change encompassed in commercialization activities are highly fragile and heavily influenced by issues related to organizational culture, such as how things are funded and how rules are followed. The rigidities found in USD’s organizational culture often “bottlenecked” good ideas and at times, stalled efforts at collaborating with industry. These issues extended from the way people perceived their roles and the differences between these roles and the roles of individuals working in industry. Thus in many ways, the problems encountered with enacting change were human resource based: the people being hired at USD were hired into roles that were anchored by very different worldviews with regard to things like milestones, product development, profit, and the importance of time in business relations.

In terms of building a culture of entrepreneurship, USD has only recently begun (the last 5-10 years) to officially embrace these activities and attach greater significance to the importance of applied science. Once again, key informants indicated that human resource issues—specifically faculty turnover—was the key to success in moving to an entrepreneurial paradigm. Many of the older faculty members were simply not interested in entrepreneurship or applied research. In fact, the institutional norms that were
perpetuated by an older, less open minded faculty exemplified risk adversity in both behaviour and budgeting. One university employee stated that even though there are entrepreneurs at USD doing entrepreneurial things, such as creating centers, working with industry, and connecting to industry resources, the system tended to “capture” these entrepreneurs by influencing the types of opportunities that were exploited and determining how external resources were used once they were obtained.

Much of the above is driven by the mandates currently in operation at USD. The baseline worldview shared by most administrators, faculty, and students is that USD is first and foremost, a producer and disseminator of knowledge. There is still an overwhelming focus on basic science and student education as USD’s core mandate:

*The students I’m educating here are going to be employed at some kind of company so what is worse to tell them that there’s an alternative career opportunity, now they’re going to be hired in some way anyway when they’re finished, so they don’t think in the alternative way as entrepreneur for their students (university employee).*

These views are in line with Denmark’s educational systems in general. These systems had a bias towards career education training, public service, and developing future scholars. Thus the time spent on activities by university staff was governed by these mandates, limiting many of the opportunities that were available to USD.

**University Logics vs Commercial Logics**

There were multiple logics at work within USD. A common theme that emerged from respondents across all three general classifications was that there was considerable conflict, and tension that existed between commercial and academic logics. These worldviews were expressed across a wide range
of topics that included philosophical debates about the ethics of selling university knowledge, the differences between university and industry based research, the highly divergent objectives of academics and business people, and the difficulties that researchers had talking with industry. Specific to technology transfer, several key informants stated that these multiple logics were often framed by unrealistic views of the input-output process of commercialization. Academics firmly believed that the inventive side of innovation was worth a great deal more than the entrepreneurial side (that actually took inventions to market). These competing worldviews led to conflict between firms and the university on the valuation of research. Technology managers felt that a culture existed that was not opportunity friendly, while academic entrepreneurs who commercialized their work felt that the VC process was akin to losing their freedom. Firms were perceived as having little trust of science and were too intent on the money side of deals. Entrepreneurs also believed that firms with dedicated R&D departments were the best place for innovating compared with universities.

In general, respondents perceived the university as being good at invention and bad at application. There was also a sense of an overall ambiguity that faculty and administration had with the creation of new products and markets (even by those who were involved with the commercialization process)\textsuperscript{28}. Drivers of tensions appeared to be centered on new mandates for entrepreneurship and commercialization driven research, the lack of resources, and the time available to contribute to these new mandates (while keeping expectations constant or growing). A general resistance to institutional change was detected, especially when change centered on reshaping the fundamental purpose of the university to become more aligned with commercial logics.

Key informants that shared their views on how to better enact positive change for facilitating entrepreneurship and innovation stated that while there

\textsuperscript{28} This did not extend to the management of Science Ventures, the organizational unit responsible for selling and managing patented IP.
was a lack of synergy, there was still an openness and general understanding of commercialization across the community. A theme of bridging between the multiple logics at play was dominated by statements such as the requirement for catalysts, incentives for faculty, and a need for developing a shared vision between industry and university.

### 7.2.6 Governance and institutions

**Highly political community**

Political influence upon the way the university community as a whole is regulated and supported was characterized by three key themes: the negative aspects of politics on policies that are significant to the commercialization of research, too many government agencies involved in the funding and support of innovation, and a high level of top down policy control from the Ministries. Politics was prevalent in many discussions and revolved around the pressure placed on the university to provide a return on investment for the research funding provided. Many key informants believed that government claims of support for a third mandate was disingenuous or even misguided due to the rigidities in programs supporting innovation, lack of understanding of the processes involved, and (apparently) only lip service being paid without greater increases in public funding. There was also the problem of overlapping governmental jurisdictions that acted as barriers to policy development and regulation. Overemphasis on certain media-friendly commercialization measurements also politicized policy developments and dictated resource flows.

**Selectivity for spinoff companies**

The most notable issues reflective of USD’s selectivity mechanisms were the manner in which the community pursued and protected IP disclosures. The disclosure policies and activities were characterized as highly unstructured with line management not very proactive. The selectivity process was thus decoupled from how knowledge might be commercialized later on down the pathway: TTO personnel were only focused on whether to protect or not protect intellectual property. Therefore disclosures were pushed by the
individual research units with varying levels of intensity and with little understanding of the commercial value of an invention. The number of disclosures was also moderated by the level of industry collaboration and the quality/type of research being pursued. Researchers also had very little guidance with respect to who applied for industry or government grants. It was found that very little entrepreneurial evaluation is conducted in the early disclosure process. Any sort of market or product evaluations were made at a much later stage by a specialized unit (Science Ventures) that collaborated with industry. Although staged and linear, commercialization pathways were varied and led to many different outcomes. One researcher characterizes these staged processes as highly unstructured and generally hidden/not recognized by the general community:

the advantage of the processes here at the University of Southern Denmark is perhaps the total absence of any strategy around commercialization – it’s just not there. (researcher/entrepreneur).

The exploitation process was viewed as highly controlled by the university. Money received through formal university processes was often attached to the slower pace and bureaucratic rigors of a university. As the process was quite unstructured and featured characteristics of “muddling through,” it was characterized by more than one individual in a negative light, as illustrated by the following quote:

It’s a one chance shot, and it also gives the system a very high power – because they can say ok, you need to do this. One of the worst things, again, that one door had very strict requirements of administration and control and of course it is money given by the state, but it was a bit of a hindrance to our start (researcher/entrepreneur).

Also of interest, one key informant made reference to the fact that more experienced academic entrepreneurs preferred less structured and selective environments:

At least in the first many years it was entirely absent – which means that you can, if there are no guidelines and no particular rules, no
precedents for how to approach things, then you are very free to make up your own rules as you go along. That’s very flexible and convenient. It causes some uncertainty as to how to handle things, who to talk to, how to regulate IP, how to license stuff and all that, but that is easy to take care of once you get moving. So flexibility, definitely (researcher/entrepreneur).

The unstructured process for commercializing IP was therefore characterized as having a low selectivity alignment for USO generation; it was favoured by those researchers who had more skills and drive because they retained more control. Since technology transfer staff had no real idea as to whether a technology should be spun out, licensed, or taken down another pathway, an ambitious researcher could then play a much larger role in determining the processes and pathways taken. From a top administration perspective, there was no mandate for selecting one pathway over another.

Institutional support for commercialization activities

There are several important contextual issues in this sub-category. The first is poorly aligned incentives for entrepreneurship and innovation. Respondents across all categories found the incentive system at USD to be inadequate. There were also several mentions of the overly legal, rigid, and sometimes slow process of disclosure to IP protection. This resulted from limited resources and the internal bureaucratization of these processes. Although innovation speed was necessary for successful commercialization, it was not a key consideration within the technology transfer office (G. Markman, Gianiodis, Phan, & Balkin, 2005). One top administrator noted that greater flexibility at the sub community level was needed to move innovation forward, and that all departments should have dedicated staff to aid in the process.

Another problem was that researchers who were career oriented did not obtain any benefits from acting entrepreneurially (but there were potential negatives). This represented a misalignment between current incentives and
the incentives required to support faculty and staff to be more entrepreneurially minded. Not having dedicated staff responsible for overseeing or providing a touchstone for commercialization processes within their communities was also seen as a disincentive, as faculty did not wish to interact outside of their department during the early disclosure process.

Yet another issue was the perceived lack of clear *measurements and objectives* for innovation. One researcher mentioned that “I don’t think it (innovation) should be defined differently for different entities.” Most informants felt that there were perhaps too many yardsticks. A second researcher/entrepreneur stated that there was both good and bad in having a clear cut set of objectives: you knew what counted but at the same time they could sometimes be limiting to what one could or wanted to do. There was also no formal reporting on resource expenditures for the third mandate (commercialization and outreach) activities. As it appeared that different groups perceived and reacted to incentives in clearly different ways, these findings suggested that objectives were too general and would be better aligned to specific sub community contexts were they could be easily translated, understood and acted upon.

Of those incentives that were viewed as positive, several *programs and services* were mentioned. Services provided by business consultants, programs delivered to scientists to educate them about the commercialization process, and others that allowed access to social networks through associated organizations (such as Robocluster) were all viewed favourably. Yet their weighting within the data was very limited compared to capacity building services such as *entrepreneurship education programs*. Three relevant issues were: (1) that entrepreneurship education programs were only indirectly linked to commercialization processes, (2) that they were focused more on students than on faculty, and (3) that there was a wide range of pedagogical challenges.

Support in the form of *research strategies* was illustrated through the formation of specialized chairs for innovation and cluster strategies that
included building platforms of specialized excellence in knowledge (both basic and applied). These strategies focused on job development and knowledge sharing through collaboration with industry. From both observation and key informant data, it was apparent that research strategies were more effective in some sub-communities than others due to the supportive nature of the faculty and staff of these communities. It was suggested by many informants across all three key groups that there was a greater need for applied research (that could piggyback on industrial contracts and imported innovations) in the social and hard sciences. But there was also some disagreement on the ratio of applied to basic research that was necessary for stronger commercialization activities. A focus on too much applied research was perceived to choke off basic research (viewed to be more relevant to radical innovation). There were also comments on the nature of support provided. As innovation at USD was driven by small sub communities, blanket policies could often create negative outcomes in one area and positive outcomes in another. This was due to the diversity of research community types, their strengths, and their objectives.

Questions on what improvements could be made elicited several responses on top administration attitudes. There was a general consensus across all groups that there was very little formal support for innovation at USD, but informal relationships and support were perceived to be much better. While there was some promotion by the university for moving toward an entrepreneurial paradigm, it was perceived by some as hollow without the commitment of resources and backed by concrete actions. Much of what could be possible with greater levels of formal and structured university management support was summed up by one entrepreneur:

*It will depend on the attitude of the university – how do they feel about the value of the IP that they want to put into the company; how do they agree on setting up the working conditions that will allow you to work part time for example at the university and part time in the company;*
how do they help you in finding other partners from outside the university; do they help you finding venture capital, things like that.

The university’s general attitude toward valuating IP was not viewed as positive by industry. Attempts to ensure the university received a healthy cut from the IP developed by their researchers were viewed as highly damaging to working successfully with firms and industry. One key informant added that the structural processes put in place and manned by individuals who are not market savvy often ended up producing a totally skewed expectation of the value of opportunity (derived from inventive processes). Nevertheless, the university maintained a good reputation with industry. It was suggested that further work in emphasizing visible success stories and setting examples through targeted funding of outstanding research groups would help to increase the prestige of the community as a whole.

The narrative of too few resources and rigid bureaucratic systems also dominated the views on the RCS support structures at USD. The combination of limited resources being administered by bureaucratic systems created problems with moving research to market:

*The bureaucracy, the way things take time. When we had the money and we were ready to start up, it took us nearly half a year to start up the company because of different papers having to be signed because of the research and not agreeing with Science Ventures and internal controversy things that had to be smoothed out, papers that had to be rewritten, the researcher was quite reluctant to committing to a close timeline benchmarks, the dates – it was a very frustrating period for myself because I finally got the money and we knew what we had to do but we couldn’t get underway because so many things had to be done first. (entrepreneur).*

One interesting finding was that current legislation prevented the university administration from supporting commercialization:

*That is one thing I’d really like to change, quite new legislation for this getting the innovations to much more freedom to enter this process and
This did not stop supportive elements of the administration from recognizing problems and attempting to do what they could within the restrictive institutional environment:

the university (is) trying to handle it, they're making changes in the organization and they're hiring people that have a focus on this and try to be supportive, so that's a good thing.

Other attempts to support entrepreneurship and innovation at USD were forwarded through the creation of a regional research cluster strategy. Indirect support of entrepreneurial activities was associated with the reputation of the university to some extent, but more specifically with the high prestige of specific sub-communities or research, such as Nanosyd (a nanotechnology lab partnership between the Mads Klausen Corporation, the Danish government and USD). These findings suggest that the overarching levels of support for commercialization at USD were not equally distributed. In fact, several sub communities that were perceived to be both inventive and entrepreneurial received specific support from firms or industry through partnerships and strategic research alliances. Internal sources of financial support were limited and mostly egalitarian. Private or external sources of support were targeted and developed around research partnerships. This finding provides valuable insight into the support mechanisms for commercialization proposed by Roberts and Malone by expanding the construct to include the evaluation of two different levels of support within a quadrant (see chapters eight and nine for a more detailed coverage of the implications of this finding).

**Institutional structures**

The development of *new or specialized institutional structures* at USD was an attempt to separate business units from administrative (bureaucratic)
units. The most prominent example is Science Ventures (the first of its kind in Denmark) a limited liability corporation (LLC) that USD created to exploit patented technologies. This new structure effectively moved the patent selling and technology management processes closer to the market and away from the public institutional functions of the university. The one drawback was that the disclosure, patenting, and contracting functions were also separated. Due to its newness, lack of resources, and capacity, Science Ventures did not perform optimally (only one individual ran the organization). Within the research environment, new institutional structures (such as industry backed institutes such as Nanosyd and the project office at the Biology institute) operated as catalysts for applied invention. It was also found that there was some variance in the coherence of the internal workings and objectives of these structures (in other words, the capacity, available resources and commitment of each sub community for facilitating entrepreneurial processes was dependent upon key sub community actors and leaders).

Organizational restructuring is closely related to the development of new organizational structures. It is different than new or specialized structures as it only takes the organizational structure that is already there and revises it. The objective of restructuring was observed to have more to do with optimization than with facilitating innovation. Over the past few years, government directed policies have resulted in the merging of several schools into the fold of USD. The fallout from these mergers and the movement toward a greater emphasis on technology transfer outcomes has resulted in further disciplinary and research group restructuring across campuses.

7.2.7 Boundary spanning roles and mandates
Boundary spanning was a prevalent theme. While it was repeatedly emphasized as an important activity, there were as many examples of barriers as there were activities that were effective with respect to a specific objective or a set of objectives related to entrepreneurship at university. The research
findings regarding boundary spanning activities are organized around a
discussion of the following issues: (1) barriers to boundary spanning, (2) the
importance of multiple stakeholder groups, (3) entrepreneurship as a
boundary spanning tool, and (4) difficulties in aligning different mandates.

**Multiple barriers to boundary spanning**

Perhaps the key barrier to boundary spanning is the view in industry that the
university is not capable of producing the quick results required by private-
sector firms. There is a long historical list of precedents that have slowly
evolved over time to become barriers that are very difficult to pull down.
Many of these barriers stem from the fact that the university community is an
educational system within a larger entrepreneurial system. To be successful
requires individuals who have a foot in both worlds (twin skills). This allows
them to integrate, understand, and exploit opportunities by harmonizing the
multiple logics at play. Other barriers are based on the differences in
knowledge that exist between university researchers and industry researchers,
even in very narrow technical fields.

Several respondents indicated the need for a dedicated industry liaison
person or a pro rector specifically responsible for putting together a strategy
and personally managing boundary spanning activities, especially internal
ones where gatekeepers were overly rigid in their dealings with other
organizations. One informant provided an example in particular of a
gatekeeper that created barriers to working with an important industry
organization that was in partnership with the university.

Several respondents mentioned the importance of establishing cross
disciplinary research teams, collaboration between departments at different
levels, and the need for greater emphasis on cross disciplinary involvement in
student education. Some of the difficulties of internal boundary spanning were
purely geographical, i.e., it was difficult to integrate internal activities
between departments and research groups that were spread across a large
region at six campuses. There were also barriers that existed with government
agencies, although this was less pronounced than the other three areas. The
one problem raised with some of the government sponsored boundary spanning activities was that innovation agents were not firmly grounded within USD. These agents often found it difficult to relate to firms exactly how they might tap into the resources controlled by the university. It was also pointed out that there were barriers created between technology transfer functions, specifically between discovery and exploitation processes. This decoupling of the discovery process from the exploitation process was viewed as detrimental to successful commercialization simply because research disclosures were not properly evaluated at an early stage.

*Multiple stakeholder groups*

While the university offered support for some processes, there were several different agencies and organizations within and around the community that supplied different resources, at different stages, dependent upon different objectives; the university itself was only a partial facilitator of entrepreneurial activities. Formal stakeholder groups were deemed highly important for maintaining linkages with industry by university employees involved in direct technology transfer activities. It was indicated that these boundary spanning processes were extremely time consuming. Several faculty informants stated that relationships with industry and small firms were extremely important as knowledge flows go both ways and that researchers learned from industry as much as industry learned from academics. As indicated above, new institutional structures were often specifically given a boundary spanning mandate, which was enacted through formal or informal means.

But were these boundary spanning activities effective? Unfortunately, several barriers to boundary spanning were observed. One external consultant stated:

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right now I see a closed box that's the university... if I had to do it myself today (entrepreneurship) I think, there's a lot of interactions with other kinds of systems that would be required to do what I wanted here... it would be better to get different kinds of organizations break
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down different kinds of walls for than trying to do it myself...(expert)

The perception of the university as a closed box was echoed by nearly all the entrepreneurs and external experts that were consulted. These perceptions serve to illustrate boundary spanning strategies and roles that existed were not as effective as they were believed to be by those who were in charge of administrating commercialization activities.

Entrepreneurship education

Another area with considerable overlap with the activity of boundary spanning is the use of entrepreneurship education as a boundary spanning tool. While the theme of entrepreneurship education is prevalent across the key informants in all three groups, several strong properties emerged that led to it being formulated as a key property of boundary spanning at USD. Several programs at USD, such as entrepreneurship camps, industry co-op programs, and project based collaboration with firms were detailed as important boundary spanning activities that brought innovation into the university, more so than moving innovation out. Community incubators such as IDEA houses also brought students and faculty together with industry. The key challenge at USD was expressed as the need to branch out and build capacity within programs that teach entrepreneurship, especially in the hard sciences faculty where it could better interact with inventive processes. One of the challenges in achieving better integrating these two functions was articulated by an informant who suggested that internal boundary spanning must also be accompanied by resources:

The first system got the money, the other system is taking care of the education, so if you want to try to start a new teaching area such as entrepreneurship within the engineering or the natural science faculty you have to talk to both those who are going to say yes this is a good course and you're going to talk to those who are going to pay for the
course and in some instances that turns out to be quite hard work to do, I guess. (University employee).

A second external expert clarified the perceived importance of entrepreneurship education programs by suggesting that these programs were directly germane to supporting and growing the entrepreneurial ecosystem of a community. Yet the data collected also showed a clear disconnect between the boundary spanning activities that originated within entrepreneurship centres and IDEA and the system for commercialization of knowledge itself. This again confirms the isolated nature of entrepreneurship education programs with respect to the function of RCS. Thus a lack of internal boundary spanning between entrepreneurship education activities and commercialization activities was identified as a perceived impediment to achieving greater success in generating innovative outcomes.

**Difficulty in aligning conflicting mandates**

One of the most pervasive themes that emerged from the study is that there was a great deal of difficulty aligning the traditional mandates of the university with those that may be categorized as commercially focused. Nearly all informants viewed the primary mandate of the university as teaching and research. But key informants that were directly involved with some kind of commercialization activity also felt that the commercialization of research provided a clear value to both researchers and society:

*I think it (commercialization) has to happen because else the researchers would not be able to see, and I think research which leads to commercialization should be valued as highly as basic or ground research which can be publicized in magazines. I would say publicizing knowledge and research in terms of projects which are put into the marketplace should be valued just as highly or maybe even higher because this is for the greater good of the human race.* (faculty member)

But commercial and academic mandates were viewed as being in
direct conflict by many informants within USD. It was obvious that tensions were created when time or resources were moved from one mandate to the other, especially when commercialization mandates were expected to be carried out without extra resources or without consideration of current responsibilities.

The theme of *new or specialized units* was broached by several university employees as a means for mitigating these tensions, sheltering these new mandates and allowing new roles and identities to grow:

> Well you need somehow to get innovation into the university, to step out of the university. In some respects I think the mythology of stepping out and creating some units outside that can be more radical or different than what (is) inside is one way of entry from inside. So creating units that are ... but closely linked to the university, but having a more commercial logic, a more project, or more (business mandate). It's kind of an identity, something they see as important and worth doing, (and) is a way of influencing the way the big thing, the 15,000 students and more the teachers and central (administration) how they see themselves (university employee).

These new structures were discussed by administrators and faculty researchers alike as an important means for aligning conflicting mandates, growing an entrepreneurial culture and changing the function of researchers from doing basic research to considering how research might be applied to real world problems. These constellations within USD, when identified were very new, and had yet to achieve the goals set out by administrators and had not yet developed a culture that was distinctly different from other research areas. Nonetheless, these specialized structures for applied research were viewed as a good first step forward by all those involved.
7.2.8 Intellectual property rights and capital management

The major issues identified by respondents in this general area were (1) funding availability, (2) intellectual property legislation, (3) and intellectual property protection strategies.

*Limited funding/investment resources available*

Interview data with key informants showed that there was an overall lack of investment capital within the community. It reflected the difficulties involved in obtaining the resources necessary for starting new ventures and exploiting university based innovation. Informants pointed to an over reliance on government investment targeted at university innovations, the dearth of early stage investment/funding, and the effects of different forms of capital. Several entrepreneurs and experts pinpointed the need for government to provide seed capital, take greater risks in funding unproven technologies, and develop a system where different types of funding could be better matched with innovation stages, processes, and objectives (research parks, incubators, etc). The perspective that government should provide greater amounts of early stage funding to incubate proof of concept research projects was a common theme, and it was noted that the early stage gaps were much larger in Denmark than in the U.S. It was of the opinion of those faculty researchers involved in commercialization that these funds should not be administered by organizations that required a return on investment: they should be supplied more as a public good for incentivizing positive externalities.

The university was also viewed as a player that might be able to provide greater levels of flexible and unattached funding for innovation. This showcased the disconnect between administrators trying to make a dollar and researchers trying to get funding to continue and take their research into applied stages where practical testing could be conducted. Researchers, entrepreneurs and administrators interviewed showed equal disdain for university equity deals: they were described as problematic. They were usually only available to early stage new ventures, small (chronically under-
resourced) and therefore not worth the effort and suffered serious dilution and devaluation over successive rounds of investment, making them extremely risky.

Informants mentioned the need for a bigger pool of financing that provided alternatives to VC firms. Many stated that VC firms were only interested in late stage involvement, introduced high pressure commitments, and often limited the control of exploitation processes in young firms (that could potentially derail the scientific process required to establish proof of concept by moving too quickly to proof of market). The dearth in funds targeted for university innovation was viewed as a result of too much investment in non-innovative types of businesses by national and international VC firms. One respondent commented on the VC process:

it is formalized, to a certain degree, because it not only takes these companies like the investors, they can only give to a certain degree the money. It’s where the business is kind of sitting, these companies – they know about business, of course, and they know also within five years that in Stage Two they can give 40% of six million Kroner to these companies if the 60% are coming from other sources. So that is formalized. The problem is just that I think the numbers that are set, and the way they are checking the success of venture capital investment are not good (entrepreneur).

This quote demonstrates that the objectives of university researchers, as well as innovation policy makers and VC firms, are not aligned in a way that best facilitates innovation from entrepreneurial ventures.

Legislation dealing with IP control and investment

This category was divided into two sub-categories: effective and potentially harmful national laws that were associated with IP rights and innovation. Several positive factors were mentioned: 1) the creation of government innovation centers that help with IP evaluation, 2) the evolving IP legislation regime (first passed in 2001) that assigns the IP rights of inventions developed
by employees to the university, and 3) the closing of loopholes in IP laws that
did not cover inventions or intellectual property developed by students
(basically, this was fixed through the option of contracting a student as a
university employee and effectively gave students the right to have inventions
protected and paid for by the university).

Other informants perceived negative factors. Some believed that the
patent system was ineffective and often led to the blocking of innovation by
predatory companies. This constrained innovation, especially in smaller start
up companies. As well, current Danish laws restrict the financial flexibility of
universities: they may invest no more than 3% of their funding (typically used
for research) into USO creation.

**Intellectual property protection strategies**

There were two emerging issues regarding IP strategy and management at
USD: an overemphasis on natural science IP and its protection, and the over
valuation of university developed IP. Interviews, secondary data, and
observations clearly showed that there was an emphasis on natural science
innovations that funnelled the majority of entrepreneurial processes through a
patented technology route:

*It's just my feeling that humanities science and social science and the
subjects we're dealing with here, are not very good at producing great
ideas or potential good ideas, there's much more potential in engineers
and natural science (university employee).*

If IP was not easily protected, it was often devalued. For example, the
university had difficulty protecting and exploiting tacit knowledge, regardless
of discipline. This often resulted in handing these types of IP back to the
inventor:

*(if the idea is) strictly connected to professor X's head so if he isn't a
part of the company there's no value for us... of course he use his own
money or go to his bank to fund the business idea (top administration)*

Because USD ignored tacit IP, it was left “stranded” and had to be
developed by the faculty/student without much community support. This also applied to codifiable knowledge as well, especially research that was at such an early stage that no one knew how it could be turned into a valuable product. An example of how this type of university IP could be stranded was offered by an expert:

because there is a technology transfer office at the university that thinks this prototype product can take a patent and they don’t think the university wants to take it so they want a company to take it. But the company doesn’t want to pay for it until they can see that they can sell it for a hundred million dollars. They can’t see that yet, so many ideas are stranded here.

Respondents also felt that USD did not have competence in selling the research they supported through their technology transfer strategy. This weakness resulted in a tendency to overvalue university derived IP and focus too much on legal or contractual issues. This hampered deal making with industry.

There was also a reluctance to support proof of concept stages within the university system. One respondent pointed out that these problems could be overcome by the university adopting a perspective that emphasized sharing as well as selling knowledge, to build better relationships, forge partnerships, and work collaboratively with industry to best bring potential innovations to market. A second respondent felt that more efforts should be directed at bringing innovations past the proof of concept stage and focus on the gap between this and proof of market where companies could better assess value. This seemed to be an impasse that was typical of most universities and confounded many of the informants (Barr, Baker, Markham, & Kingon, 2009). One technology transfer manager admitted that the reality was that no matter what was done, that there would always be gaps that could not be filled. The realities were that the resources necessary for properly assessing and guiding knowledge and technologies to market were limited, and the disclosures near endless. This
appeared to be a serious problem that was germane to the selectivity of intellectual property: a deluge of disclosures of varying quality and nebulous value bogged down the efforts of administrators to determine 1) which disclosures had value, 2) the types of disclosures that might be best suited for spinning out into a new venture and 3) whether or not some disclosures should be released back to the inventor to pursue on his/her own. The analogy used was by one key informant was that “lots goes in, but very little comes out”.

7.2.9 Entrepreneurial processes contextualized

The categorical areas above offer a structured assessment of the contextual realities and factors relevant to the function of RCS at the University of Southern Denmark Overall, a description of the contextualized entrepreneurial process at USD can be summarized as:

- Best characterized as a formal, staged and highly generalized knowledge management processes that are not highly selective with respect to the exploitation pathway
- Patent driven and focused upon codified hard science discoveries that are only valued as a commodity if IP can be protected
- Discovery and protection processes de-coupled from evaluation and exploitation processes
- Impacted upon by a limited understanding of innovation speed and the complexity of the commercialization process from start to finish
- Influenced significantly by limited resources for incentivising behaviour, the ambiguity of roles, a lack of time for research faculty to effectively contribute (considering already limited time due to the need for meeting responsibilities of teaching and administration)
- Heavily dependent upon outside resources and expertise that are more often than not disconnected from the community by a lack of formal and informal networks
- Driven by a few high quality specialized research teams or units that are well resourced (often from external organizations) with research infrastructure but dependent upon one or two key individuals
- Impacted on by conflicting (and sometimes multiple) community logics that did not view commercialization in a positive way
- Plagued by a lack of expertise in moving technologies through proof of concept stages
- A lack of flexible pools of concept development funding, little to no early stage seed capital and a limited amount of government and VC investment sources through mid to later stages

7.2.10 Synthesis of USD’s specific context and its influence on process
This section provides an illustrated rendering and synthesis of the key qualitative issues and factors that emerged as significant to understanding the relationship between the specific community context of USD and entrepreneurial processes relevant to its RCS (see Figure 7.2). The data collected from primary and secondary sources and analysed using qualitative strategies discussed in chapter six were much too voluminous to be represented completely; distillation, generalization, and clarification was required to simply and clearly present the factors and issues that were found to be integral to describing the flow and the interrelationships of the key concepts within the model.
Figure 7.2 SS-1 USD: Early stage hard science commercialization model

*Note VOD = “valley of death”. It is an analogy used to describe the lengthy process few technologies survive.

In the figure, there are several shapes, lines, and coloured objects that denote certain categories of elements important to interpreting the model:

- Circles denote inputs (resources) and outputs (events or outcomes).
- Circles that are dashed represent a lack of certain inputs or outputs.
- The greater the thickness of the border of a filled (coloured) object, the greater the weighting of its importance; a dashed border suggests a lack or absence of an element.
- Solid blue rectangles indicate structures, groups, organizations, or stakeholders.
- Grey rectangles or circles indicate clear ownership or rights.
- Clear boxes that have dashed borders are contextualized issues, variables or elements that are specific to the case; they are placed as closely as possible to the factors that they are most associated with.
• Arrows denote directional influence or transfer; in the absence of arrows, it is assumed that the model flows from left to right.
• Arrows that are dashed represent a less significant association, linkage, or transfer.
• Large circles with black borders and no fill represent specifically identified community borders (these categories are applicable to the models illustrated for each of the cases in this chapter).

The model illustrates how context influences the entrepreneurial process at USD. The illustration represents an early stage hard science commercialization model due to the early and evolving nature of the RCS represented.

7.3 Case Study B: Roskilde University

7.3.1 Case Abstract
Founded after the Danish student uprisings of the late 1960’s, Roskilde University (RUC) was intended as an experimental institution that offered an unorthodox (at the time) program of higher education to students that were dissatisfied with the more traditional, lecture based, faculty governed universities. The educational concepts introduced included basic study programs, a move to interdisciplinary teaching and research units, and an emphasis on group project work that focused on problem solving skills.

Under the supervision of instructors, students were required to practically apply their knowledge to the external world through actively working with individuals, organizations, firms, and governments to complete their projects and gain their degrees. This format replaced the traditional exam based system. The institutional concepts were characterized by the rejection of faculty control of the university and the introduction of a democratically elected board of governance. This governance model allowed the students (and the community) much greater control in the decision making
processes of the university until 2003, when universal laws were enacted that created a top down structure of control.

Roskilde is one of the smallest universities in Denmark. Located only 40 miles from Copenhagen, RUC was a means for relieving the pressure of the larger city universities. This proximity to the capital is both a strength and a weakness for RUC. Many students in the city find the university desirable due to the short commute from the city by train. This helped to raise the attendance of the school from 723 when first founded to approximately 8,000 in 2007. The university also has access to many of the networking and resource benefits of Copenhagen. Conversely, the university has faced several challenges when engaging its local community directly. The university is widely viewed to be isolated from the local community, especially in the area of economic development.

Roskilde is a unique case study in that it reflects the duality of a highly innovative educational system that is abundant with entrepreneurial activities that are more aligned with solving social issues and a very rigid left leaning academic culture that views commercialization as a highly contentious issue. Its size and focus on education as a primary mandate also contributes to its lack of resources. The strongest area of Roskilde’s research lies in the social sciences and humanities. Characterized by strong cross disciplinary research institutes and highly flexible and informal organizational structures, the university is able to provide experiential project-based degrees. The combination of Roskilde’s unique culture, organizational structure, and research focus has culminated in the development of strengths in the area of social innovation. Emphasis on social innovation has also contributed to partnerships with government organizations.

The strengths in social science are balanced by the relative weakness in the natural sciences. Roskilde lacks an engineering school, a medical school, and other schools associated with the hard science disciplines. With very little in the way of lab and scientific infrastructure, the natural science faculty is small and dependent upon informal relationships with industry for
additional research funding. Government mandates that are pushing innovation at universities are redirected into social innovation projects, as there is very little competence, experience, resources, or infrastructure to deal with IP protection, patenting, and licensing. Attempts at introducing and enforcing IP policy have been met with apathy or disdain by the small circle of researchers that have developed informal industry contacts and received external funding support. Previous technological inventions in biology and chemistry (an independently funded research unit that came to RUC under the previous Rector, and that is mainly left alone by administration) have leaked out to firms that have patented IP, while current research partnerships have been clouded by the university’s formal introduction of new policies. These policies have led to the issuance of several patents with no further activities pursued (see table 7.1).

Although RUC has built a science park or CAT (Center for Advanced Technology), it had not been used as an incubator or as a facilitation node for community outreach until 2009. Under a new strategy for meeting the government’s mandate for promoting innovation, a specialized unit called RUC Innovation has been established through a joint partnership with two levels of government and other community partnerships. Its mandate is to link researchers and students and public/private organizations and companies. It acts as a support center and catalyzing agent for consulting work, student training programs (that may lead to the start up of new ventures), and as a bridge to national and international practice-based research communities and granting agencies (namely, the EU). Therefore, the unit builds upon the distinct educational and research communities that already exist that are well aligned with the social mandate and focus of the university.

7.3.2 Synthesis of RUC’s specific context and its influence on process
The model in Figure 7.3 illustrates how context influences the entrepreneurial process at RUC. The community is defined as a practice-based outreach model due to its emphasis on the delivery of applied social sciences and humanities-based knowledge through educational and consulting type
programs rather than the protection of natural sciences IP. The distinct lack of a commercialization agenda, characterized by low levels of hard science research production, few resources for the discovery, protection and exploitation of IP, and the complete lack of competence and expertise in the area of technology transfer classifies this model as belonging to the human capital development perspective of entrepreneurship at university. RUC views the student as the key entrepreneurial resource, not knowledge in the form of intellectual property. The key used above for figure 7.2 may be used to interpret the meaning of various shapes, arrows and shadings in figure 7.3.

Figure 7.3 SS-2 Roskilde Universitet: Practice based outreach model

While there is a great deal of formal and informal boundary spanning within the institution, there is a history of very little interaction with the external community (namely the city of Roskilde and the Zealand region). Although formal actions have been taken to address this lack of interaction
with the external community through RUC Innovation, these activities are currently at too early a stage to be critically evaluated.

7.4 Case Study C: Deakin University

7.4.1 Case Abstract

Founded in 1977, Deakin is a relatively young Australian university that can be best described as a multi-campus Tier 2 research university. Although there is a large campus in Melbourne, the mandate of the university was originally intended to include a regional focus on the Geelong area of Victoria to bolster and support much needed economic development efforts. The combination of a regional focus and its nascence within the research world provided early academic leaders the opportunity to strategically flesh out niche disciplinary areas where excellence could be strategically established around small flexible research teams that were well aligned with regional manufacturing needs. These elements were the foundation of a research culture that is highly collaborative with regional, national and international industry.

There are two key events that are critical to explaining the contextual evolution of Deakin university over the past thirty years. First, the hiring of a superstar engineering academic from the U.K. explains much of the current success of the university. The administration of the day gave the researcher considerable leeway to create a program around his research interests. Through personal leadership the researcher has championed an interdisciplinary and industry focused collaborative funding strategy. Deakin is now one of the fastest growing industry sponsored research universities in Australia. These events have culminated in the establishment of the Geelong Technology Precinct (GTP), a standalone facility that houses many of the collaborative, interdisciplinary research teams and centres. The GTP is equipped with the latest lab technology and infrastructure.

The development of a biomedical program at Deakin around an extremely enterprising faculty researcher was the second event. This
researcher singlehandedly convinced private angel investors to donate millions of dollars to his research program. This privately sponsored research allowed considerable flexibility (due to the need for less time spent on pursuing government research grants) and contributed to the development of the research capacity necessary for the discovery of highly valuable cancer inhibiting agents. Intellectual property developed within Deakin laboratories was eventually spun out into a multi-million dollar pharmaceutical company through backdoor means. This took place in the early 1990’s when little to no IP policies were in place or enforced at Deakin.

As with all Australian universities, there is an emphasis on recruiting international students as a means of obtaining revenues to support other activities such as research. While there is a considerable international marketing wing for international undergrad and executive programs at Deakin, the establishment of highly focused interdisciplinary research centers has allowed a bottom up approach for tapping into the quality of students recruited from overseas. This reflects a well aligned capacity development focus on the improvement of research quality at the institution, specifically in the natural science disciplines. This strategy is somewhat a reverse position taken from the tuition revenue models. It uses scholarships and the development of culturally supportive communities as a key attractor of the best and brightest Oceanic students. Thus an emphasis on boundary spanning globally is harmonized with regional boundary spanning to create quality research capacity and the means to fund it.

While this open relationship with the community has resulted in a prodigious amount of internationally recognized applied science programs in textiles, composite metals, and biotechnology, the culture within these research sub-communities has been somewhat insulated from the traditional institutional bureaucracy of Deakin’s administrative leaders (which has been described as overly rigid). This has lead to the development of a schizophrenic personality of the institution. Officially, it is advocating for increased academic mandates with the goal of becoming one of Australia’s
top eight research universities. Meanwhile, informal networks fuel an applied research agenda by engaging industry. The key implication from this disconnect is characterized by the formalized changes in addressing commercialization activities by the university administration through the creation of new policies and mandates under the Department of Research Services. Simply put, new formalized processes are creating friction, confusion, and resistance from the specialized units that have operated using informal means, resources, and networks. The top down approach that has been in operation at Deakin has therefore not been able to capitalize on the research outcomes generated, yet the success of Deakin and its applied research prestige with industry continues to grow. This makes a large amount of the value created through Deakin researchers difficult to measure or be translated into direct revenues for Deakin’s administration.

7.4.2 Synthesis of Deakin’s specific context and its influence on process

The model in Figure 7.4 illustrates how context influences the entrepreneurial process at Deakin. The community is defined as a regional collaborative research model due to its emphasis on the creation of industry partnerships to fund a growing applied natural science research program. The disconnect between the top administration and the applied research centers is partly reflected in (1) the rigid top down hierarchical approach of university administration that creates barriers to strategic planning, funding, and communication issues specific to which unit has the primary role of boundary spanning with the community, and (2) the difficulty in aligning the multiple logics, values, and mandates between top administration and the research units. Furthermore, the administrative unit responsible for overseeing research and commercialization processes suffers from being under-resourced, having multiple and conflicting roles and mandates. It also does not have the competencies to facilitate entrepreneurial activities that may produce USO’s. Even though there are great improvements, the trust and legitimacy required between the research centers and industry is still tenuous due to the unclear messaging and actions of top management.
This model illustrates that specific sub-communities within the university have successfully adapted the role of interfacing with the external community. It also shows that USO creation is not a direct outcome of the primary processes that may be considered important to innovation. New technology ventures may still emerge from indirect and informal entrepreneurial processes, but that only happens when industry sponsors it or star scientists are able to escape the gravity of environments where universities have not ensured that IP rights belong to the university.

7.5 Case Study D: Swinburne University of Technology

7.5.1 Case Abstract

Swinburne University of Technology (SUT) was founded in 1908 and has a long prestigious history as an engineering and trade school in Australia. Although it has several campuses elsewhere in smaller communities such as
Lilydale, Croyden and Wantima, the core of the university’s natural science research exists at Hawthorne, a suburb of Melbourne. Known for its engineering college, SUT and its administration have long favoured and protected the program as its crown jewel of research. The program has helped to generate funding through federal sponsored research granting agencies and four ARC and five CRC centers have been established. The emphasis on this specialization has helped to develop excellence in other areas, as the research quality of the school is consistent across the board in QS rankings maintaining a 300-350 score across the Arts & Humanities, Natural Sciences and Engineering and IT disciplines.

The importance of top administration support of initiatives is critical at Swinburne, as the bureaucracy of middle management has very little line influence over their areas. This rigidity has limited innovation, cross disciplinary expansion, and bottom up initiatives in most schools other than engineering. Conversely, top administration has been pivotal in recruiting star engineers to Swinburne by effectively giving them carte blanche to do whatever they wish, especially entrepreneurial scientists. This has indirectly resulted in the establishment of Mini-fab (a non-patented spin off company supported by Swinburne top administration), Swinburne Knowledge (a technology transfer department), and a Swinburne Ventures (a wholly owned venture firm).

The research park is located in a suburb of Melbourne and backed by private entrepreneurs and philanthropic gifts (low rent buildings from a boat manufacturing company). Mini-fab, has now attracted 8-10 more businesses to the park, many with linkages to the university, and has grown through investment of its revenues back into operations and is now an internationally recognized nano-manufacturing company, one of the few in the world. This success is partially attributed to top administration’s support of the star scientist, the supportive nature of its technology transfer unit (which seeks to build value over earning revenues from selling licences), and the drive and quality of research of the star scientist. It is therefore a situation of low
selectivity and high support, where all other ventures (and sub-communities working toward commercialization at Swinburne) receive low to medium support.

A key champion (also an engineer) is responsible for the development of the Australian Graduate School of Entrepreneurship (AGSE), one of the first entrepreneurship education programs in Australia. The key issues of this story revolve around the relationship between the champion and top administration, the drive of the champion, his ability to build a robust team of fellow champions/experts, and the strategy involving a global partnership with Babson College, the top ranked entrepreneurship university in North America. This culminated in a Masters of Entrepreneurship and Innovation (MEI) degree that was built through a well developed network of Australian entrepreneurs and Swinburne faculty members to deliver an experience based “pracademic” lead program to help entrepreneurs start their businesses. Unfortunately, difficulties arising from the hierarchical structure of Swinburne, the program leader’s inability to tap into cross disciplinary boundary spanning with natural sciences departments, and the usurping of the AGSE’s community boundary spanning (fundraising) roles by the top administration of the business school, ultimately lead to the demise of the school after a twenty year run.

7.5.2 Synthesis of Swinburne’s specific context and its influence on process

The model in Figure 7.5 highlights the effect of one sub-community (mini-fab) on the networking capacity of the university and provides an effective means for boundary spanning into a key community of technology specialization. This sub-community stands out as a prime example of informal networks and resource acquisition that is possible through the direct support of top administration for a star scientist in a medium quality research university. The university itself is not engaged with the local community in a notable or direct way, but does have specific formal networks with government and industry. Unlike the Deakin case, this model is not as open to
the regional community, nor is it focused on internal boundary spanning or capacity development. The result is mediocre non-scalable technology spinoffs across a wide range of disciplinary areas with the rare exception of Mini-fab.

Figure 7.5 SS-4 Swinburne University: Unstructured value creation model

7.6 Case Study E: Louisiana State University

7.6.1 Case Abstract
As a land, air, and sea grant institution, Louisiana State University (LSU) has a strong mandate for regional outreach and development programs. This regional footprint can be seen in many of the institutes and centers that are focused on the needs of Louisiana’s environment, industry, and people. Yet, LSU is moving through a transitional period where there are multiple pulls from the community around it and an academic backlash of internal resistance...
that comes with change. Currently dwelling at the bottom of its cohort rankings, LSU’s key mandate is to enhance its status in research excellence within the land grant state universities in the U.S. through its flagship agenda (a mission statement to improve its standings through world class research and local application of this research to Louisiana’s problems). It also seeks to become a world class leader in commercialization and new venture facilitation within its many communities, alongside the multiple non-for-profit outreach activities expected of it. Mired in funding shortages brought on by turbulent economic times in the state of Louisiana, the university has turned to greater reliance on national funding grants, philanthropic giving from the community, entrepreneurs, and large industry donors (through the LSU foundation) and a state funded agenda for building up the local economy.

LSU is a multi-campus institution and has difficulties with internal boundary spanning within its own system, in particular, the commercialization units and stakeholders. There has been little political appetite for breaking down a heavily siloed, turf protection system to create better, more efficient working relationships between units, colleges, and campuses. Key informants frequently commented on the need for a single window access point for industry and community.

One important issue has been with the way commercialization units within the university operate, particularly at LSU’s main campus. Key individuals in the top administration were replaced and a more prominent position for the VP of Research and Economic Development was mandated. University personnel in charge of patenting and licensing activities were seen as a key barrier to boundary spanning with industry and the facilitation of new ventures. They adopted a “patent and protect” attitude that strove to enhance the position of LSU in all bargaining with licensees. The relatively low outcomes from commercialization of research were overwhelmingly cited as being an issue with key technology transfer people. As the university has been very keen to build up the necessary infrastructure for producing, incubating, and exploiting IP through wet labs, professional incubators and research
parks, the statement, “we have all the pieces, it’s now just down to execution,” was a common lament from key informants. With new highly skilled and more flexible minded individuals now running the patent office, positive change is finally being realized, but the process of regaining trust and staking out a new legitimacy around the mandates issued by top administration is still slow to come in terms of support from the community.

One of the key findings in the LSU case is the central role of the entrepreneurship center (located within a highly ranked business school) and its champion-driven mandates of informal network building, capacity development, cross disciplinary participation with natural sciences departments, and the technology transfer office. Several specialized line units such as the Stevenson disaster relief research center, the Louisiana Business and Technology Center (LBTC), and the Stevenson Institute for Entrepreneurship have the structural ability, leadership, and (self-acquired) funds to facilitate entrepreneurial ventures, both university research related and not. These units are driving awareness of entrepreneurship, innovation and community value creation through a series of programs, activities, and functions, although uptake is slow within other schools and sub-communities due to the limited human and financial resources that are at work through these specialized structures. Other than the LBTC—which served as an incubator and research park—there was scarce tangible evidence of start up activities. Yet there was a sizeable collection of evidence that pointed to many pathways for value creation both within the university and external community that was heavily influenced and driven by activities that would by definition, be viewed as entrepreneurial.

7.6.2 Synthesis of LSU’s specific context and its influence on process
As illustrated in Figure 7.6, there is a distinct set of boundaries between the external community and the university community with several key nodal areas for interaction, the most positive emanating from the business school. Due to the complexity of the multiple commercialization units at work, the need for regaining trust and legitimacy with the community due to the patent
and protect strategy that was in operation until recent times. Change in both top administration, middle management, and technology transfer units is slow to provide positive inroads with the community and positive commercialization outcomes. Due to the well developed policies and processes around IP rights and the transitional state of mandates, cultures, and sub-communities operating within the system, high levels of disclosures are not being converted into entrepreneurial outcomes in the form of USO’s. The majority of tenants within the award winning incubator are non-university patent types with several emerging and potentially scalable biotechnology companies housed within the wet lab incubators.

Figure 7.6 SS-5 Protect and hard sell (transitional) model
7.7 Case Study F: Iowa State University

7.7.1 Case Abstract

Iowa State University (ISU) is a land grant institution located in the small city of Ames, Iowa. Of the second-tier universities studied in this thesis, it boasts both the highest rankings in research quality and the highest level of total gross revenues from commercialization (TGR) produced from its research programs, placing it in the upper third quadrant of all second-tier universities in the U.S. It is also the only institution within this set that has produced a highly visible and valuable patent from its research programs and has a deep history of research excellence and success, most notably through its linkages to the Manhattan project. It also places in the top five of patent producing universities in North America, generating nearly 100 patents per year from a wide range of disciplinary schools, departments, and centers. Nevertheless, USO outcomes relative to its cohort are very low, in part due to the past success of its patenting history and large revenue producing licenses.

The Iowa State University Research Foundation (ISURF) acts as the technology transfer unit for the institution but is run as a pure profit LLC wholly owned by the university. Due to the largesse received from their one big patent ISURF has been able to build up an endowment of several million dollars with a patenting budget of $1 million dollars and an operating budget of several million more. ISURF’s business model revolves around patenting as much as possible of the valuable IP that is derived from the research programs within the university and selling that IP for profit, mainly through licenses to established firms. ISURF will also involve the PappaJohn Entrepreneurship Center when there is a faculty member or a certain type of IP that is well suited for creating a USO, but this pathway is the rarer of the two.

Even though there are very few USO’s created from the ISU research program, 25% of the students that graduate from ISU have started a business, and these students have a large economic impact upon the region. Case
analysis also determined that over 7000 students have taken courses with entrepreneurship education components in them. An interesting entrepreneurial shadow culture emerges from the interviews and observations made. This culture is primarily driven by a large donation given by the PappaJohn (pizza) family to establish a center for entrepreneurship at ISU. Emanating from this center, a large self funded, campus wide, and departmentally delivered entrepreneurship education network is revealed.

The PappaJohn Center is located at the research park and geographically separated from the main campuses. But it has also become over extended and less capable of providing leadership and support over time. Therefore, initiatives at ISU are mainly spearheaded by middle management (assistant and associate deans) within each school and coordinated through faculty or entrepreneurial leaders. These leaders form a council for steering the facilitation of entrepreneurship education curriculum, programs, activities, and ultimately the facilitation of new ventures within the university community. While there is considerable buy in from top administration, there is little real financial support and each school or department is left to fund these programs on their own (sometimes with direct philanthropic donations).

The need to balance teaching, research, and outreach focused mandates with limited, time, funding and resources is challenging for faculty and deans. The structure of ISU contributes to the inability to effectively provide top down support for these bottom up initiatives due to the disconnect between two key departments: Vice President of Economic Development (VPED), and Vice President of Outreach Services (VP Outreach), thus leaving a void in strategy and funding leadership. There is also an inordinate amount of support for the more successful ISURF and the commercialization activities generated from its function, leaving the fragile network of entrepreneurial education and support structures as an afterthought.

The structure of ISU is specifically tailored to the establishment and operation of cross disciplinary research centers that deal directly with industry and that have formal and informal relationships with the local community and
industry. These specialized units often have a great deal of flexibility and budgetary freedom to pursue innovative routes of applied research and collaboration with industry. Yet outside of these units, the default attitude for most research faculty is aligned with academic pursuits that encompass more basic research, a greater affinity for federal research grants (better on resume) over industry grants, and a relative disinterest in entrepreneurial activities of any kind. Unlike the other five universities in this set, most ISU researchers’ attitudes toward commercialization activities are more apathetic than opposed. But there is considerable variance in worldviews among the many different schools and sub-communities of research that exist. There is also an awareness in the entrepreneurial faculty members that even though ISU may be perceived to be more entrepreneurial than other universities, it is a stretch to compare it to universities like MIT or Stanford where starting up businesses by faculty is a well engrained cultural characteristic.


**7.7.2 Synthesis of ISU’s specific context and its influence on process**

ISU demonstrates clear partnerships between industry, government, and the units within the university to collaborate with firms, provide outreach and economic development functions, and facilitate a variety of different types of entrepreneurial processes (see Figure 7.7). The dominant process for transferring technology to the marketplace is highlighted by ISURF and can be described as a profit center business model. Sub-processes include USO formation through the support of several units, funds, grants, and the PappaJohn center, as well as less formal, non-patent focused, non-scalable small businesses start-ups by students and alumni. Nevertheless, a low level of USO’s was generated. It was very difficult to identify new ventures that were not associated with the university through typical commercialization pathways.
7.8 Overview of second tier models

This chapter ends with a brief discussion of the six second tier case studies investigated. Each framework (SS-1,2,3,4,5 and 6) represents a rich illustrated map of how context impacts the entrepreneurial process in each case. This rich variance and complexity attributed to the entrepreneurial process is generally postulated by Gartner (1985) and specifically by O’Shea et al., (2005; 2007) with respect to entrepreneurship at universities in particular. It adds a further contribution to understanding the diversity in commercialization outcomes that are generated from the second tier context that may not be viewed as typical (Mustar et al., 2006). It also provides beginning insight into why some universities have limited or no capacity to achieve the objective of commercializing research through a typical USO process, emphasizing the potential importance of alternative pathways for facilitating entrepreneurial outcomes.
Chapter summary

In this chapter, I have provided data and findings from my case study analysis of the second tier set of universities. All six cases are represented diagrammatically using a model of how context influences entrepreneurial process at each university. One case study is presented in full narrative style as to show the rich and robust nature of the data and the approach employed for analysing/presenting it. Each framework represents a sub categorical model of the second tier set. Findings show that while each of the universities may belong to the second tier set, the variance in the models suggests that context plays a specific role in the entrepreneurial processes conceived. Thus, the second tier set would benefit from further analysis of cases and sub-classification so as to provide greater focus on the relationship between context and entrepreneurial process: the study of different ‘types’ within the second tier set is thus warranted as a future research stream.
Chapter Eight  Comparison of the Research Commercialisation Systems of First and Second-tier Universities

Chapter Abstract

This chapter is separated into three sections. In the first section, the specific models SS-1 to SS-6 presented in chapter seven are distilled into factors common across the sample to produce a general model of the Second-Tier sample (SG-2). The second section compares and contrasts the First-Tier (FG-1) and Second-Tier (SG-2) frameworks. This analysis provides insight into the contextual factors that may be significant to both groups, as well as those that are distinct to each group. Implications for the transfer of policies, best practices, and objectives between the models are discussed. In the last section, an enhanced conceptual framework (UG-3) is developed for understanding the factors that are significant for improving the innovation performance of the RCS of any university, whether first- or second-tier.

8.1 Synthesis of a General Model: SG-2

There was a high degree of contextual variance among the rich, contextualized process maps developed from the case studies in chapter seven. For example, Roskilde Universitet had no discernable TTO structure, Deakin University had a research services unit that consisted of subunits that took on typical functions attributed to a TTO while other subunits did not, and Louisiana State University had a dedicated TTO that had gone through a substantial transition in personnel and policy and was only one of several TTO-type units within the many geographically and disciplinary diverse campuses in the LSU system. Any meaningful interpretation of patterns behind these observations must therefore be highly generalized. As a result of the general factors produced from the synthesis of the six cases, the model
produced (Second-Tier general, or SG-2) is well aligned for comparison and contrast with the First-Tier model (FG-1).

The one main advantage of the precise methodology used in chapter seven is that other factors have also surfaced that portray a much tighter picture of the social interaction of communities attempting to engage in the process of entrepreneurship. The surfacing of these “community focused” contextual factors provides valuable insights for answering the research question(s) that are central to this thesis. They are also integral for developing a final enhanced framework that highlights the main context-process factors that are important to all universities, regardless of whether they are rich or poor.

8.1.1 Analytical techniques and aggregate model

The process for developing the SG-2 framework involved several highly recursive analytical procedures. These procedures required the use of techniques suggested by Lincoln and Guba (1985), such as adding new codes based on insights (filling in), interrogating old codes and interpreting them in new ways (extension), making sense of previously not understood relationships within units that may call for new configurations of categories (bridging), and the identification of new categories based on a more intimate relationship between the researcher and the data (surfacing). This was done to ensure that all the coded areas represented in the SG-2 framework were based upon patterns detected that were significant to the sample of second-tier universities that were analysed.

Several findings stand out. First, an amalgam of factors signify the lack of clear boundary spanning roles and mandates with a limited set of specialized external agents that are relevant to the operation of RCS. These systems appear to be less “open” to industry linkages, so there are several implications for resource gathering, knowledge sharing, and capacity building that arise from the observance of these combined factors. These implications will be discussed later on in section 8.2. Furthermore, what is available in
terms of local agents and firms is typically not adequate or well aligned with the function of RCS. Social networks often exhibited structural holes with respect to key (specialized) market agents. One of the most effective strategies for commercializing research found within the sample cases was to form partnerships with industry and entrepreneurial firms to fund research and provide resources for commercialization. This amalgam of factors suggests a need to better understand the types of structural relationships that exist between the university community, and the many different types of community-defined factors that are necessary for a successful entrepreneurial (commercialization) process across its many stages and pathways.

Second, key findings of the SG-2 framework suggest that these universities are indeed resource poor (human, physical, and financial). The lack of resources has directly impacted their ability to invest in the human, financial, and social capital that are necessary for creating effective RCS. Not only were the contexts of the second-tier cohort found to be resource poor, they were also poor with respect to the understanding, experience, and skill required to effectively engage in entrepreneurial activities related to commercialization. This culminated in the employment of ineffective incentives or policies with respect to support and selectivity mechanisms. Most university RCS suffered from having the wrong people in the wrong roles. Geographically, they were also limited by the capacity of local communities to support and facilitate entrepreneurial activities. In almost all cases, difficulty in boundary spanning between academics (including administrators) and industry had the effect of limiting performance. This breakdown stemmed from the institutional rigidities of academic communities that were still highly focused on mandates that were aligned with traditional aspects of teaching and research. Multiple logics within the community—many of which were contradictory to the pursuit of commercial activities—acted as highly significant social barriers to entrepreneurial activity.

Third, there are three outcomes that are highlighted in the SG-2 model: (1) innovative products & services through corporate means, (2)
backdoor USO’s (indirect spinoffs by students or faculty), and (3) non-high growth USO’s. These observed typical outcomes suggest that there may be more innovative types of activities being conducted than what typical measures may report. It also suggests that high growth USO and million dollar patents are not a realistic outcome.

Fourth, and perhaps most important, the emphasis on entrepreneurial sub-communities as the key drivers of innovation (and their relative fragility) has significant implications and therefore must be clearly explained. Entrepreneurial sub-communities may consist of groups such as research teams, line departments, and/or specialized units that share a common identity, space, or vision. More often than not, they house inventive processes derived from hard science research, but may also develop new knowledge through other means (applied social sciences, management sciences, etc). Entrepreneurial sub-communities possess influential leaders/champions (usually anchored by a star scientist) and exhibit strong ties with market agents through networks that exist across community boundaries.

Figure 8.1 Contextualized framework of second tier universities: SG-2
For example, the Mini-Fab research park is an entrepreneurial sub-community that consists of key actors from Swinburne’s top administration—the faculty, students, various entrepreneurs and teams, a wealthy philanthropist, networks of nanotechnology scientists, and specialized technology agents across the globe. While this is an extreme and highly complex example, it adds the necessary richness required for the description above to illustrate a clearer meaning. While the interaction of the community members is varied, and their motives sometimes diverse, they each contribute to the culture, sustainability, and primary objective of the community: the continued success and growth of the Mini-Fab research community.

A much more institutionally structured sub-community is the Nanosyd centre in the Mads Klausen Institute at the University of Southern Denmark. It may be described and consists of a key faculty researcher, a teams of secondary researchers, grad students, and an academic social network in the field of nanotechnology, several key industry partners and a small administrative staff. As well, the institute is funded by private industry. In each of the above two cases, the implied fragility of the construct is due to the key importance of two star scientists upon which these sub-communities are highly structured: Dr. Erol Harvey and Dr. Hans Gunter-Rubahm. The absence or exit of either of these key individuals will produce dramatic, if not cataclysmic effects upon the communities.

Each of the cases examined had at least one entrepreneurial sub-community that was driving innovation (regardless of research quality). These sub-communities were often fragile, under-resourced, and relied on twin skills to navigate between academia and industry using informal networks. In many cases, these communities were either insulated from the effects of multiple contradictory logics to commercialization or were able to harmonize or even
create new logics that resulted in more formal structures or units. In some cases they were supported externally by industry, government, or third party organizations. This led to a series of outcomes that were not typically measured as primary indicators of commercialization performance: collaboration with industry, consulting, back door new venture creation, and indirect opportunity exploitation from active or failed USO’s. In cases where there were greater levels of research quality and experience found within RCS, patents, licensing activity, and even spinout companies were observed, but not in great numbers and typically not as high growth firms.

One example of a prestigious back door USO was ChemGenex Pharmaceuticals Limited, a biotechnology company that was started by a former Deakin University scholar, Dr. Greg Collier. Due to the rigours of the research grant application process, the limitations of university resources and the need for quickly developing his work in targeted cancer treatments, he approached an angel investor (boundary spanning) that immediately provided him with the sufficient level of funding he required. After several other rounds of investing, and unencumbered by the bureaucratic elements surrounding the application, submission and evaluation of research grants, Dr. Collier was able to quickly develop products far enough along the stage to where a viable new biotechnology venture could be started. As the intellectual property laws were not clear at the time of the discovery and funding of the project, Dr. Collier was able to quickly move his inventions out into the market place where eventually ChemGenex was purchased by a larger pharmaceutical company: Cephalon.

8.3 Comparing and Contrasting Rich and Not Rich: FG-1 and SG-2

Common institutional traditions, general structures, and the functions of these communities has resulted in some similarities between coded categories that
are present in first- and second-tier universities, but the differences between them are more significant. All categories are compared and contrasted in table 8.1. A third column (adaptability) assesses the community’s ability to control or change specific factors that are relevant to the categorical domain analysed. A basic three-value ordinal scale is used to intuitively rate a unit’s ability to enact change as low (not adaptable), medium (potentially adaptable) or high (adaptable). This method is taken from Roberts and Malone (1996) but differs slightly from the simple “high” or “low” scheme used within their design. The intuitive process was aided by the rigorous and detailed literature discovery in chapters two, three, and four that provided the structure for managing this process in a valid and reliable manner.

Table 8.1 Comparing and contrasting common factors in FG-1 and SG-2.

<table>
<thead>
<tr>
<th></th>
<th>FG-1 specific properties</th>
<th>SG-2 specific properties</th>
<th>Adaptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total research expenditures</td>
<td>High levels</td>
<td>Low-Med</td>
<td>Low</td>
</tr>
<tr>
<td>Twin skills</td>
<td>Well represented</td>
<td>Lacking</td>
<td>Med</td>
</tr>
<tr>
<td>Quality of science</td>
<td>High</td>
<td>Low-Med</td>
<td>Low</td>
</tr>
<tr>
<td>X-disciplinary specialized centres/units</td>
<td>X</td>
<td>X</td>
<td>High</td>
</tr>
<tr>
<td>Technology transfer offices (TTO)</td>
<td>Experienced, well resourced</td>
<td>Poorly resourced and minimal experience</td>
<td>Med</td>
</tr>
<tr>
<td>Support infrastructure</td>
<td>Well established</td>
<td>Variance in support infrastructure</td>
<td>Med</td>
</tr>
<tr>
<td>Patent protection</td>
<td>X</td>
<td></td>
<td>Med</td>
</tr>
<tr>
<td>Grants and seed capital</td>
<td>High levels</td>
<td>Gaps</td>
<td>Med</td>
</tr>
<tr>
<td>USO’s</td>
<td>High growth</td>
<td>Non high growth</td>
<td>Med</td>
</tr>
<tr>
<td>National characteristics</td>
<td>X</td>
<td>X</td>
<td>Low</td>
</tr>
<tr>
<td>Boundary spanning functions</td>
<td>Well established</td>
<td>Limited</td>
<td>Med</td>
</tr>
<tr>
<td>Open to external community resources</td>
<td>Well established</td>
<td>Limited</td>
<td>Med</td>
</tr>
<tr>
<td>Low selectivity for USO</td>
<td>X</td>
<td>X</td>
<td>High</td>
</tr>
<tr>
<td>Institutional prestige, history and success</td>
<td>High levels</td>
<td>Low levels</td>
<td>Low</td>
</tr>
<tr>
<td>Support for USO’s</td>
<td>High levels</td>
<td>Low levels</td>
<td>Med</td>
</tr>
<tr>
<td>Multiple logics</td>
<td>Aligned with TT</td>
<td>Not aligned with TT</td>
<td>Med</td>
</tr>
<tr>
<td>Students as key resource</td>
<td>Significant to SG-2</td>
<td>1) Commoditization 2) inventive</td>
<td>Med</td>
</tr>
<tr>
<td>Limited resources &amp; revenue streams</td>
<td>Significant to SG-2</td>
<td>Chronic underfunding</td>
<td>Med</td>
</tr>
<tr>
<td>Entrepreneurship driven by fragile sub communities</td>
<td>Significant to SG-2</td>
<td>Targeted best practices</td>
<td>Med</td>
</tr>
<tr>
<td>Established firm’s fund patents research</td>
<td>Significant to SG-2</td>
<td>Reliance on industry/firms resources</td>
<td>Med</td>
</tr>
<tr>
<td>Revenue neutral commercialization activities</td>
<td>Significant to SG-2</td>
<td>Sizable sunk costs, potential ROI</td>
<td>Low</td>
</tr>
<tr>
<td>Backdoor (indirect) USO’s</td>
<td>Significant to SG-2</td>
<td>Faculty, student, IB/re-assignments</td>
<td>High</td>
</tr>
<tr>
<td>IP revenues to research (inventive)</td>
<td>Critical mass and strategic capacity to grow/expand</td>
<td>Distinct to FG-1</td>
<td>Low</td>
</tr>
<tr>
<td>IP revenues to capacity (entrepreneurial)</td>
<td>Critical mass and strategic capacity to grow/expand</td>
<td>Distinct to FG-1</td>
<td>Low</td>
</tr>
</tbody>
</table>

-X denotes similarities between the two models

8.3.1 Common ground codes

These codes (denoted by paired X’s) are similar in nature and important to both the FG-1 and SG-2 frameworks. In some cases, the implications for the
importance of these codings differ for each context. A brief discussion of each of the common areas is presented below.

**Cross disciplinary centres and specialized units:** In both groups, formal units are often established to bring together different disciplinary perspectives, to focus mandates on specialized areas of research, and to develop new logics within institutional structures to carry out mandates for applied research, collaboration with industry, and entrepreneurial activities. These structures are often created around key strengths or desired mandates. These structures are readily identifiable and are observed to be related to success in each group in regard to facilitating entrepreneurial outcomes from RCS.

**Patent protection strategies:** A common theme across both groups is that the commercialization process entailed a patent focused strategy within RCS. An underlying element to this strategy was the emphasis on converting codifiable hard science research into protected intellectual property (IP) that could then be sold. The driving factors are societal, legal, and market based: governments have a higher propensity to target and fund hard science, financiers judge value based on the protection of IP (mitigates legal costs associated with infringements suits), and markets demand competitive advantages that patent protection affords (Ziedonis, 2008).

Jaffe and Lerner (2004) have argued that hard science based patent strategies may be flawed and thus may not be the best means for driving the innovation economy. Although Bessen and Meurer (2008) have provided evidence that patent rights do not universally convey the same benefits as general property rights, patent protection strategies do perform well in certain industries such as pharmaceuticals. At worst, patent strategies may suffer from transactional costs believed to be derived by a weak institutional environment when universally applied to all technologies. This brings into question the efficacy of patent-based commercialization activities as a revenue generating activity for many universities. In particular, it may have policy implications for universities where governments are more interested in
the types of commercialization activities that may benefit the region, regardless of the university’s revenue position. More attention must be given to the effect of patent strategies within second-tier contexts.

National characteristics: Most significant were government policies that encompassed the funding of post secondary institutions, the structure of research granting institutions, and processes and patent/innovation policies. For instance, in Denmark and the USA, intellectual property laws follow Bayh-Dole requirements: the university owns the rights to any IP developed by its employees. In Australia, IP laws were not uniform across the country and were often left to the provincial legislature or individual universities themselves to set out policy.

Low selectivity for USO’s: Both the first- and second-tier groups illustrated low selectivity for spinning out USO’s as the common default perspective. Interviews with technology transfer staff at each university studied reported that they had no preferred strategy or policy for commercializing IP through a new venture spin off exploitation route. These decisions were often left to the inventors or dependent upon the type of IP developed. Roberts and Malone (1996) hypothesized that a low selectivity perspective may be a better strategy at universities that have a strong entrepreneurial infrastructure. High selectivity settings were described as a policy or strategy for moving IP through the USO process. Therefore, while both models share a common strategic stance with respect to policies for spinning out new ventures, the second-tier sample, by virtue of its performance, suggests that a high selectivity for USO’s may be a better strategy (dependent upon contextual capacities) if a clear objective of the university is to create larger numbers of USOs.
8.3.2 Divergent categories

Categories with dissimilar properties are described below. Criteria used to ascertain the differences between the first tier and second tier university cohorts are provided under each heading category.

Total research expenditures: The gap between the two groups is extremely significant. First-tier universities all had extremely high TRE compared to the low-to-medium TRE found in second-tier universities across each country.

Table 8.2 TRE Mean comparison: four year aggregate totals

<table>
<thead>
<tr>
<th>First tier mean</th>
<th>$1,668,456,738</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second tier sample mean TRE</td>
<td>$307,565,000</td>
</tr>
</tbody>
</table>

Twin skills: The necessity for understanding and navigating among academia and industry was found to be important in both but undersupplied in the second tier universities. Of the 125 key informants surveyed, only 31 were found to demonstrate twin skills. The criteria for evaluating this category were achieved by asking each key informant to describe an entrepreneurial opportunity evaluation process that he or she had been involved in. The majority described non-economic opportunity evaluations or decision making processes that were aligned with their role.

Quality of science: The QS university rankings database was utilized to determine overall academic quality of the 6 sample universities and compared with the top 10% for each country.

It was clear from secondary ranking sources that the quality of science being produced was higher in the first-tier cohort than the second-tier cohort. Proxy evidence using the star scientist concept also supports the contextual divergence observed (Zucker et al., 2002; Zucker & Darby, 2001).

Technology transfer offices: Although the qualitative ranking and comparison of technology transfer office staff is challenging, the level of
resources, expertise, and number of TTO agents offered highly comparable proxies for determining the relative disparity between cohorts in this category.

Table 8.2 Technology transfer agents mean comparison

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First tier mean TTA</td>
<td>32.6 FTE</td>
</tr>
<tr>
<td>Second tier sample mean TTA</td>
<td>5.6 FTE</td>
</tr>
</tbody>
</table>

**Support infrastructure:** During the course of each embedded field work session, support infrastructure was enumerated and visited at each location. While support infrastructure is a common theme in each of the groups, the type, size, quality, and overall numbers of these variables was quite different between them. Findings of the comparison between field work and current studies suggests that infrastructure such as entrepreneurship centres, incubators, wet labs, research parks, and funding programs/organizations is a necessary but perhaps not sufficient condition for success.

**Grants and seed capital:** This category was expressed by key informants in every second-tier case to be important, as well as lacking. Although some of the cases had better access to identifiable sources of grants and capital that others did not, (for example, Swinburne Ventures had a small fund that consisted of less than a million dollars while Deakin had no access to an internal funding source) these sources paled in comparison to those capable of being harnessed by first-tier universities.

**USO’s:** The key divergence in the USO’s observed between the two groups was evident in the number of high growth companies generated. From the interviews and secondary data analysis of the second-tier sample, the majority of USO’s were lifestyle, niche, or exhibited conservative growth patterns. The only high-growth firm that was observed emerging from this group was an indirect spinoff (backdoor). Conversely, there was empirical evidence of high growth USO emanating from the first-tier group across each nation surveyed.
Table 8.3 USO mean comparison: four year totals

<table>
<thead>
<tr>
<th>First tier mean</th>
<th>17 USO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second tier mean</td>
<td>6.67 USO</td>
</tr>
</tbody>
</table>

**Boundary spanning functions:** Evidence from both groups points to the importance and necessity for developing formal and informal boundary spanning mechanisms and mandates. First-tier universities (case studies) exhibited clearer mandates for boundary spanning, and had well-defined boundary spanning roles amongst a wide variety of actors that encompassed both formal and informal means. The second-tier cohort (case study field evidence) illustrated counterproductive formal and informal boundary spanning, fewer informal routes, and formal routes that were not effective.

**External community resources:** Access to external resources is conceptualized as (1) how open a university community was to external communities, and (2) the type, quality, and value of the resources available in the external community. In general terms, first-tier communities had well developed tactical social networks compared to the second-tier. These networks were linked to external communities that had greater levels of resources (geographical proxies such as high technology regions, surrogate and serial entrepreneurs, angels, mentors, and VC’s, as well as social proxies such as global academic networks and access to specialized consultants or technology managers). Compared to first tier case study evidence, field evidence pointed to deficits in both categories, although each university investigated were aware of the importance of these issues.

**Institutional prestige, history and success:** Variables and constructs such as legitimacy, entrepreneurial culture, and deep historical roots of working with industry (cultivation of trust through collaborative efforts) are valid proxies. This category was evidenced to be much more evident within RCS of first-tier universities (chapter 4, case study and secondary data).
**Support for USO’s:** Following Roberts and Malone (1996), the combined level of support evidenced within the first-tier was high\(^{29}\) and the combined level of support evidenced within the second-tier was low (or extremely low). As these factors are broadly conceptualized, further implications are discussed with respect to more specific issues relative to RCS in section 8.4 and chapter nine.

**Multiple logics:** While multiple logics were found to be barriers to commercialization in both groups, first-tier universities were more adept at aligning academic (teaching and research) and commercial logics through the development of clear mandates. These processes then became normalized as routines over time. Commercial means were perceived as necessary (or viewed as an opportunity) to further research activities in the face of resource gaps. Although the second-tier universities did provide evidence for the alignment of academic and commercial logics, it was perceived to be much rarer and tenuous in occurrence and thus was not established as a normal or legitimate routine or practice. Of the 125 key informants interviewed, references, 108 made reference to the concept of multiple logics in one form or another, usually through framing opposing worldviews, pointing out tensions, or implication through discussion of personal incidences of peer or administrative conflicts.

### 8.3.3 Categories unique to the SG-2 framework

In this section, factors found to be unique to the SG-2 framework are presented (not found in the FG-1 framework). The primary objectives were to identify factors that were potentially key barriers, and then identify alternate pathways, processes, or objectives that would facilitate best practices found

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\(^{29}\) Although the ‘high support’ finding differed from findings in Robert’s and Malone (1996), this is argued to be based on the difference in research design: Roberts and Malone looked at the differences between different types of ‘rich’ universities while this research project looked at the differences between ‘rich’ and ‘poor’ universities.
within the second tier. In this way poor performance may be explained and pathways for better performance explored.

There are seven factors that are unique to the SG-2 framework: (1) that students may be an undervalued resource, (2) they (RCS) are chronically underfunded, (3) it may be necessary for industry to step in or be invited in to make up resource shortfalls, (4) investment in RCS infrastructure must accompany commercialization mandates (with no certainty of success), (5) alternate pathways for technology transfer (collaboration with firms, industry consulting, strategic alliances between government, industry, and university) are more likely and less risky than USO creation, (6) there are a variety of innovative outcomes that are indirectly generated from university research that are not easily measured and, (7) entrepreneurial sub-communities are the key driver of innovative activities/outcomes but are often highly fragile due to the lack of critical mass in certain areas or specific roles.

8.3.4 Categories unique to the FG-1 framework

There are only two categories that stand out as unique to the FG-1 framework (they are not found found within the SG-2 cohort). Both categories suggest a “low” adaptability to change ranking (making them highly improbable to replicate within most second-tier contexts). These categories are highly interrelated and involve the creation of two different kinds of virtuous circles: (1) revenues from the commercialization of IP targeted back to research and development (inventive processes), and (2) revenues from the commercialization of IP targeted back to infrastructure, support programs, and capacity development (facilitation of entrepreneurial processes). Although these two categories are mostly embodied within the operation of one independent organization, they may be operationalized in many different ways.

Three effects are evident as a result of these two virtuous circles: (1) success breeds the resources and experience for more success, (2) the proclivity for engaging in commercialization based activities are legitimimized
and incentivized by the flow of resources and programs set up to promote and facilitate entrepreneurial processes, and (3) the evolution of these virtuous circles generates greater interaction between academic agents and market agents; this acts to harmonize the different logics between them (see chapter four).

These two virtuous circles are not synonymous with “policies” or “strategies” that act to return portions of commercialization revenues back to individual researchers. Instead, they represent an evolutionary development of context and process where distinct contextualized events that are translated over time into the development of critical mass through re-investment of revenues from past successes (and thus into the ability to do more of the same). This is achieved through cashing in equity stakes of high growth USO’s and the redistribution of royalties or licensing fees. Typically, the involvement of a specialized organization or unit such as a research foundation is involved\(^30\). These organizations can be internally or externally run. For example, the mandate of the Washington Research Foundation (WRF) is to “assist universities and other non profit research institutions in the state of Washington, and to provide support through gifts and grants for scholarship and research” (WRF website, 2010). This independent organization is also a technology transfer company that holds, sells, and manages investments made through the commercialization of IP transferred from its affiliates and partners. Gifts and licensing disbursements totalling more than $200 million dollars have been returned to the University of Washington. These gifts have supported:

- The creation of over 100 endowments for chairs, professorships, research fellowships, and stipends

\(^{30}\) In chapter four, section 4.3, the data collected on Institutional history, entrepreneurship education programs, and financial capital added considerable depth to the content analysis and helped to formulate the insights that underpin this finding. Research foundations (or similar institutions/organizations) often played the role of research facilitator, resource provider (investment stages), and human resource development (capacity building).
• The development of educational programs that include the Centre for Technology Entrepreneurship and the Program for Technology Commercialization
• Technology gap funding programs at UW, the Cancer Research Centre, and WSU.
• The creation of a venture investment arm that is a leading early stage investor that partners with a broad spectrum of entrepreneurs, universities, other institutions, and angels to develop technology based start-ups

While these two virtuous circles are unique to the FG-1 framework, they are not irrelevant to the second tier. For example, ISU has a similar foundation structure, but few if any USO’s are generated from their RCS. What is distinct to the first tier is therefore not the structure, policies, or purpose represented by a research foundation such as WRF per se, but the effects of the critical mass that is achieved through the progression of a strong input/output process over time that leads to a unique, highly interrelated and complex set of contextual factors that cannot be found or easily produced within second-tier universities.

As a policy prescription, it would only be a strategy that second-tier universities may potentially benefit from if they had already built up a sufficient critical mass of revenues (royalties, active licenses generating income, cashed in equities from start-ups) and the ability to divert these back into constructive programs for stimulating inventive and entrepreneurial processes. Furthermore, the initial evolutionary pathway to do this is moderated by the prestige, research funding, and geographical proximity to resources that “rich” universities command. To summarize, funding inventive and entrepreneurial processes are necessary for generating high performance commercialization at universities, but the sufficient components are a complex amalgam of community factors, resources, events, and temporal pathways that are available only to a very small number of RCS’s in (typically) first-tier universities.
8.3.5 Summary of key differences and implications for policy

“Being rich” makes specific support policies impossible to achieve

There is strong evidence to support the argument that some of the most significant categories and factors relevant to facilitating entrepreneurial processes that culminate in successful commercialization outcomes are simply not transferable between the two university types that are classified and investigated in this thesis. Findings from the analysis conducted above show that key contextual differences are predicated on munificence, research quality, institutional prestige, past history of successful USO, and the long evolutionary pathways that result in the creation of sustainable virtuous circles of new sources of revenue that create more of the same. Simply put, the fact that some universities are rich is a significant component of the context that influences the performance of their RCS. Thus, second-tier universities are at a comparative disadvantage simply due to the effect of critical mass, culture, experience and the tangible effects of basic input output functions.

Yet as chapter seven illustrates, these disadvantages are not uniform, nor are they constant. Therefore, it may be relatively easier for some second-tier universities to work toward addressing issues that underlie policy prescriptions that are attached to areas of adaptability or control related to change that are categorized as “high” or ”medium.” Those advantages attached to factors categorized as “low” with respect to adaptability or control related to change are not easily transferable from one type to the other and in many cases are beyond the control of most universities to effect or fabricate.

In essence, the configuration of these immutable contextual factors of first-tier universities constitute evidence that explains much of the performance achieved through certain types of entrepreneurial processes and objectives. Outcomes such as high growth, direct USO, the selling of exclusive licenses to entrepreneurial firms and large corporations, and the ability to charge royalties on non-exclusive licences is a function of the
evolutionary specialization of these institutions to become “entrepreneurial universities.” The process takes many years, and is driven by, and founded upon, several key factors that are not amenable to change. These immutable factors in turn drive evolutionary factors that are very difficult to facilitate in second-tier universities, namely the generation of revenues from IP and the re-investment of these revenues into resources that are targeted to create more of the same (invention through research dollars and entrepreneurship through capacity building). Future success is built on past success which is leveraged by clear advantages. It is therefore difficult to cultivate and a real policy challenge (especially for increasing commercialization performance beyond a limited threshold).

**Categories and factors that may be translated into effective policies**
The majority of categories and factors distilled from comparing and contrasting the two groups reveals that contextual differences between the cohorts may be potentially bridged in some areas. Thus, policies and best practices may be transferable between the two groups when adaptability is evaluated as either “mid-range” or “high.” Yet, the complex and interrelated nature of these factors and their properties make it difficult to single out precise guidelines for how to do this effectively. Nor are they easily adaptable to change without paying attention to the context as a whole and the objectives that are contextually suitable. Therefore, the treatment of policy that is transferable between the two groups is left to the following section where an enhanced framework for understanding the context/process relationships relevant to the design of objectives for RCS and the allied guidelines for their achievement may be fully deployed.

**8.4 Final Framework Synthesis: UG-3**
The objective of this section is to synthesize factors common to both groups (as well as factors that are significant to the RCS of second-tier universities) into an enhanced conceptual framework for understanding how context
influences the entrepreneurial process. The framework provides a means for viewing the problem of underperforming RCS’s through a perspective that focuses on the significance of context to the function of any entrepreneurial process. By controlling for factors of “richness” that only pertain to the contexts of first-tier universities, the framework represents the essential factors that must be considered by any practitioner, administrator, or policy maker seeking to enhance innovation performance. It may then be used to guide the development of theory, policy prescriptions, and best practices for facilitating entrepreneurship that is applicable to the RCS of all universities. The model is shown in Figure 8.1.

Figure 8.1 UG-3: Entrepreneurial Adaptability Framework for University RCS Performance

The model consists of several key contextual factors. *Individual/team* capacity factors (twin skills, entrepreneurial sub-communities, and research quality) emphasize the importance of individuals, teams and/or groups in the entrepreneurial process; they frame the activity of entrepreneurship as a
human driven phenomenon. *Social factors* (mandates, boundary spanners, and business networks) emphasize the importance of relationships, networks, worldviews, and culture that aid and/or constrain the entrepreneurial process. *Spatial factors* (resources, support mechanisms, and bridging units) emphasize the importance of local resources, institutions, and modes of organizing that must be leveraged and/or aligned to facilitate well defined objectives. All of these factors must be addressed.

There are also three general objectives related to the decision pathways for converting knowledge into innovation for every distinct entrepreneurial process. The large horizontal arrow (context specific processes) illustrates that entrepreneurial sub-communities are the key driver of innovation within a university context. These processes are always important and act as rules of thumb for the efficient function of the activities related to research commercialization. The vertical arrows crossing back and forth under the larger horizontal arrow illustrate the interrelated nature of each of these categories. Objectives represents the three general pathways that must be considered upon evaluation of the contextual assessment of the community for any distinct entrepreneurial process, targeted commercialization strategy, or university-wide policy prescription that is relevant to the production and performance of innovation.

### 8.4.1 Key contextual factors and underlying constructs/variables

The categories represent the general contextual factors empirically observed to be important to understanding and/or facilitating entrepreneurial activities that are significant to generating valuable and sustainable innovation from within the RCS of all universities.

*Existence of Entrepreneurial Sub-Communities*
The case study data show that entrepreneurial sub-communities (specific groups of individuals, research teams, units, or departments) are the key drivers of commercialization and innovation within second-tier universities. Once entrepreneurial sub-communities are identified, they can be strengthened through the following practices and policies:

- Recruitment of star scientists, top students, and innovation specialists specific to the sub-community in order to build upon strengths and strive for critical mass
- Exemption from egalitarian budgetary treatment relative to other sub-communities (more resources and support) with a focus on attracting specific resources from aligned industry
- Provision of flexibility and freedom (direct from top administration) to operate in achieving inventive and entrepreneurial goals through targeted policies
- Leadership from key individuals who have academic and business legitimacy to champion/shield projects and or objectives (may be supported or complemented by aligned individuals from other units)

Sub-communities are often fragile, limited in number, and are comprised of individuals that possess two key characteristics: *twin skills* and *research quality*.

**Twin skills**

Community champions, academic entrepreneurs, and industry agents must display a keen eye for understanding the processes, worldviews, and incentives that are important to both business and academia. Twin skills are best described as a general competency for understanding and operationalizing these two worldviews that are often difficult to harmonize. Those who employ twin skills seek to merge conflicting logics or isolate them when necessary in order to best achieve specific objectives that are influenced or tangential to both. (I’m not sure what the phrase “that are influenced or tangential to both” means.) Twin skills competencies may be embedded within individuals, within groups, or in networks and are often characterized
by an understanding of how both academia and markets operate. Twin skills are operationalized by:

- Shielding academic entrepreneurship from unsupportive elements by winning and maintaining support from community leadership over that of peers
- Separating business and academia in some key processes to alleviate or remove contentious issues
- Encouraging continuous boundary spanning between business and academic worlds
- Creating overlapping virtuous knowledge circles that incentivize action and commitment from both academia and industry (for example, aligning commercialization objectives with the support and growth of research funding to entrepreneurial sub-communities)
- Establishing legitimacy within the community by doing (commitment) and punctuating it with success.

Twin skills may be developed through:

- Specific capacity development through hiring qualified people for the TTO (have both business and academic experience), researchers who are interested in exploring applied research, and top administration who are supportive of entrepreneurship
- The importing of serial/surrogate entrepreneurs, technology/market specialists, legal specialists with industry experience, and financial specialists (angels or investor groups with experience in new venture capitalization) into the community as line staff, advisors, and mentors.
- The development of entrepreneurship education programs, centres, industry/firm co-ops, and other functions that are formally and informally linked to RCS.
Research Quality

Not all universities can be strong in all areas. Often natural strengths in research emerge through an evolutionary process (e.g., biomedical at Deakin). Research strengths are mandated by policy or purpose (Agriculture at LSU), seeded in key areas by administrative fiat (Nano-engineering at Swinburne), or the establishment of specialized government labs (Nuclear Physics at ISU). More often than not, universities may have very little in the way of research programs (industrial chemistry at RUC) and thus focus on strengths in the social sciences (social entrepreneurship at RUC) instead. Others have developed research quality across several areas through industry and government partnerships (USD) but do not have a single area where research quality and excellence are leaders or even considered world class.

Through whatever means or focused on whatever disciplinary strengths, the performance of university RCS’s are heavily dependent upon the establishment and support of at least one key area of excellence in research quality. While specific strategies for developing this research quality are manifold and moderated by prestige and funding levels, across all six universities surveyed, the importance of implementing long term plans for hiring quality faculty members based on research potential was found to be highly significant. While this may seem obvious, the problems encountered when trying to align current faculty strengths with strategic vision are often vexing. Reasons for this extend from the community (union mandated) rules for hiring faculty by current faculty. Left to their own devices, faculties may not often hire the best qualified, or those best aligned to the vision or mandates of the university community as a whole. Hiring practice were found to be highly influenced by caprice (had to know somebody), jaundiced by the worldviews of the most senior faculty members (rather than on the input from younger faculty deciding who was the most dynamic and thus would be good to work with), and evaluated based on the metrics of prestige (where you went
to school rather than what you had produced or could produce) over that of research potential.

There are, of course, exceptions such as strategies developed at Deakin to recruit top graduate students from India through pro-active recruiting junkets, targeted scholarships, and developing a safe, welcoming, and culturally aligned environment for international students. Nevertheless, identifying and building on those research strengths that evolve naturally are often the best practice for any university.

**Clear mandates & sustainable paradigms**

In order to facilitate specific entrepreneurial activities within RCSs, clear objectives must be defined, manageable, and supported by key institutional figures:

- Mandates for entrepreneurial activities or commercialization must be both feasible and clearly indicated as a key institutional objective with adequate resources provided to achieve the objectives
- Aligned/strengthened steering core required to drive mandates (new people, designated structures, and commitment to mandates)
- Mandates must be viewed as long term, subject to change, and sustainable

**Pool of available resources**

Highly interrelated with clear mandates is the need for slack resources or pools of new resources to support and drive mandates. Without dedicated and sustainable resources, mandates were found to be limited in their capacity to enact change. Those mandates that were supported in an unsustainable way or through short term budget to budget means risked the chance of dying on the vine (e.g., Swinburne AGSE). Others that were strongly supported until they were self sustainable fared much better (LSU incubator program). Often, the efforts directed at bricolage to leverage new resources outstripped the
effort of sustaining and building on the mandates. Problems like these can be resolved by:

- Top performing units (entrepreneurial sub communities) must be funded in non-egalitarian ways (resources re-directed to pet projects, and support mandates that have potential for a return on investment) from either internal or external sources of revenue
- Gaining political commitments from local or national government agencies to provide the necessary seed capital for projects deemed to have significant positive externalities.
- Recognizing that new resources are often best leveraged by faculty who work with industry or have aligned interests or research strengths rather than less skilled top administrators or liaisons that lack the necessary social capital (although top administrators and liaisons may play a complementary role by aligning messages and administering the deals as brokered)
- Getting industry commitments to research where tangible value (to either specific firms or industry alliances) could be well articulated and made easily contractible
- Working through government research agencies to identify and manage complex industrial relationships

**Aligned boundary spanning roles**

Not only must boundary spanning (BS) activities be established, but clearly defining who are the boundary spanners, the necessary stakeholders, and the objectives to be achieved is important to success. Some positive actions that are found within the empirical are:

- Assignment of clear roles and objectives for BS across the top, middle, and bottom elements of community structure
- Alignment of messages between informal (faculty) and formal (administration) boundary spanning roles
• Active and dedicated resources directed at external boundary spanning (this could take the form of a disciplinary industry liaison officer or top administrative official such as a Vice President of Economic Development (VPRECD))

• Internal boundary spanning activities between departments and entrepreneurial sub-communities with the goal of enhancing RCS (typically through specific Dean’s committees or faculty committees that focus on entrepreneurship or commercialization objectives)

**High support & context specific selectivity policies**

Based upon Roberts and Malone’s (1996) seminal concepts, support and selectivity policies are found to be important to the generation of USO’s. Findings from this study indicate that the conceptualizations are much too narrow and require 1) a broader conceptualization of policies that are associated with the facilitation of entrepreneurial activities and the generation of outcomes beyond USOs, 2) an understanding that policies cannot be effectively administered without taking into account other community contextual factors, and 3) categorization of sources of support as internal (the university) or external for different processes. For any university to do spinouts well, a high support policy setting will obviously be better than a low one, especially in RCS that are characterized by weak entrepreneurial infrastructures. But as indicated from the case study evidence, dependent upon the entrepreneurial process and the strategy used to commercialize research, policies that entail leveraging support from firms or industry may be better suited than internal support mechanisms, especially when an overall USO strategy may not be the best suited. In other words, what type of support and whether it is an internal or external support policy matters. A high support setting, in general, is characterized by:

• Programs, resources, grants, and capital to help facilitate commercialization and technology transfer activities (proof of concept centers, proof of marketing grants/funds, mentorship, seed capital)
Policies and incentives that encourage disclosure and participation in commercialization activities (clear IP and contracts assignment, revenues returned to individuals, departments and university, teaching releases/supportive leaves of absence and resources to guide and evaluate processes)

Back end instead of up front valuation of IP when negotiating with firms (pro-active approach over protectionist approach)

The selectivity concept (whether or not to exploit IP using a USO process or not) is also very dependent upon the types of objectives that are selected and the contextual factors to which it may be best suited. Therefore, a high selectivity policy for USO generation may be suitable within a university RCS that has significant investments in commercialization infrastructure, experience in spinning out new ventures, and resources available for moving through proof of concept and proof of market stages. Conversely, a high selectivity for entering into a strategic alliance with a firm may be better suited for a university RCS that has limited experience in spinning out technology ventures and few resources available for commercializing it. Typically, a university with limited resources may be better served by allowing a larger corporation to take on the risk associated with the commercialization of certain technologies in exchange for research funding and/or a smaller stake in the ownership of the intellectual property developed.

Active business networks

Another key pattern was an open door policy with business networks (firms and industry). Not only were networks required to leverage resources, but they were important for learning and research functions, opportunity evaluation, and policy advice. Although most universities observed were not good at providing a friendly and welcoming environment to industry, it was
always found to be a key goal by universities and a key issue for industry.
Positive activities include:

- Defining key local and key global social networks that are important to RCS (local communities may not have the capacity to fill structural network holes)
- Creating linkages/partnerships to align specific goals with industry needs
- Understanding the importance of formal and informal networks and establishing complementary goals within each
- Emphasizing the building of both academic and industry networks

**Bridging multiple logics: specialized units & structures**

Specialization of units or specific institutional structures was found to be a well established pattern for harmonizing/isolating the multiple logics within university RCS that acted as barriers. These structures also better framed roles, allowed for resources to be more easily targeted/new resources to be leveraged and new logics (for commercialization of research) to be established. Some facilitating actions were as follows:

- The creation of cross-disciplinary research centres with objectives aligned with industry
- Development of institutional structures with clearly defined roles and objectives, such as technology transfer companies, applied research institutes, foundations, and research parks
- Support structures such as incubators, applied labs (wet labs, etc), and entrepreneurial support centres that are complementary to commercialization activities
- Aligning logics through the creation of new units within old established academic communities or units that shield new activities (clearly identified roles and matching incentives, time resources for pursuing entrepreneurial objectives, and the establishment of synergies)
8.4.2 Context specific processes
Since innovation is the result of both inventive and entrepreneurial processes, the interaction of these two processes has a direct impact upon the three interlinked tactical domains of entrepreneurial process. Therefore it must be clear that inventive and entrepreneurial processes are both important and interrelated within the university context. Key issues for each domain of the entrepreneurial process as outlined in the MEP are explained further below.

Right people for each opportunity/stage of process
One of the most notable findings from the university case studies was the de-linking of discovery/creation processes from evaluation/exploitation processes. This was illustrated by the disclosure of early IP and its evaluation by individuals whose role it was to protect it (not to evaluate whether or not the IP presented an entrepreneurial opportunity). Thus patenting units were often separated from exploitation units. Individuals with academic/legal backgrounds and not entrepreneurial backgrounds were mainly those who were involved in the early evaluation of research disclosures. This led to “patent and protect” strategies more often than not. Furthermore, several external experts in each of the three nations made reference to the importance for including the right people with the right skills at different stages of the commercialization process. Thus what was described by internal key informants as a highly linear process was viewed as a highly dynamic, iterative and non-linear process by experts. Some recommendations were:

- The inclusion of individuals with entrepreneurial experience in the earliest stages of the disclosure process may help to increase the effectiveness and selectivity of university technology transfer units. This is often achieved through the use of entrepreneurial or academic social networks, hiring specialized consultants, and bringing in individuals who have legal, science, and entrepreneurial backgrounds.
• Consulting with the right people at the right time; this is determined by the stage of commercialization, academic discipline, the potential product, and market associated with the IP being evaluated.

**Gauging commitment to select objectives**
Based upon the entrepreneurial sub-communities that produce IP and the general contextual circumstances that are pervasive within the community, objectives must be matched with the level of commitment for achieving them. Thus if there is greater commitment within a sub-community toward partnerships and collaboration with firms and little commitment towards spinning out a USO, this should be taken into consideration when determining IP exploitation strategies and setting support and selectivity policies.

**Moving exploitation processes out quickly**
An overwhelming number of responses by key informants across all three categories points to the need to move IP from out of the university community and into the market place (or specialized units independent from the community) as quickly as possible. While this strategy is not always possible, due to IP type and the many layers of administrative complexity to be found within the university context, in situations where the atmosphere for commercialization is toxic, or resources scarce, the best route for exploitation may be through transfer of IP to firms in order to maintain the integrity of research relationships and industry partnerships. The bottom line is that innovation speed is a necessity, yet it is unclear as to when and in what situations, cutting the cord sooner than later can produce more effective results.

**8.4.3 General objectives and potential commercialization outcomes**
Specific to commercialization outcomes, there are three general patterns that are the most significant to universities that are not rich. They are:
Direct USO’s
Although the most risky, resource dependent, and difficult to manage, this approach also potentially offers the most lucrative outcomes. The evidence from the second-tier sample clearly shows that this is a pathway that only makes sense when entrepreneurial infrastructures have been at least partly developed, the IP is suitable (platform technology, etc), and when external financing and internal champions are well aligned. Even in the best of circumstances, the rate of failure is high.

Other forms of commercialization or technology transfer through industry
Industry partnerships, research collaboration with firms, and the licensing of technology to larger corporations may not be considered the most entrepreneurial of outcomes for second-tier universities, but they may be best suited, especially when the capacity, resources, and infrastructure within the community are weak. As well, innovation may be realized in many ways and produce a myriad of outcomes. Universities with weak entrepreneurial infrastructures must allow for opportunities to be seized that are perhaps not typical of commercialization processes but which build upon community strengths through:

- Support of entrepreneurial activities within the social sciences that may have quasi-commercial outcomes or benefits for the industry/community
- The promotion and inclusion of all faculties in RCS
- Not limiting opportunities to commercialization revenues or university profit seeking but embracing all reasonable means for transferring research to industry and gaining whatever resources that may be offered/beneficial to enhancing research programs
- Supporting any and all other types of entrepreneurial outcomes and being proactive and alert to societal demands
Indirect USO’s

There was consistent and well documented evidence showing that students who either started companies while attending university or after graduation, were a significant, yet rarely measured outcome of the university context. Indirect spin offs by students through entrepreneurship education programs is observed to be the least costly and perhaps the most significant entrepreneurial outcome of second-tier universities, especially those that have weak commercialization infrastructures. Furthermore, faculty consulting companies and small lifestyle businesses started from IP given back to the inventor or developed through social networks were much more numerous than actual USO’s. Thus an argument for releasing or inexpensively selling back IP rights to inventors, students (for evaluating and potentially exploiting through educational programs), or other third party buyers of technologies may be a more cost effective way to dealing with poor quality, limited potential, or difficult to evaluate technologies.

8.4.4 Summary of UG-3

Several summary observations are in order at this point. First, each of the contextual categories in the model is interrelated. To best use the framework, one cannot simply focus on any single factor, ignoring some or all others. They must all be considered in concert. As indicated earlier in this thesis, due to the general nature of the means of comparison and contrast between the two performance-based university groups and the methods used to collect empirical data, the framework does not provide the necessary depth required for understanding the effects of specific properties within each of the factor categories. Greater detail in the substance and measurement of these properties will be an important step in fully operationalizing future studies based on this framework.

Second, those categories that are not adaptable to change cannot be regarded as relevant and thus are not included within UG-3 (ie. virtuous circles for inventive and entrepreneurial capacity development). Furthermore,
as the contextual factors found to be unique in first-tier universities may actually moderate how successful these universities are with commercialization, or for that matter, any other activities that they undertake, the conceptual framework developed may actually be a better fit for all universities. The framework was developed from cases that were relatively unencumbered with contextual factors such as prestige, munificence, geographical proximity to resources, and large research budgets. To date, this framework represents the extant understanding of how context influences entrepreneurial process that is controlled for these highly significant factors that embody “richness.” This focused research perspective thus potentially offers insight into even top performing universities.

Third, the framework offered is an improvement over those that exist and will be useful to any university that is seeking to better facilitate entrepreneurship within its communities. Through this focus, the framework may serve as a tool to help evaluate context and inform decisions that seek to improve RCS performance by matching contextual realities to feasible objectives. Thus the framework should be of interest to researchers in the area of entrepreneurial universities and act as a theoretical guide for policy makers and practitioners seeking to diagnose the context-process-performance relationship.

Summary of Chapter 8

In this chapter I have distilled from empirical evidence supplied in chapter seven general framework of the context - entrepreneurial process relationship in second tier universities as guided by a performance based taxonomy developed in chapter six. Comparison and contrast of the Second tier General (SG-2) framework with the First tier General (FG-1) framework produced a set of categories ranked by their transferability between the two sets as determined by adaptability and ease of control. Factors that the evidence demonstrates are important to facilitating entrepreneurship within the second
tier context are used to develop an enhanced framework for guiding research and practice that may be applicable to all universities: University General (UG-3).
Chapter 9 Conclusion

Chapter abstract

This study has investigated and integrated both the relevant research literature and the empirical findings from a multiple case study analysis of a generic set of six universities across three nations to produce an enhanced framework for understanding the context-process-performance relationship within a university’s research commercialization system (RCS). This framework offers an improved perspective that refocuses policymakers and practitioners on factors that are more adaptable to change and may therefore be useful to any university. The project concludes with a discussion of how the research procedures employed have answered the study’s main research questions. The limitations of the study are presented, followed by a discussion of the implications for theory, practice and future research avenues.

9.1 Summary of Research Questions Answered

Through an iterative process of discovery and research action, this thesis identified three demonstrable research gaps associated with the phenomenon of entrepreneurship at university: (1) the lack of a clear and systematic understanding of the “entrepreneurial university” concept, (2) the need for performance-based university typologies associated with the activity of entrepreneurship, and (3) a scarcity of studies that take a contextual approach to the investigation of the research commercialization systems (RCS) of second-tier universities. The research gaps discovered (and addressed) were the catalyst for refining the research problem and developing a set of five primary research questions (introduced in chapter one) that were aligned with the overarching goal of this project: to better understand the relationship among context, process, and performance. The questions are restated below, followed by a precise accounting of how the research actions undertaken have formally answered them to satisfy the objectives of this project.
The first objective was conceptual and involved a review of the existing entrepreneurial university case study literature in order to examine current models and synthesize from these a general framework of the context-process relationship across two empirically defined and classified types of universities: first-tier (or “rich” or “high commercialisation revenue”) and second-tier (or “poor” or “low commercialisation revenue”). Thus the first question was:

(1) How does context influence the entrepreneurial process in the RCS of universities classified as first-tier (rich)?

In order to answer this question, a research procedure using a literature review, case study identification, case classification, content analysis, and secondary data collection was undertaken. The yield of this work was the synthesis of a general framework (First-Tier General or FG-1) that represented the bulk of the entrepreneurial case studies examined. The findings pointed to the fact that most of the existing case study knowledge pertaining to the policies, practices, and objectives relevant to the function of RCS were derived from universities considered to be exemplars (they were drawn mostly from first-tier universities). Prior to this work, there have been few usable case studies which examined RCS (or any other form of entrepreneurial activity) operating in the context of universities classified as second-tier. Evidence provided by this study also suggested that existing cases investigated were indeed “rich.” But they were found to be “rich” in more than just their total expenditures on research and returns from commercialization. Several other patterns were observed that provided insight into the exact nature of this richness:

(1) High levels of total research expenditures
(2) Large revenues derived from cashed in equity/running royalties
(3) Highly ranked quality research across multiple disciplines related to hard science
Highly ranked in academic prestige
(5) Local pools of financial/startup capital with experience in high technology
(6) Proximity to high technology corridors
(7) Well resourced/experienced technology transfer organizations
(8) Substantial commercialization infrastructure
(9) History of commercialization performance and success

This knowledge provides more structure and depth around the definition of “richness” attributed to the contextually significant conditions of first-tier universities relevant to the function of their RCS.

The second research objective was motivated by a lack of available university case studies pertaining to second-tier universities. It was this identified research gap that culminated in the foundation of the primary empirical component of the thesis and led to the second question:

(2) How does context influence the entrepreneurial process in RCS at universities classified as second-tier (not rich)?

This question was answered by conducting a multiple case study analysis of six universities across three nations. A methodological suite of key informant interviews, mind mapping, embedded observations, and secondary data analysis was used to develop rich data sets for each case. The first yield from the analysis of these data sets was the development of six distinct context/process maps (second-tier specific or SS) of the cases investigated: SS-1 through 6. These six models demonstrate the heterogeneity of universities with respect to the contextual factors that impact the function and performance of their RCS. Synthesis of these six models into a general framework (SG-2) provided the foundation for comparison and contrast of the two broad groups investigated in this thesis.
The third research objective was analytical and involved the comparison and contrast of the FG-1 framework with the SG-2 framework and was driven by the following question:

(3) What are the key contextual differences/similarities of first-tier and second-tier universities relevant to the activity of entrepreneurship within their RCS?

A general set of contextual factors from the two models were scrutinized. This analytical task produced four categories (factors that are similar, factors that are dissimilar, and factors unique to each framework) that illustrate the observed differences in the factors reported between the two broad groups. Evidence suggests that the two groups are quite different in terms of several factors that are linked to resources, experience, and research quality. In short, first-tier universities are indeed “rich” and second-tier universities are not. These differences are enumerated, ranked, and discussed to provide a deeper qualitative understanding of the differences attributed to “richness.”

The fourth objective was also analytical and involved the task of evaluating the differences between the two groups so as to answer the question:

(4) What are the policies and best practices for facilitating entrepreneurship found in the first–tier that may (or may not) be effectively transposed into the second-tier set to improve the innovation performance of RCS?

This question was answered by identifying, framing, and discussing what is unique to the first-tier cohort and extremely difficult to adapt to the second-tier sample. The function of virtuous circles targeting resources back to facilitate additional inventive and entrepreneurial activities played a significant role in the success of top performing commercialization
universities. But, these virtuous circles have evolved over many years (unique and context driven events and processes). They are fuelled by the existence of high levels of available resources, prestige, and research quality, and are sustained by the development of both resources (via revenues derived from successful commercialization processes) and capabilities (in the form of new organizational structures, mandates, and experienced agents). These, in turn, produce the competencies required to generate more of the same.

The distinction between the mechanisms used (foundations, USO seed funds, and other organizational structures) and the actual processes that unfolded within the unique contextual conditions of first-tier universities were highlighted. Universities defined as “rich” possessed a distinct competitive advantage that may be difficult to match or overcome by universities of lesser distinction in these key factor areas attributed to richness, and in particular, the virtuous circles that evolve from entrepreneurial events and circumstances over time. Thus the policies and practices that have developed for improving the function of RCS are perceived to be less important than the quality of being “rich,” but there are many other factors that still do matter. The remaining “meat on the bone” is important in establishing incremental, yet potentially significant change whether a university is rich or not. This is where the true nature and function of entrepreneurship is observed, analysed, and discussed to present an argument for its undervalued but important contribution to innovation performance.

These findings lead to the development of a fifth objective that is conceptual in nature and involves the task of developing an improved model that is applicable to all universities by answering the question:

(5) What is a succinct and testable framework that illustrates the factors that are essential to fostering the most appropriate entrepreneurial processes and objectives for improving the innovation performance within all university contexts?
Drawing from the comparison and contrast of the existing (FG-1) contextual model (influenced by “richness”) and the contextual models produced from the focused study of underperforming cases (SG-2), an enhanced framework was produced that incorporated factors that are applicable to all (the Entrepreneurial Adaptability Framework for University RCS Performance or UG-3). In other words, it refocuses policymakers and practitioners on those factors—that when decoupled from whether a university is rich or not—still represent the essential contextual conditions that must be identified, evaluated, and overcome so as to best determine the objectives and allied processes necessary for improving the function of a university’s RCS. The framework consists of 15 interrelated factors of context (individual/team, social, and spatial), process (pertaining to entrepreneurship and guidelines for its function), and objectives (connecting goals to achievable outcomes). This framework is posited to be the most detailed representation of the relationship among, context, process, and performance at university available in the field of entrepreneurship.

9.2 Limitations of this study

The limitations of this thesis have been noted and briefly discussed in previous chapters as they arose. First, different methods were used for collecting data that underpin the two typologies (models) compared. There are several reasons for this. First, the canon of case studies classified and selected as “first-tier” provided an overview of the existing perspectives that are synthesized into a model of how context influences the entrepreneurial process at university RCS. This is an important aspect of the literature because it establishes the study of exemplar universities as the main source of knowledge that informs policy and practice concerning “entrepreneurial universities.” Second, existing case studies of first-tier universities were already available and classifiable using the taxonomic framework developed. Only with very substantial resources and privileged access (a very difficult goal to achieve, especially when considering prestigious universities) could a
similar six case, three nation purposive sample study have been conducted. The published case studies selected to develop the FG-1 model use a wide variety of methods that are not focused on the primary research questions of interest to this thesis and are thus limited by their own philosophical perspectives, ontologies, and methodologies. They represent the best tools available rather than the optimal tools for answering the research questions asked. Obviously, the FG-1 model was subject to whatever errors may have been made by other scholars (e.g., problems arising from scale and proportion and the diversity of methods utilised). Previous research has simply lacked the high degree of detail utilized in the creation of the SG-2 model presented here. Third, there were very few usable case studies available to represent examples of second-tier research commercialization systems. This limitation prompted field work that led to the establishment of a case study protocol that used several complementary guides for analysing data. The field work provided a specific sample of “not rich” universities that was necessary for developing an enhanced framework.

There are several differences between Roberts and Malone’s (1996) matrix framework and the study presented here. First, their study used cases taken from (randomly selected) high ranking universities in the USA and the UK, while the group in the present study consisted of empirically justified classifications of two universities in each of the U.S., Denmark, and Australia. Second, the cases used in their study were not classified into top-tier and second-tier university groups. They also used non-university R&D organizations in their sample. Third, their study concentrated only upon the activities of TTO’s and regions (that were deconstructed into factor categories of venture capital and experienced entrepreneurs). The study presented here was more broadly-based, so there was a mismatch in the concepts of support and selectivity developed by Roberts and Malone. As these mechanisms feature prominently in the models and primary framework created, they present a limitation on the cogent nature of their usage that must be made clear to readers as a point of clarity and preciseness of measure. Nevertheless,
implications for usage of their research and its extension through this study are provided below in the implications section.

The concept of “community” has been well defined and structured through the application of Hindle’s Bridge (Hindle, 2010b) and sanctioned by important authors in the field (Steyaert, 2007), and its use is therefore warranted. But it does involve multiple levels of analysis, and this potentially creates a problem of scale and proportion when considering past studies of context, in particular those that are framed by economic boundaries. Environmental factors that may be assumed as regional or national may in fact be considered to fall within a community-based perspective if they are found to impact/incentivise behaviour or vice versa. As well, individual and team factors may also be included. Although the approach taken involves a level of analysis (the community or sub-community) that is loosely based on an institutional or organizational level of analysis (the university), it cannot be seamlessly compared with other organizational or institutional level studies (Per Davidsson & Wiklund, 2001). The second issue with the concept of community is that it may or may not be attached to geographic factors. This leads to a potential disconnect when surveying an entire community that has definite geographic elements to its definition. Sub-communities within the main university community are potentially linked socially, regionally, or globally. Parts of these communities (or their linkages) may be considered “external” to an institutional boundary while still adhering to boundaries defined by community.

Considering these issues, the communities investigated in this thesis were overwhelmingly local and defined by geographic space. Third, the concept of community may be confusing when linked to aspects of entrepreneurial process that are driven by causist thinking (Burgelman, 1983; P. Davidsson, 2004) and by positivistic philosophies (Acs & Mueller, 2008). For example, the socialized meaning of the transformational process of entrepreneurship may be lost in a positivistic attempt to classify and apply meaning to the relationship between context and process (B. Bygrave, 2004).
Depending upon their epistemological roots, social constructionist perspectives of entrepreneurship (such as used in the conceptualization of community) may not always focus specifically upon individual or environmental aspects in particular, or even the “firm creation” process in general, but instead, seek to improve our understanding of the interactions between enterprising individuals and relevant stakeholders across several social dimensions (Downing, 2005). These abstract progressions of social relationships may be argued by some to represent ”entrepreneurial processes,” either in full or in part (Berglund, 2007) as well as aspects of community that are often characterized as social, structural and/or spatial (Hindle, 2010b).

This argument may be rejected by researchers who are only interested in determining an input/output function that consists of well-defined variables and constructs that may be statistically linked to a well defined independent variable (such as a USO, a licence, or a dollar). Because debaters cannot agree on premises for discussion (Rorty, 1979), in this study a pragmatic stance was taken that is neutral with respect to the opposing views. Future attempts to operationalize findings into variables/constructs to statistically test significance and direction in relationships may be a natural step to the evolution of this research area. Nevertheless, the study and its findings must be viewed as a stand-alone contribution of knowledge discovered, analysed, and structured to present a means for understanding the phenomenon under observation and to use this understanding to guide theory development and guidelines for best practice through the process of entering these findings into the academic conversation. In other words, the contribution should be considered as indicative and not prescriptive.

Germane to the above discussion, since the goal of this study was to identify patterns that were detected in each group, the only weighting of factor categories in UG-3 was their relative ease of adaptability. Ordinal ranking of each factor category from low to high allowed for a determination of its relative significance to the framework with regard to affecting change. This type of intuitive ordinal ranking has been used in previous studies that this
project directly and indirectly builds upon (Roberts and Malone, 1996; Degroof and Roberts, 2004).

A further limitation was due to the space requirements: only one full narrative of the six case studies could be presented. Good research should reflect maximum parsimony and communication of key points (Trochim, 2005), so in chapter 7 a full narrative was provided for just one case study. This approach illustrated the narrative method used for data presentation. All other cases were summarized and contained a detailed context process map. The cases were also analysed and categorized by assigning meaningful descriptions of the context/process models that were developed. These categorized models may now be investigated across a larger population to determine whether or not they “fit,” require modification, or do not fit.

It is beyond the means of any researcher to comprehensively discover, analyse, and conceptualize the complete set of categories and factors that may be identified to fully contextualize any university with respect to the function of its RCS and the role that entrepreneurship plays in that function. Furthermore, the methods used here are also open to human error and key informant bias. Therefore, no claim is made that the findings of this thesis are comprehensive. That being said, attempts were made to mitigate key informant bias through triangulation and the inclusion of secondary data analysis. The study attempted to capture as much relevant evidence as possible, to rigorously analyse it, and to organize findings in a manner that allows for it to be viewed as a positive contribution to our understanding of the phenomenon.

9.3 Implications and Future Research

The main research problem identified in this study was the inadequacies of current contextualized process models with respect to understanding and informing policy and practice. The resolution of this problem required a quest to better understand the relationship among context, entrepreneurial process, and performance within “entrepreneurial” universities. Several gaps in the
literature were identified: (1) issues concerning the clarity of the “entrepreneurial university” concept, (2) the lack of a valid and reliable method for developing performance based typologies for comparison and contrast, and (3) a scarcity of research on second-tier universities where RCS was under-resourced.

9.3.1 Implications for theory
The main research objective of this study was to generate a theoretically and empirically derived, testable framework that is widely applicable and thus represents an improvement over current theory on the context-process-performance relationship within university RCS. Frameworks have been distinguished from models and are not automatically synonymous with theory, but they can be, especially if they explain a phenomenon and demonstrate the qualities of generality, accuracy, and simplicity. “A theory is a statement of relations among concepts within a set of boundary assumptions and constraints. It is no more than a linguistic device used to organize a complex empirical world” (Bacharach, 1989, p. 1). Merton (1967) provides four characteristics of an alleged theory that does not actually qualify as a theory:

1) general orientations in which broad frameworks specify types of variables people should take into account without any specification of relationships among these variables;
2) analysis of concepts in which concepts are specified, clarified, and defined but not interrelated;
3) post factum interpretation in which ad hoc hypotheses are derived from a single observation, with no effort to explore alternative explanations or new observations;
4) empirical generalization in which an isolated proposition summarizes the relationship between two variables but further interrelations are not attempted (Merton, 1967).
Considering Merton’s guidelines above, the primary framework developed in this study, Entrepreneurial Adaptability Framework for University RCS Performance (or UG-3) could be considered as a mid-range theory (Thompson, 2011; Weick, 1995). The theory is encapsulated in the form of a logical, structured, indicative framework that can also serve as a tool and set of guidelines for both further research and practice. The theory qualifies as mid-range because, in spite of the fact that the existence of interrelationships among variables is proposed, there is no specific statement of exactly how they interact. Rather, the claim is only that they do interact, and that the categories that have emerged are significant to understanding the research problems that are posed. With respect to the varied secondary contributions, they seem to be consistent with what Weick (1995) refers as the “interim struggles” that are considered as valuable contributions, even if they exist only as approximations of theory (Staw & Ross, 1987). These “interim struggles” are outlined, and they provide the implications for the theory and theory development that arise from the primary contribution of this thesis.

There are three implications of this study for theory development. The first is that entrepreneurship at university can be envisioned as consisting of four interrelated domains of activity, and that the commercialization of research is one of the four (see figure 2.1, chapter 2). This thesis has made a contribution to the study of the entrepreneurial university literature by applying a multifaceted approach. Phenomena have been studied using a combination of general systems theory (L. von Bertalanffy, 1951), entrepreneurial process theory (Hindle, 2010a; Moroz and Hindle, 2012), and the theory of entrepreneurial context (Al-Shanfari, 2011; Welter, 2011). The interrelationship between these four domains may now be more precisely investigated by future researchers to determine the interrelationships between each and how these interrelationships may impact upon the function of one or more of these systems.

Second, this study addresses another gap in the entrepreneurship at university literature: a lack of empirically justified typologies and an inability
to compare them. One of the first research activities of this thesis was to develop a taxonomic approach that may now be utilized to classify and evaluate universities in order to (1) test for informative patterns in university populations based on commercialization outputs, (2) classify universities by performance into groups with similar characteristics (these groups may then be compared and contrasted to better illuminate holistic contextual issues), and (3) advance work that includes the development of increasingly precise typologies based on observed context-process patterns within both first-tier and second-tier universities. This may possibly open up a new sub-field of research within the entrepreneurial university literature.

Third, with respect to (sub) typologies, especially within the second tier, the specific context/process models drawn from the study of the six universities presented will be helpful in furthering development of theory pertaining to the stages of entrepreneurial university growth and evolution (Shane, 2002), issues dealing with paradigmatic shift and sustainability (Clark, 2004), and ultimately the pathways (and opportunities) that are best suited for universities that are constrained by issues of scale, location, resources, or other contextual limitations, such as “entrepreneurial infrastructure” (Degroof and Roberts, 2004).

Moving to the contributions made from answering the core questions of the thesis, the Entrepreneurial Adaptability Framework for University RCS Performance (UG-3) provides a novel perspective for viewing the challenges specific to “typical” under-resourced universities that are attempting to commercialize research, transfer technology, or interact with entrepreneurial firms in order to generate valuable innovation. To this point, researchers who were interested in understanding entrepreneurship at university often concentrated specifically on the creation of USOs. The study of USO development has overwhelmingly focused on universities that may be viewed as exemplars or classified in this thesis as first tier. This study serves as the first intensive empirical study that concentrates on the systematic study of
second-tier universities (which constitute the vast majority of all universities throughout the world).

The implications arising from the main contribution of this study are set out below:

(1) This study has provided empirical evidence that highlights the contextual issues that are unique to the first and second tiers, and assesses areas between them where the transfer of concepts, policies, and best practices may have merit (and where they may not). Researchers should be cognizant of ignoring context when developing broad theory in this area.

(2) Findings from this study suggest that growth in commercialization performance may be extremely difficult, potentially more cost intensive, and disproportionately risky for the second tier cohort. The advantages pertaining to “richness” (size, scale, prestige, resources, experience, and virtuous circles) that the most productive universities enjoy, simply do not apply to the majority of RCS of typical universities. The implications arising from this are directly relevant to the concept of the “entrepreneurial paradigm”: shifting the mandates of universities to an entrepreneurial paradigm with a goal that embraces wholesale movement to institutional sustainability through the function of the commercialization of their research programs is an improbable strategy (B. Clark, 1998). Rather, the adoption of entrepreneurship as a means of altering or improving the function of RCS should be approached from the perspective of complementariness to the geographically defined economic drivers of a community and viewed as a cost, or at best, a zero sum activity instead of a sustainable revenue generating scheme.

(3) There are also implications for institutional evolution theory: some universities in the second tier may be better off not following the same pathways as first-tier universities. Instead, these universities must realistically assess their strengths and potential for producing innovation that involves entrepreneurial opportunities that are more appropriate to
their contextual (and evolutionary) state (such as developing organizational alliances, community based entrepreneurial objectives, greater emphasis consulting/research based projects with industry and entrepreneurial firms that provide research funding, and low cost targeted support for student and faculty who may seek to commercialize ideas/inventions through new ventures not formally attached to the university).

(4) One of the most interesting yields from this thesis was the identification of fragile entrepreneurial sub-communities operating within second-tier universities, and their role in RCS. Thus there are several implications for social network theory. This discovery points to an underserved area in the entrepreneurship at university literature that encompasses the need for better understanding the individual, social, and spatial nexus of economic opportunity discovery from a multi-component perspective. While there is a great deal of work completed in the area of social network studies, very few studies look at the context/process issues that are germane to entrepreneurial teams or groups that are working from within university based communities. The application or fusion of social network theory into the context/process relationship requires clearer explication and structuring.

(5) There are also implications for theories that suggest that university spinoff development is a positive outcome. The realization that high growth USO’s are more an exception than the norm within the second tier should be of critical importance to decision makers that may be seeking to invest large sums of money into programs and infrastructure on the promise of high returns. For those universities that do have the science and capacity to generate USO, re-investment of revenues back into research and capacity development is an important step in maintaining sustainable programs. But that is not likely to spur growth that has the potential to transform a second-tier university into a first-tier university.
(6) As a result of this research, several categories have emerged as factors that are important to the conduct of entrepreneurship at university, particularly for guiding those universities within the second tier toward increasing their entrepreneurial effectiveness and developing transformative strategies for their RCS. Some of these factors have direct linkages to previous theoretical work (and therefore can be built upon), others have indirect or ambiguous relationships to past research (and must be scrutinized for potential linkages), and some are potentially new contributions. Implications specific to these concepts were discussed in chapter eight. Implications for theory that directly influence past work are considered below.

9.3.2 Other specific contributions to theory
There are two further implications for theory that are important and intriguing. The first involves theory development in the area of support and selectivity policies as outlined by Roberts and Malone (1996). The second has to do with the psychological component of the entrepreneurial process that is specific to the context of university RCS and potential cross fertilization with intentions theory (Krueger, 2000).

An enhanced conceptualization of support and selectivity mechanisms
Within the second-tier university sample, the opportunity discovery process was decoupled from the opportunity evaluation process (K. Hindle, 2010; Shane, 2003). This has serious implications for the development of high selectivity mechanisms for evaluating the commercial potential of IP at an early stage (or at any stage). If university RCS do seek to better increase the performance of the USO they do generate, the “patent and hard sell” model (chapter 8) will need to be replaced with a process and system that allows for the discovery, evaluation, and exploitation stages of the IP disclosure process to be streamlined and/or the function to be overseen by only one key group that has access to a wide range of skills
and specializations (both internal and external). This also has ramifications for disclosure backlogs and intellectual property black holes (where IP that is semi-valuable is taken in and not released back to willing inventors, but instead sits on a virtual shelf) as well as the efficiency of selectivity processes with respect to filtering out higher probability “winners.” Thus the construct of selectivity may be enhanced by its conceptualization of specific policy considerations pertaining to the entrepreneurial process. Secondary improvements may be achieved using the broader UG-3 framework to determine if selectivity mechanisms should consider exploitation through direct USO process, corporate means or indirect USOs (see chapter 8 figure 8.1).

With respect to support mechanisms, the findings of high and low levels of support were not found to be entirely replicable within this study (although this result was explained partially by the sample selection differences between the studies). This was due to the narrow assumptions placed upon the original conceptualization of support mechanisms (it only considered the creation of USO’s and a specific focus on the technology transfer office as a unit of analysis). Considered apart from a broader evaluation of community context, the support mechanism was found to be of limited use. Reformulation of the concept to take in a much wider birth of outcomes and processes helped to increase the power of its utility. The identification of alternative commercialization objectives and processes opened up the concept to rigorous examination, especially in regard to the mode of external support mechanisms engaged. While Roberts and Malone framed an external level of support (local infrastructure, agents, and networks that facilitated transfer of IP out into a spinoff organization or new venture) as being a “low” policy setting (or the requirement of the university to provide little in the way of direct management and resource support), evidence from the multiple case study analysis suggested that this was a poor means for framing the concept. What better reflected the
observed phenomenon was not a measure of “level,” but a categorization of “mode.”

Instead of a universal “high or low” level setting (where “high” means committed internal support and “low” means non-committed internal support and a reliance on existing environmental support structures), a better interpretation would extend the support concept’s scope to include an external mode of resource acquisition that also pertained to “research partnerships” and “research consulting.” Research partnerships were evidenced as resource acquisition (through targeted research funding to the university) while research consulting could be viewed more as a means of commercializing research or IP without the requirement of capital or financial outlay of resources (managed through contracts with firms that provided the necessary resources and/or capital to take research developed by faculty to market). This added dimension, when applied, better explained and characterized the support mechanisms of most second-tier universities as low (internal) and mode (detailing the type of external support engaged).

**Synthesis of the assessment of community context with the intentions literature**

The introduction of the personal domain into the understanding of the entrepreneurial process at university illustrates that a psychological capacity for commitment (to the opportunity) must be considered in regard to the selectivity of the specific objectives associated within RCS. Even if entrepreneurial capacity development is present and an opportunity can be clearly articulated into a value proposition, a dearth of individuals vested with a commitment to exploiting that opportunity will not lead to favourable outcomes. In cases where there is little commitment from faculty, administration, or other key stakeholders (to rigorously pursue the opportunity), the opportunity is undervalued, left unexploited, or exploited poorly. As most faculty members within university communities are first
and foremost educators and researchers (their role is teaching and research, not entrepreneurship in general or technology transfer in particular), a lack of commitment to the process may lead to other alternatives being considered over a USO. In cases where there is very little commitment surrounding an entrepreneurial opportunity, the best strategy may be to move the IP out of the university community into the hands of entrepreneurs, venture capital firms, or other organizations that allow for rapid exploitation to take place (Markman, et al., 2005).

There are a limited number of authors that have employed the entrepreneurial intentions literature to seek a better understanding of the motivations of academic or technology entrepreneurs (Chell & Allman, 2003; Standish-Kuon, 2008). The entrepreneurial adaptability framework for university RCS performance (UG-3) may be a complementary asset to theory development in the field of intentions. As the intention of an entrepreneur to start a new business has been empirically observed to incorporate dimensions or perceived feasibility and desirability (Klyver & Schøtt, 2008; J. N. Krueger, M. Reilly, & A. Carsrud, 2000), there is potential for the UG-3 framework to be implemented to inform these dimensions with respect to the substantive area of university entrepreneurship. The synthesis of theory developed in the area of entrepreneurial intentions with the evaluation of community context may facilitate the application of the concept of psychological capacity and commitment—which is featured in Hindle’s model of entrepreneurial process (MEP)—to specific decisions made around commercialization objectives and activities, with emphasis on the mode of exploitation in particular.

A rigorous evaluation of a university RCS using the UG-3 framework may turn up certain issues with regard to a specific context for pursuing an entrepreneurial opportunity. For example, an isolated research academic who is lacking in twin skills, but is doing cutting edge applied work in the micro fabrics area may be influenced by several key social and
spatial factors in the RCS environment. In order to determine feasibility and desirability of a range of commercialization strategies and entrepreneurial exploitation options particular to the researcher’s situation, an assessment of the relevant community context is conducted. This assessment may turn up issues that are germane to the factor areas corresponding to mandates, resources, bridging units, support and selectivity mechanisms, boundary spanning, and active business networks. For example, there may be no clear mandates for supporting commercialization activities, few internal support resources to help develop an invention to a proof of concept stage, an industry liaison unit that does not have any inclination to spend money on a patent (as they have no way of discerning the value of the technology because the unit consists of a single lawyer with little industry experience), few if any specialized centres or groups to shield the researcher from the scorn of his peers (who have conflicting worldviews with respect to the nexus of academia and commerce), and a department head that wants the researcher to teach overload courses. But, the researcher also knows someone within the local regional economic development organization that knows of a newer firm that produces durable and protective microfiber clothing for cyclists and the lawyer in the industry liaison is happy to write up a research contract for the clothing firm to fund the researcher’s work in exchange for an exclusive licensing option. The UG-3 framework could therefore be integral in developing a survey tool that measures the perceived feasibility and desirability of the researcher’s intentions to start a business (or opt for a different pathway).

9.3.4 Implications for practice

The “academic entrepreneurship” literature is well represented by studies that focus on the importance and positive benefits of generating successful USO’s from university research programs (Bray & Lee, 2000; Shane, 2005). Furthermore, the sub-field that encompasses the study of the “entrepreneurial
university” presents a normative assessment of transformation to new paradigms as unavoidable, feasible, and good (Clark, 1998; Etzkowitz, et al., 2000; O'Shea, et al., 2007). While evidence may be cited to support both of these assertions, a deeper survey of the literature surfaces contentious viewpoints (Tuunainen, 2005; Vestergaard, 2007). Scholars who are less idealistic about the reality, feasibility, and value that is created through the introduction of entrepreneurial functions at university underscore the need for better measures and decisive evidence of the costs and benefits attributed to the activities of research commercialization, entrepreneurship education, and business incubation/facilitation (R. Harrison & Leitch, 2010; Sotirakou, 2004; Tuunainen & Knuuttila, 2009). In particular, scholars of entrepreneurship warn of the dangers of assuming that the outcomes of any entrepreneurial process will be positive (Venkataraman, 2004). Other scholars present serious concerns with the concept of entrepreneurial transformation in universities, outlining the challenges faced by the majority of universities to become commercially focused and resource independent, but still maintain the standards and goals of a traditional academic paradigm (Armbruster, 2008; Rinne & Koivula, 2005).

By breaking down universities into two empirically justified, performance based groups, this thesis provides empirical evidence suggesting that for some universities, the direct generation of USO through commercialization of research may not always be the best strategy. It also points to the need to examine other pathways and alternatives that may be better suited to second-tier university contexts, and that may diverge from the typical technology transfer paradigm (observed in the first-tier context). An examination of the two models finds that second-tier universities are contextually disadvantaged when compared to first-tier universities with respect to the pursuit and generation of successful commercialization outcomes. Research expenditures, science quality, past success, critical mass, access to capital, integral local geographic symbiosis with high technology research clusters, and copious amounts of human capital, both inventive and
entrepreneurial, suggest that it is very unlikely that most universities will ever be as productive in commercialization and impactful through the generation of high growth technology USOs.

Through this thesis, arguments have been advanced on the “what” and the “why,” but it is difficult to provide specific answers on the “how” that is the domain of the entrepreneurial process, as the objective of the thesis is to be indicative and not prescriptive in its conclusions. As Gartner (1985) suggests, each entrepreneurial process is distinct, but there are generalities that may be assumed over time based on the observation of broader patterns. Nevertheless, several specific implications from this research may be clearly and parsimoniously formulated into knowledge that may potentially inform best practices for those second-tier universities that do seek to pursue an “entrepreneurial” agenda:

• Where possible, inventive processes must be continuously weaved with entrepreneurial processes, and not decoupled. Inventive sub-communities should have access to both scientific and entrepreneurial networks, and technology transfer office functions should be structured to allow for entrepreneurial opportunity discovery, evaluation, and exploitation processes to be simultaneously and recursively engaged throughout the commercialization process so as to enhance selectivity pathways.

• The key tenets that mark a university based twin skills inventory are (a) shielding of academic entrepreneurship from unsupportive elements by winning and maintaining support from community leadership over that of peers, (b) separating business and academia in some key processes to alleviate contention, (c) creating new institutional (corporate) structures when necessary, (d) focusing on continuous boundary spanning between the business and academic worlds that take into account existing networks and match boundary spanning roles with the right individuals (their strengths and limitations), (e) generating overlapping virtuous knowledge circles that are of interest to both academia and industry (dollars from
commercialization flow back to basic and applied research), (f) aligning commercialization with the sustainability of research areas denoted by the sub-communities that are the most entrepreneurial (dollars redirected back to grants, investment funding, etc), and (g) establishing institutional legitimacy by doing (commitment) and punctuating it with success (however small and staged).

- Over protection and over valuation of patents by legally oriented administrators will more often than not kill a deal and raise barriers between university and industry. Intellectual property is considerably less valuable than the time, resources, and expertise required to transform IP into a product that can be taken to market. In essence, its value is effectively zero without the function of an entrepreneurial agent.

- Clear and enforceable IP policies are a necessary foundation for any commercialization strategy.

- Findings from the first tier cases suggest that the majority of researchers are risk averse and are not interested in creating a new venture. Their role identity is firmly associated with the logics pertaining to teaching and research. But most faculties interviewed were not averse to working with industry as a means for sustaining and expanding their research mandates. Thus in terms of Hindle’s harmonized model of entrepreneurial process (Hindle 2010a), the personal domain where commitment to a new venture is a component in every entrepreneurial process is an important aspect to understand when seeking to support innovative activities within university communities. There are very few researchers with the type of interest, skill sets, and commitments to effectively contribute to the commercialization of research, technology transfer, and interaction with entrepreneurial firms. But due to the roles, worldviews, and logics that pervade the communities of most typical academics, commitment to working on research that has practical outcomes where role identities are maintained (stay a researcher and not an entrepreneurs) is a much less dramatic leap and it therefore may
be more effective to take this approach within risk averse and research oriented sub-communities.

- University administrators who oversee fragile sub-communities that drive innovation should be cognizant of the fact that faculty who start new ventures also must dedicate sufficient time to these ventures. This often results in the requirement for flexibility around duties, leaves of absence, and sometimes the departure of a researcher from the faculty. Roles must be changed to accommodate these new activities. Faculty participation in the USO process thus has direct implications for the stability and sustainability of research programs where a star scientist is a key champion. For second-tier universities, commercialization processes that allow for star scientists to grow research programs may be a better alternative than to involve them in a USO process. Losing star scientists to an entrepreneurial venture may be more damaging to research programs and produce greater levels of innovation.

Although the ability to provide a longer list of best practices for universities in general is beyond the scope of this thesis, the above findings have emerged as relevant and important in each case surveyed. In most cases, they reflect or support common themes in the literature.

### 9.3.4 Implications for future research

The UG-3 framework provides a map that is both theoretically and empirically derived to assist policymakers and practitioners. The map consists of broad concepts and factors that are highly interrelated and overlapping. In aggregate, they present a formidable means for informing, evaluating, and transforming a university’s context for facilitating, supporting, and doing entrepreneurship, especially when the university in question is not a resource rich community, a first-tier Stanford or Oxford or Sorbonne or MIT, but a typical challenged community, a second-tier, resource-stressed, barrier-laden and commercial-logic-deficient university.
Future research may be envisioned around the following aspects of the Entrepreneurial Adaptability Framework for University RCS Performance (UG-3):

- Forwarding ontological based studies of the context/entrepreneurial process at university through a more robust understanding of community and how it may be effectively interlinked to prominent theories such as social network theory, social capital theory, boundary spanning, role identity and professionalization theory. A deeper examination is needed of the concept of the entrepreneurial sub-community and its relationship with other perspectives and concepts such as entrepreneurial teams and social network analysis.

- Further examination of specific entrepreneurial processes within second-tier universities, comparison of these processes with prominent theories within the entrepreneurship literature; for example, bricolage and effectuation (Baker & Nelson, 2005; S. Sarasvathy, 2006).

- Exploration of the psychological domain of USO creation at university, the significance of its impact, and the possible relationships and linkages that may be drawn from the entrepreneurial intentions literature with respect to “commitment” as conceptualized in Hindle’s (K. Hindle, 2010) MEP.

- Other pathways (joint ventures, alliances, and structural changes) for commercializing research that are available to second-tier universities. Are these pathways limited by the structure of current national innovation systems?

- Identifiable patterns in the stages of entrepreneurial development or models used across university populations. How may they be classified around key factors that may be important in determining what types of entrepreneurial outcomes are best suited?

The next step for any qualitative study in this field is to progress to operationalization through the measurement of significance and causal direction so as to test hypotheses about the framework and draw firm
conclusions. Thus the qualitative work presented in this thesis may be well suited for construct development around the interrelated categories, concepts, and factors found to be important to measure and/or test significance using quantitative means.

9.4 Conclusion: Pathways and Opportunities Revisited

Perhaps the most striking insight that has emerged from this four-year study into the “the entrepreneurial university” and current systems for commercialising university research, is that the deeply personal and social elements of which entrepreneurship is fundamentally comprised are far too often overlooked in much of the academic writing surveyed. At a recent conference, a renowned scholar in entrepreneurship, Dr. Mike Wright, gave a lecture on the nexus of entrepreneurship and academia. He remarked that even though researchers have studied this phenomenon for many years, he believed that:

There is a limited understanding of the processes by which academic entrepreneurs accumulate resources to get to market. (Wright, 2011)

He went on to state that there has been a narrow of a perception of academic entrepreneurship (in particular, the focus on the spin off process) and this has led to a much wider debate about the nature of innovation policy in Europe and around the world (Kenney & Patton, 2009). From his perspective, a much broader concept of the academic entrepreneur was needed that embraced the heterogeneity of the university context and the implications for how the process occurs.

This thesis is an attempt to provide an accurate and dispassionate understanding of entrepreneurship and research commercialisation in the university context. Of course, entrepreneurship is a passionate human activity, not a dispassionate technical one. But to put that passion to fruitful use
requires a deep understanding that only dispassionate scholarship and painstaking research can provide. And I have tried to provide it.

The terminology approaches and frameworks that were developed in this thesis make a substantial new contribution to the literature. This thesis demonstrates powerfully that as Julien (2007) and Hindle (2010a) and many others (J. Katz & Steyaert, 2004; Minniti & Bygrave, 1999; Welter, 2011) have argued, context is not just an important; perspective from which to view and understand the entrepreneurial process; it is an essential perspective.

The thesis is a specific demonstration of the general truth that if you fail to account for the influence of context, you will fail to understand entrepreneurial process with any degree of adequacy. The examination of performance classified universities provides strong (and hopefully compelling) evidence illustrating that key differences exist between two highly skewed types of universities with respect to commercialization performance. These differences have been examined through the concepts of community and entrepreneurial process to capture a complex array of contextual factors that are all fundamentally important to the phenomenon of research commercialization systems at university. This examination explains why some do not perform as well as others in commercializing research, technology transfer, and interacting with entrepreneurial firms (that are important for generating direct or indirect USO’s).

Findings from this study confirm that the skewed pattern of university commercialization performance—which was first noticed with respect to North American universities (P. W. Moroz et al., 2008)—also pertains globally. One suspicion has been resoundingly confirmed. For second-tier universities, strategies successfully employed by first-tier universities may not be effectively reproduced or may actually be damaging to the innovation performance of second-tier universities. Thus, alternate pathways and opportunities for all universities should be contextually identified and rigorously evaluated. One way to do that is to use the Entrepreneurial
Adaptability Framework for University RCS Performance that has been developed here.
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Appendix A

These tables summarize the raw structured coding that emerged from the content analysis of the classified case studies of the five nations selected.

### Classified top tier cases: Sweden

<table>
<thead>
<tr>
<th>Sector/Theme</th>
<th>Raw coding</th>
<th>Role coding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Resources</strong></td>
<td>China School of Business, student training, pre-proposal; requires faculty; did not access evidence; understanding of not small portion of relevant issues; innovation;</td>
<td>capacity develop; selectivity; innovation;</td>
</tr>
<tr>
<td><strong>World Wide Social Networks</strong></td>
<td>Alliance networks; Cultural differences between US and Sweden; student exposure; promotion of entrepreneurship among students;</td>
<td>Alumni; Promotion;</td>
</tr>
<tr>
<td><strong>Boundary Spanning Architectures</strong></td>
<td>Support of economic missions region; Cross collaboration with public and private site;</td>
<td>Co-creation; exchange;</td>
</tr>
<tr>
<td><strong>Physical Resources</strong></td>
<td>China's postgraduate; pre-proposal; offsite office;</td>
<td>Student; Education;</td>
</tr>
<tr>
<td><strong>Governance and Utilization</strong></td>
<td>Move to private sector; collaborative public/private strategy for institutional development; lack of transparency with innovation;</td>
<td>Strategy; Transparency;</td>
</tr>
<tr>
<td><strong>Property Rights</strong></td>
<td>Research Policies (proxy patents and licenses); China's postgraduate;</td>
<td>Intellectual;</td>
</tr>
<tr>
<td><strong>Processes</strong></td>
<td>Commercialization of research processes: strongly a minority of facilities; had clear processes;</td>
<td>Intellectual;</td>
</tr>
</tbody>
</table>

320
### Classified top tier cases: Canada

<table>
<thead>
<tr>
<th>General Factor</th>
<th>Specoding</th>
<th>Aidcoding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Teachers, students, technologies; many key entrepreneurial scientists (KES); strong pool of talent contributes to IP; high licensing and spin-off activity;</td>
<td></td>
<td>Research capacity; R&amp;D; Patenting;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capacity building;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge transfer;</td>
</tr>
<tr>
<td><strong>Worldviews/Networks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Presence of political and programmatic value propositions in multiple sectors; encourages engagement of entrepreneurs in different fields;</td>
<td></td>
<td>Perceived support;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Net influence;</td>
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<tr>
<td>- Structural advantages: large university systems;</td>
<td></td>
<td>Formal and informal networks;</td>
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<tr>
<td></td>
<td></td>
<td>Interdisciplinary knowledge;</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Boundary spanning and stakeholders</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Industry collaborations with Canadian and international companies;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Industry collaboration with Canadian and international companies;</td>
</tr>
<tr>
<td><strong>Physical Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Medical school clusters; high-tech companies; research parks; large research institutions;</td>
<td></td>
<td>Medically based clusters;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laboratory R&amp;D;</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Governance and Institutions</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Professional and informal activities;</td>
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<tr>
<td></td>
<td></td>
<td>- Regulatory and institutional structures;</td>
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<tr>
<td></td>
<td></td>
<td>- Key contributors:</td>
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<tr>
<td></td>
<td></td>
<td>- Funding mechanisms;</td>
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<tr>
<td></td>
<td></td>
<td>- Funding structures;</td>
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<td></td>
<td>- Financing mechanisms;</td>
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<tr>
<td></td>
<td></td>
<td>- Intellectual property;</td>
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<tr>
<td></td>
<td></td>
<td>- Intellectual property;</td>
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<tr>
<td></td>
<td></td>
<td><strong>Venture</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Investment process;</td>
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<td></td>
<td></td>
<td>- Investment process;</td>
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<td></td>
<td></td>
<td>- Investment process;</td>
</tr>
</tbody>
</table>

### Classified top tier cases: United States (A)

<table>
<thead>
<tr>
<th>General Factor</th>
<th>Specoding</th>
<th>Aidcoding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Professors, students, technologies; many key entrepreneurial scientists (KES); strong pool of talent contributes to IP; high licensing and spin-off activity;</td>
<td></td>
<td>Research capacity; R&amp;D; Patenting;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capacity building;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge transfer;</td>
</tr>
<tr>
<td><strong>Worldviews/Networks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Presence of political and programmatic value propositions in multiple sectors; encourages engagement of entrepreneurs in different fields;</td>
<td></td>
<td>Perceived support;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Net influence;</td>
</tr>
<tr>
<td>- Structural advantages: large university systems;</td>
<td></td>
<td>Formal and informal networks;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interdisciplinary knowledge;</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Boundary spanning and stakeholders</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Industry collaborations with Canadian and international companies;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Industry collaboration with Canadian and international companies;</td>
</tr>
<tr>
<td><strong>Physical Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Medical school clusters; high-tech companies; research parks; large research institutions;</td>
<td></td>
<td>Medically based clusters;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laboratory R&amp;D;</td>
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<td></td>
<td></td>
<td><strong>Governance and Institutions</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Professional and informal activities;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Regulatory and institutional structures;</td>
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<td>- Key contributors:</td>
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<td>- Funding mechanisms;</td>
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<td>- Funding structures;</td>
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<td>- Financing mechanisms;</td>
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<td></td>
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<td>- Intellectual property;</td>
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<tr>
<td></td>
<td></td>
<td><strong>Venture</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Investment process;</td>
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<td></td>
<td></td>
<td>- Investment process;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Investment process;</td>
</tr>
</tbody>
</table>

321
### Classified top tier cases: United States (B)

<table>
<thead>
<tr>
<th>Physical Resources</th>
<th>Nodal centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT resource richness researcher industry rather than govt funding local industrial composition: medical center; industry sponsored labs have sciences more expensive than social sciences to conduct research; research park incubators</td>
<td>Med center; Labs; FF Inc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Governance and Institutions</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies: exclusive licensing, royalty distribution to inventors; holding equity in SO; proseed stage investment; focus on for faculty to start ventures, patent roles of university resources for enhancing spin-off development smaller shares of inventor royalty returns; aligning resources with strengths:</td>
<td>Dept; seat of governance alignment; Recomp; B2C policy</td>
<td></td>
</tr>
<tr>
<td>Benefits: engagement of internal stakeholders; develop proper rewards and metrics; empower professionals and instill in private sector leadership; science idea competitions; monitoring programs; entrepreneurship incentives; distinctiveness and structure of scientific/professional communities (depts; research groups; institutes);</td>
<td>employee; flexibility; empowerment incentives;</td>
<td></td>
</tr>
<tr>
<td>institutional structures for generating innovation (displaced from the culture, norms and resource fights of others): the creation of new academic units to tackle new innovations; legitimization of new norms through changing institutional frames; affiliates programs;</td>
<td>Metrics;</td>
<td>Leadership</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property Rights &amp; Capital Management</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic access to capital: access to property rights: effectiveness of patents moderated by industry: licensees can be worked around to evade paying royalties: licenses have short royalty windows: portfolio patents breed versus patent block incomparability: patenting plays only a small role in technology transfer</td>
<td>Access to capital:</td>
<td>S0 vs. license:</td>
</tr>
<tr>
<td>Management</td>
<td>Patent strategies:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processes</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Process of discovering commercial opportunity in new technologies: Spinnoffs: equity process is found to provide returns quicker and capture value whether license provides royalties or not; proof of concept; prototypes; product development; venture funds; competitions; process of organizational adaptation to changes in society/market;</td>
<td>Equity spinoff process; Yielding proof of concept; market</td>
<td></td>
</tr>
</tbody>
</table>

### Classified top tier cases: Singapore

<table>
<thead>
<tr>
<th>Generic Factors</th>
<th>Open coding</th>
<th>Social coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resources</td>
<td>Key producer of human capital growth of research staff by 5% over 10 year period (half of all HE researchers in Singapore); entrepreneurship minor, new venture creation courses targeted at grad and PhD students; strong patenting faculty;</td>
<td>Labour costs; Capacity development; High quality research</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Worldviews/social Networks</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>International recognition for research and educational standards (top 200 in world; 4th in Asia; 22nd in world) promotion of cent through EEC; competitions; and EEC initiative on campus; NUS programs focus entrepreneurial mindset into students; NUS establishes life-long social networks in leading tech hotspots; world: US for 300 billion dollars; technology commercialization explicit goal of unit;</td>
<td>Prestige;</td>
<td>Promotion; Ent; Tech networks;</td>
</tr>
<tr>
<td>Boundary spanning and mandates</td>
<td>Institutional B2B through NUS programs bringing up to 50 graduate students from 25 units across the world;</td>
<td>X nap B2B; Ind B2B;</td>
</tr>
<tr>
<td>Physical Resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large regional manufacturing component to industry; growing high tech manufacturing industry and K intensive business services; rapid growth in research funding; Entrepreneurship center;</td>
<td>Industry/tech; EE center</td>
<td></td>
</tr>
<tr>
<td>Governance and Institutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key goals to globalize university: growing competition for faculty; students and resources; twin goals of local and global educational hubs; tenets and promotion policy aligned with US benchmarks; NOC (overseas) programs send best and brightest to work in high tech startup companies for one year; taking courses related to entrepreneurship through immersion and apprenticeship model (SO students to 6 locations/year); policy change; in 2000 to encourage spinoffs; enterprise cluster approach;</td>
<td>Global/local strategy; Ent cluster policy;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property Rights &amp; Capital Management</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In terms of patenting intensity, NUS exceeds several OECD countries; seed fund programs;</td>
<td>Seed; Intensity;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processes</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Globally focused competency and entrepreneurial development processes; spinoffs, education</td>
<td>Transition; spinoff creation</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Semi-structured interview questions:

Overview (to focus the key informant upon the research problem)

This section is to be read verbatim to the interviewee. Inform the interviewee that it will draw focus onto the issues to be discussed.

I am researching entrepreneurship and innovation as practiced within the university context. I am focusing particularly on the processes used within the university system to commercialize research and interface with industry. I intend to study in depth, the characteristics of these systems across six universities in three nations. My goal is to analyze the key features, both good and bad, with the intent of designing an improved model that will be of use to many universities throughout the world.

At this point, you should state these points:

- Most universities that are studied are the exemplars and are currently at a well progressed stage along the evolutionary path for doing commercialization and innovation
- We want to study universities that are not as far advanced along the developmental and experiential path and compare the processes, contexts and systems with those that are to see if models from high performing universities further down the pathway can be transposed upon those not as far advanced. The research will test this and synthesize a new model for developing a set of facilitation tools that are both context specific and that are general in nature.

Introductions
First of all I’d like to find out a little bit about you. I am interested in entrepreneurship, innovation and commercialization at <name> university. Let’s call that “X” for now. These terms are all unique but interlinked, so feel free to pull out any one of them to speak to specifically if you wish at any time. We are interested in knowing how you define these concepts. The interviewer may also ask questions specifically about any one of these terms individually during the interview process as well.

I’m interested to know more about how the system works so I can try my hand at making it a bit better. Here’s the first question:
1. Tell me a little bit about your background, education, prior experience and your relationship(s) to the university and how it relates to ‘X’.

Three big questions:
I am interested in understanding some key features of <name> university system for ‘X’ from your perspective. What’s best about it what’s worst about it and what’s the one thing you would do to make it better? You can start with the best or the worst, entirely up to you.
2. What would you say is the worst feature of the system?
3. What would you say is the best feature of the system?
4. What is the one thing you would do to improve the system?

Drawing the system
I’m going to make you an artist now.

5. I want you to draw the system for ‘X’ from your perspective in any way you’d like. We are interested in understanding the processes in as much detail for entrepreneurship, innovation and commercialization as possible. Explain to me what you’re drawing as you draw it. Can you offer any suggestions to make it better? Point out any of the distinct processes that you have outlined that you deem are entrepreneurial.

You can tell them to map the steps, processes and people involved, and or draw a flow chart, or draw it any other way that they think may be helpful to our understanding of his viewpoint.

**Your evaluation of the system as whole.**

6. Would you call what you’ve just drawn an entrepreneurial system? (should it be? You want to gauge their interpretation of what they have drawn here)
7. In your experience, is the university a good place to be doing ‘X’ in?
8. How would you define success in ‘X’ for this university system (or any university system);
9. Is there anything else that you think I should know about X?

**Individual questions about entrepreneurial evaluation of opportunities.**

This question can be prefaced by the following:

*There are two ways that we define entrepreneurship:
- The first involves the creation of a new venture to create value and involves organizing. It focuses on ‘emergence’ as both necessary and sufficient for defining the process of entrepreneurship.
- The second involves the creation, identification or discover of opportunities, their evaluation, and the eventual exploitation of these opportunities that have economic value, that may or may not involve a new venture and ‘emergence’. In this sense, entrepreneurship can be engaged within corporations, institutions, etc, without the act having to lead to the creation of a new venture. Opportunity is also a very nebulous term, and can consist of ideas, new knowledge, and can be a dynamic process.*

10. We are interested in how entrepreneurs evaluate opportunities. Please describe the processes and steps that you have used in the past to evaluate opportunities. Try to use as much detail as possible. Have these processes changed over time? How so? Discuss examples if necessary to provide specific details.

You are looking for the following:
- If the individual states that he has an intuitive ability to see a good opportunity, ex ante. You can probe using the following question if you do not think it is revealed in the data:
  - **ASK:** How much do you weight your ability to evaluate an opportunity using just intuition and a small amount of information?
- If the individual talks about passion, emotion or other things other than profit that drive evaluation processes, and whether or not the individual evaluates other non-monetary considerations such as personal time with family, stress, long hours, etc.
  - **ASK:** Does affect (or emotion) influence your ability to evaluate opportunities? If so, how, so?
- If the individual uses networks or talks to people to get other opinions when evaluating. Look for issues such as trust, kinds of expertise these people possess etc.
  - **ASK:** How much do you weight talking to other people as a tool when evaluating an opportunity?
- Whether or not they evaluate using a business model, how much they weight its importance and whether it they view business models as static (a business plan) or
dynamic (constantly changing). Make sure that you preface the ask with business
models are very different than business plans, as business plans are static, written
documents.

  o **ASK**: How much do you weight the business model as a tool for evaluating
    an opportunity? Do you use more formal and structural models, or are
    they less formal and unstructured.

  o We are interested in determining if the evaluation process is recursive or not. If they
talk about constantly assessing, evaluating along several different steps this is a
positive result. If not, this is a negative result. You can prompt this by asking the
following:

    o **ASK**: When you are evaluating an opportunity, is it just a one time thing, or
      is it continuous? Explain? Where and when are you evaluating?

  o Lastly, you are looking for how their past experience has influenced their evaluation
capacity. Prompt by asking:

    o **ASK**: Do you feel that you are better at evaluating entrepreneurial
      opportunities now, than at (some other period in your life before)? How
      so? What do you do differently?

FINAL QUESTION: **ASK**: Do you feel that you are an entrepreneur? Why or why not?

Thank you.
Appendix C

Mind maps taken from key informants at the University of Southern Denmark

Key informant #12 Industry Expert
Key informant #15: Faculty researcher

![Diagram](image-url)
Appendix D

External Invitation to Participate in Research Information Statement
and Informed Consent Form

Faculty of Business and Enterprise
Australian Graduate School of Entrepreneurship
Swinburne University of Technology
PO Box 218, Hawthorn
Melbourne Victoria 3122
AUSTRALIA

November XX, 20XX

Dear,

Project: Entrepreneuring at Universities

Thank you for agreeing to participate in this research project concerning entrepreneuring at university. The PhD study is being conducted by Mr Peter W. Moroz under the supervision of Professor Kevin Hindle of the Australian Graduate School of Entrepreneurship, Swinburne University of Technology in Melbourne, Australia and Professor Robert Anderson of the University of Regina, in Canada. Six universities from three countries, Australia, Denmark and the USA, are being approached to participate.

This interview will take approximately 1 hour and will be audio-taped. The questions I will ask are directly related to the objectives of the research listed below:

 Identify and understand the ideal internal and external environmental factors that are likely to influence entrepreneurial value creation and innovation within average sized universities looking to move to an entrepreneurial paradigm.
 Attempt to develop a comprehensive analytical framework for understanding and analyzing the environment that is conducive for creating and developing entrepreneurship at university with the objective of increasing the innovation performance of the institution and region.
 Provide a practical framework for effectively creating, implementing and evaluating entrepreneurship within average sized universities with respect to embracing an entrepreneurial paradigm.

Before we begin, I will ask you to sign the Informed Consent Form which provides participants with a choice of levels of anonymity, confidentiality and privacy. All data will be dealt with according to the requirements of the Swinburne Policy on the Conduct of Research.

Should you require any further information about this project, please do not hesitate to contact me on ph: +1-306-343-3384 (CANADA) or by email at pwmoroz@swin.edu.au. My Co-ordinating Supervisor can be contacted at: khindle@swin.edu.au.

Yours sincerely,

PETER W. MOROZ
PhD Candidate

HINDLE, KEVIN
Co-ordinating Supervisor

ROBERT ANDERSON
Associate Supervisor

This project has been approved by or on behalf of Swinburne’s Human Research Ethics Committee (SUHREC) in line with the National Statement on Ethical Conduct in Research Involving Humans.

If you have any concerns or complaints about the conduct of this project, you can contact:

Research Ethics Officer, Swinburne Research (H65),
Swinburne University of Technology, P O Box 218, Hawthorn, Melbourne, Victoria, AUSTRALIA, 3122.
Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au

INFORMED CONSENT TO PARTICIPATE IN RESEARCH
PLEASE READ AND SIGN:

 I have read and understood the project information statement.
 All questions about the research have been answered to my satisfaction.
• My participation in the research is voluntary.
• I agree that the data collected may only be used for the purposes stated above.
• I understand that I may withdraw from the research at any time and all the information I have provided will be destroyed.
• I agree that the interview can be audio recorded and that a transcript may be made of the recording.
• I agree to answer the questions understanding that the answers to some questions may provide personal information that makes me identifiable.
• I agree that transcripts of the interviews will eliminate the names of individuals, organisations or places to ensure anonymity, confidentially and privacy of myself and others.
  YES  X
  NO   X
or
• I agree that personal information or direct quotes will not be published without my approval of the final text.
  YES  X
  NO   X

* or
• I agree that my name and the name of my affiliations may be used in publications about this research and personal information or direct quotes will not be published without my approval of the final text.
  YES  X
  NO   X

Participant:
Family Name (Please print).............................................., First Name(Please print):..........................
Signature................................................................. Date ...........................
Contact details Email.............................................................................................................................
Mail Address...........................................................................................................................................

Researcher:
Family Name (Please print).............................................., First Name(Please print):..........................
Signature................................................................. Date .............................

Please keep a copy of this Information Statement and Informed Consent Form for your records.
Appendix E

These tables summarize the raw structured coding that emerged from the key informant interviews of the multiple case study analysis of USD.

<table>
<thead>
<tr>
<th>Source/Domain</th>
<th>Content/Category</th>
<th>Properties of Source/Content Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resource</td>
<td>Important resources for innovation</td>
<td>Internal recruitment of dynamic students</td>
</tr>
<tr>
<td></td>
<td>Important resources for innovation</td>
<td>Skills-based community building</td>
</tr>
<tr>
<td></td>
<td>Important resources for innovation</td>
<td>Experience in applied research</td>
</tr>
<tr>
<td></td>
<td>Important resources for innovation</td>
<td>Utilize research built upon industry research funding</td>
</tr>
<tr>
<td></td>
<td>Important resources for innovation</td>
<td>Students find it easier to transition (not relying on USD)</td>
</tr>
<tr>
<td></td>
<td>Important resources for innovation</td>
<td>Open to fluid training</td>
</tr>
<tr>
<td></td>
<td>Important resources for innovation</td>
<td>Life cycle between students and USD</td>
</tr>
<tr>
<td></td>
<td>Important resources for innovation</td>
<td>Students viewed at Morse for employees, understood internally</td>
</tr>
<tr>
<td>Facility research</td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Commercial faculty staff</td>
</tr>
<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Increased problem solution focus higher quality faculty</td>
</tr>
<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Professional research teams focused on open ended and diverse</td>
</tr>
<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Faculty/industry have entrepreneurial opportunities</td>
</tr>
<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Forwards commercialization of results (pipeline)</td>
</tr>
<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Outsourcing for patent parsing</td>
</tr>
<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Social science and humanities left out of innovation activities (grant structures)</td>
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<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Faculty research outside standard that is valuable in creative fields (law)</td>
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<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Analytical entrepreneurship, not risk</td>
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<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Multiplicity not incentivized at USD</td>
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<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Applied research more</td>
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<tr>
<td></td>
<td>Facility research quality goal in student/multi-disciplinary</td>
<td>Life sciences for USD these professional academics</td>
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<tr>
<td>Intellectual property</td>
<td>Intellectual property capacity or tech transfer community</td>
<td>Few examples of commercial entrepreneurship among</td>
</tr>
<tr>
<td></td>
<td>Intellectual property capacity or tech transfer community</td>
<td>Lack of dedicated entrepreneurship experience</td>
</tr>
<tr>
<td></td>
<td>Intellectual property capacity or tech transfer community</td>
<td>Faculty and community entrepreneurship often weak around system</td>
</tr>
<tr>
<td></td>
<td>Intellectual property capacity or tech transfer community</td>
<td>Few high-level entrepreneurs</td>
</tr>
<tr>
<td></td>
<td>Intellectual property capacity or tech transfer community</td>
<td>Technological depth of linking with academic and business worlds, often far beyond faculty striking out into business services venues</td>
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<tr>
<td>TTO Agent Prior to Innovation Utility</td>
<td>Content and protection formalized</td>
<td>Underestimated</td>
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<tr>
<td></td>
<td>Content and protection formalized</td>
<td>Strong ability to legal and advice to protect intellectual property</td>
</tr>
<tr>
<td></td>
<td>Content and protection formalized</td>
<td>Peremptory</td>
</tr>
<tr>
<td></td>
<td>Content and protection formalized</td>
<td>Empower</td>
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<tr>
<td></td>
<td>Content and protection formalized</td>
<td>Entrepreneurial capacity to pursue all intellectual</td>
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<tr>
<td></td>
<td>Content and protection formalized</td>
<td>Life in co-located transfer services</td>
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<tr>
<td>Limited number of changestreams</td>
<td>Reduced in practice</td>
<td>Increased rigor research norms increase TTO’s</td>
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<tr>
<td></td>
<td>Reduced in practice</td>
<td>Strong leadership that drive change</td>
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<tr>
<td></td>
<td>Reduced in practice</td>
<td>Formal mechanisms here life to drive change</td>
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<td></td>
<td>Reduced in practice</td>
<td>Vaccine as grid</td>
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<tr>
<td></td>
<td>Reduced in practice</td>
<td>Geographically and not community driven</td>
</tr>
<tr>
<td></td>
<td>Reduced in practice</td>
<td>Often a more specialized than monoculture</td>
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<tr>
<td></td>
<td>Reduced in practice</td>
<td>Frequently has more creative and exploratory outside of other universities</td>
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<tr>
<td></td>
<td>Reduced in practice</td>
<td>Transfer via case studies shared</td>
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<tr>
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<td>Reduced in practice</td>
<td>Enterprise culture developed</td>
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<tr>
<td></td>
<td>Reduced in practice</td>
<td>Interdisciplinary and compatible to community</td>
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<td>Reduced in practice</td>
<td>Support is related to work against disciplinary system</td>
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<tr>
<td></td>
<td>Reduced in practice</td>
<td>Interdisciplinary and cross-function in effect change</td>
</tr>
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<td>Reduced in practice</td>
<td>Empower community driven</td>
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<thead>
<tr>
<th>Intellectual Property</th>
<th>Intellectual Property can be developed and research value</th>
<th>Fiduciary weak stewardship</th>
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<td>Intellectual Property can be developed and research value</td>
<td>Culture for applied research and limited in extending if</td>
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<tr>
<th>Total network: lack of expertise</th>
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<th>Multinational are limited in communication, shared</th>
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<tbody>
<tr>
<td></td>
<td>Total network: lack of expertise</td>
<td>Factors on multinational: propriety of research, limited contact with industry,</td>
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<td></td>
<td>Total network: lack of expertise</td>
<td>Weak trust and structural friction with international network</td>
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<td></td>
<td>Total network: lack of expertise</td>
<td>Increasing need for knowledge - greater value embedded in academic, Silicon,</td>
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<td></td>
<td>Total network: lack of expertise</td>
<td>Benchmarking in trust for intellectual property and its definition of ESP</td>
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<td>Total network: lack of expertise</td>
<td>Factors on multinational of research and community</td>
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<tr>
<th>Entrepreneurs as multi-entrepreneurs</th>
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<th>Competitive risk-taking culture on campus that is different from TTO’s</th>
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<td></td>
<td>Entrepreneurs as multi-entrepreneurs</td>
<td>Entrepreneurial philosophy that is different from TTO’s</td>
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<th>Fragile resource-based scales</th>
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<th>Mergers with banks and financial institutions</th>
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<th>Traditions of research</th>
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<th>Education and training in offshore overlays</th>
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<tr>
<th>Innovations difficult</th>
<th>Innovations difficult</th>
<th>Open to innovation by industry and entrepreneurs</th>
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<tr>
<th>Reputation – prestige control</th>
<th>Reputation – prestige control</th>
<th>Reputation for good research highly important</th>
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<tbody>
<tr>
<td></td>
<td>Reputation – prestige control</td>
<td>Reputation for good research highly important</td>
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<td>Reputation – prestige control</td>
<td>Reputation for good research highly important</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Project Stage &amp; Capital Management</th>
<th>Barrier for patenting</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment of research contracts</td>
<td>Lack of research capital in universities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Government funding and firms contracts signed but define scope of collaboration</td>
<td></td>
</tr>
<tr>
<td>Lack of seed capital and development grants</td>
<td>Small development/discovery funds with no strings attached</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Often require seed capital, environment is region or geographic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low funds allocated, public, low level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Creation of university business VC funds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stages, prototyping, and proof of market ready</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VC funds have difficulty linking with university co-investors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Legislative barriers to university involvement in IPR's</td>
<td></td>
</tr>
<tr>
<td>IP protection over dead sidelines</td>
<td>Clear policies on IPR rights provided by government or through university policy</td>
<td></td>
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<tr>
<td></td>
<td>Research collaboration often legal negotiation of IPR rights and control</td>
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<td></td>
<td>Tech transfer firm and the deal on valuation</td>
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<td></td>
<td>Overemphasis on patent science IPR protection</td>
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</tr>
<tr>
<td></td>
<td>Not wanting or winning IPR's is degree for patent value and shows up by university</td>
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<tr>
<td>Processes</td>
<td>Capacity development processes</td>
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<tr>
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<td>Entrepreneurial processes</td>
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<td>Specific outcomes</td>
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<td>Entrepreneurial capacity building</td>
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<td>Research capacity building</td>
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<td></td>
<td>Integrated with knowledge management processes</td>
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<tr>
<td></td>
<td>Entrepreneurial not well-tuned with evaluation process</td>
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<tr>
<td></td>
<td>Formal evaluation at senior stage (patent wording, prototype interface with industry, product/service evaluation)</td>
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<tr>
<td></td>
<td>Technology approach</td>
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<td></td>
<td>Decision process, communication, value to financing</td>
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<tr>
<td></td>
<td>Patent/IP Commercialization process</td>
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<tr>
<td></td>
<td>Non-I/P based processes</td>
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