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UNIVERSITY SPINOUTS: AN ESCALATION OF COMMITMENT AND ORGANISATIONAL LEARNING PERSPECTIVE

By
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This thesis is submitted for the degree of Doctor of Philosophy of the University of London and for the Diploma of Imperial College London

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DECLARATION

I declare that this thesis for examination of the PhD degree for the University of London is solely my own work, other than where I have clearly referenced the work of others.



Harveen Chugh

ABSTRACT

This study focuses on the development of university spinouts. The aim of this study was to build theory on how the failure to raise venture capital affects spinout development. This study contributes to theory by: (1) introducing the role of learning as a mediator between feedback and how an organisation responds to feedback by adapting its behaviour or goal; and (2) integrating organisational learning and escalation of commitment theories.

A qualitative methodology was utilised in this study. This enabled a small sample of university spinouts to be studied in depth using a multiple case study design. A process and longitudinal design allowed spinout development to be captured over a two year period. During the theory building process, this study employed the escalation of commitment and organisational learning theoretical perspectives from existing literature.

The findings showed university spinouts that fail to raise venture capital receive feedback from venture capitalists that can be classified into three types: (1) Type A - Inconsistent; (2) Type B - Consistent and workable; and (3) Type C - Consistent and unworkable. Spinouts that received Type A or Type B feedback adapted their behaviour i.e. escalated commitment to raising finance. Spinouts that received Type C feedback adapted their goal i.e. exited. The spinouts' actions (behaviour or goal adaptation) based on the feedback from venture capitalists was mediated by single-loop learning and inhibited double-loop learning respectively.

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ABBREVIATIONS

AUTM	The Association of University Technology Managers
BVCA	British Venture Capital Association
FY	Financial Year
IP	Intellectual Property
IPO	Initial Public Offering
MIT	Massachusetts Institute of Technology
TTO	Technology Transfer Office
UNICO	The University Companies Association
VC	Venture Capital
VCs	Venture capitalists

1 INTRODUCTION

1.1 Introduction to University Spinouts

University spinouts are companies formed to commercialise intellectual property developed within a university. They are a unique set of companies that differ from the average start-up company because they rely on cutting edge technology and are formed at a very early stage (Shane, 2004, p.173). There are five key reasons university spinouts are important: (1) they contribute to local economic development by providing an important source of jobs; (2) they are a mechanism for commercialising university technology; (3) they help universities achieve their research and teaching missions by providing financial support for university research; (4) they are extremely high performing companies and are more likely to reach an IPO than the average company; and (5) they have the potential to generate more income for the university than licensing the technology to an established company can generate (Shane, 2004).

There is a growing interest in university spinouts and they are becoming a significant global phenomenon (Shane, 2004, p.1). Both the US and UK have experienced strong growth in spinout activity since the 1980's and 1990's respectively. An emphasis has also recently been placed on universities in Asia and Europe to create spinouts with a view to driving economic growth (Shane, 2004, p.1). In Asia for example, Japanese academic institutions are now required to 'make a contribution to society' in addition to research and teaching (Atun et al., 2007). In Europe, the

university spinout phenomenon is still relatively new and universities are still in the process of creating good rules for practice (Djokovic & Souitaris, 2007).

Universities that are active in technology transfer hope they will spinout the next success story such as Google (from Stanford University, US) or Ceres Power (from Imperial College London, UK). Such spinouts bring great credence to the parent university along with financial benefits from the spinouts' success (Wright et al., 2004a). In the quest to achieve such success, university spinout formation has increased in the last few years (Franklin et al. 2007; Wright et al., 2004a). In fact, the creation of successful university spinouts is now a major policy objective of governments and universities (Wright et al., 2006; Di Gregorio & Shane, 2002; Wright et al., 2004a; Lockett & Wright, 2005).

In the late 1990's, there was an emphasis on spinout creation in the UK and the number of spinouts created rose sharply between 1996 and 2001[1] (Lambert, 2003; Wright et al., 2002; Franklin et al. 2007). 554 spinouts were formed during this period (Wright et al., 2002). Data from the top 36 UK research universities shows spinout creation reached a peak in 2001 and has since declined (Franklin et al. 2007; BVCA & Library House, 2005). Spinout creation fell from 2001 to 2003 and the most recent data available for 2004 shows spinout creation has increased again (BVCA & Library

[1] This rise in spinout formation from 1996-2001 in the UK has been consistent with an increase in research on university spinouts (Djokovic & Souitaris, 2007).

House, 2005; UNICO[2], 2003-05; Wright et al., 2002). Data for US universities (from AUTM[3]) for spinouts formed from 2001 to 2004 follows the same trend. Table 1.1 shows the number of spinouts formed in the UK and US for the years 2001 to 2004. The table includes the number of spinouts formed in the US in 2005; however the equivalent data for the UK is not yet available[4].

Table 1.1 Number of spinouts formed in UK and US from 2001 to 2004 / 05

FY	UK	US
2001	175 (Wright et al., 2002)	426 (AUTM, 2005)
2002	158 (UNICO, 2003)	401 (AUTM, 2005)
2003	151 (UNICO, 2004)	374 (AUTM, 2005)
2004	229 (UNICO, 2005)	462 (AUTM, 2005)
2005	*Not available*	628 (AUTM, 2006)

1.1.1 Spinout Quantity vs. Quality

The number of spinouts created by a university is often hailed as an achievement to imply their success in technology transfer. However, in a report to the

[2] UNICO is 'The University Companies Association.' It is a support network for technology transfer professionals in the UK. They carry out an annual survey of university technology transfer in the UK.

[3] AUTM is the Association of University and Technology Managers. It is a network of technology transfer professionals in the US. AUTM surveys include data on spinouts from hospitals and research institutes in the US.

[4] This data was not available by the date the thesis was submitted.

UK government (2003), Richard Lambert[5] raised the issue of whether the number of university spinouts formed had taken precedence over quality and questioned their sustainability. Minshall & Wicksteed (2005) carried out a pilot study to try and gain an understanding of this issue of quality. They recommended university spinouts should be tracked in their early stages to understand this issue. The debate of 'quantity versus quality' is also highlighted by Djokovic & Souitaris (2007) as an important area for future research to understand success of university spinouts.

Although spinout formation is often commended, the US licensing survey (AUTM) provides a reality check by reporting the number of spinouts that become non-operational[6] in each financial year (FY). 142 spinouts are reported as becoming non-operational in FY 2002 (AUTM, 2003); 133 in FY 2003 (AUTM, 2004); and 92 in FY 2004[7] (AUTM, 2005). In the UK, Binks et al. (2004) reported 14 failures / liquidations of university spinouts in FY 2002. As Wright et al. (2007, p.3) simply state, '...the act of creating a company does not necessarily mean that it will subsequently create capital gains or income. There is, therefore, a major need to understand the spinout creation process...' This raises the question of how the success of university spinouts should be measured.

The success of university spinouts is often measured by those that achieve an IPO (Wright et al., 2007; Shane, 2004, p.255). However, this is a long-term measure

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[5] Richard Lambert is a member of the Bank of England's Monetary Policy Committee.

[6] The UK University Commercialisation Report (UNICO) does not report how many spinouts became non-operational.

[7] The number of spinouts that became non-operational in 2005 was not included in the AUTM (2006) Survey Summary.

and not all spinouts reach an IPO. A measure of success that occurs at an earlier stage in a spinout development is the success in raising finance. The ability of a spinout to attract external private equity should be used to judge its quality (Lambert, 2003, p.60). The success of raising external equity finance signals there is market interest in the company (Wright et al., 2002; Shane, 2004, p.255). It also indicates investors have undertaken due diligence procedures, screened and assessed the venture, thereby validating the quality of the technology, management team and market opportunity (Wright et al., 2002). Conversely, an inability to raise finance is the biggest reason that spinouts are abandoned (Shane, 2004, p.224). The success or failure of raising finance therefore provides a method of assessment for the quality of university spinouts.

1.1.1.1 Research Question

In this study, spinout quality is assessed in terms of a spinout's ability to raise venture capital[8]. Venture capital is important to new ventures for four reasons: (1) it provides them with the cash they need to develop technology and create a viable market position (Shane, 2004, p.254; Pearce & Barnes, 2006, p.5); (2) it marks a key milestone in their development (Shane & Stuart, 2002; Shane & Cable, 2002); (3) it signals their legitimacy (Shane, 2004, p. 255; Rothaermel & Thursby, 2005); and (4) it is a strong indication of future success as it decreases the probability of failure and increases the probability that a company will reach an IPO (Shane & Stuart, 2002).

[8] Venture capital is defined as a professional fund that invests cash in high risk start-ups, in return for equity with the aim of generating substantial capital gains (Pearce & Barnes, 2006, p.6).

In this study, the focus is on the development of university spinouts that fail to raise venture capital. Although university spinouts provide a strong source of deal flow for venture capitalists (Franklin et al., 2007), they still find it difficult to raise venture capital and this is a major hurdle in their development (Wright et al., 2006). For example, of 135 investment proposals made by early stage university spinouts in 2002, only 18 were successful in raising venture capital (Binks et al., 2004). *This study essentially asks what happens to the university spinouts whose investment proposals are rejected i.e. what happens to university spinouts that try, but fail to raise venture capital - how does their development continue?*

1.1.2 Methods and Theoretical Perspectives

To explore how the failure to raise venture capital affects the development of university spinouts, a qualitative research methodology was adopted in this study. Data collection took place in three phases over three years and was collected from multiple sources of evidence (Yin, 2003). Phase 1 consisted of a preliminary round of interviews. This phase was carried out to gain an understanding of how the spinout process operated at different universities and how best to undertake the main study. Phases 2 and 3 comprised the main study. In the main study, data was captured on the development of a small sample of university spinouts through a multiple case study design (Yin, 2003). This also involved a process (Pettigrew, 1997) and longitudinal research design that enabled the data to be captured over two years. The sample included six university spinouts from Imperial College London that formed between 2000 and 2002 and were all biotechnology companies. When data collection began,

the spinouts either planned to or had already started the process of trying to raise venture capital. In total, from phases 1, 2 and 3, data was collected from 60 interviews (lasting approximately 50 hours) and generated 1375 transcript pages. The documents and archives collected gave a total of 1127 pages.

To build a theoretical explanation of how the failure to raise venture capital affects university spinout development, I took a theory building approach. During this process, the data was linked to two theoretical perspectives from the organisational theory literature:

(1) Escalation of commitment (Staw, 1976; Staw & Ross, 1978)

(2) Organisational learning (Argyris & Schön, 1978; Cyert & March, 1963).

The method by which the data was linked to these theoretical perspectives is explained in detail in Chapter 3. The escalation of commitment theoretical perspective explains how organisations behave following a negative outcome from a course of action. Although one might expect behaviour to change, an escalation of commitment occurs when further resources are committed to make the course of action pay off (Staw, 1976; Staw, 1981). The organisational learning theoretical perspective taken in this study stems from the behavioural theory of the firm (Cyert & March, 1963). This takes the view that an organisation is an adaptive system and learns by adapting its behaviour over time (Cyert & March, 1963, p.172). Within the organisational learning literature, there are a number of different perspectives that are presented in the literature review (Chapter 2). The perspective of organisational learning employed in this study is based

on the work of Argyris & Schön (1978, 1996). They argue organisational learning is a process of detecting and correcting error that allows an organisation to continue with, or modify their goals or objectives. The theoretical perspectives of both escalation of commitment and organisational learning were employed in this study to help explain the findings.

The theory built in this study is largely presented towards the end of the thesis (Chapter 4 - Results & Analysis; and Chapter 5 - Discussion & Conclusion). However, to provide orientation towards the findings, I present the literature on the two theoretical perspectives in Chapter 2 (Literature Review & Theoretical Perspectives). This method of presenting the study follows the model used by Pratt et al. (2006) in a recent article.

Pratt et al. (2006) carried out a qualitative and longitudinal study on professional identity construction in the medical profession context. The aim of their study was to 'build and enrich theory about how professionals construct their own professional identities' (Pratt et al., 2006, p.236). They identified three literatures (careers and role transitions, socialisation, and identity work) as helpful in understanding the identity construction process. They found one of three theories alone could not explain the findings, but the three theories together helped to explain their findings (Pratt et al., 2006). For this reason, the theory they built was presented towards the end of their article where they could provide an explanation. However, they provided a review of the three streams of literature on identity construction at the start of their study to help orientate readers towards the findings (Pratt et al., 2006). Similar to the approach taken by Pratt et al. (2006), this study took a theory building

approach and involved the use of two theories, as one theory alone could not explain the findings. For this reason, the literature on the two theories employed in this study is presented in Chapter 2. Arranging the study this way is also supported by Gephart (2004, p.460) who argues qualitative studies often appear mysterious if they only provide a literature review at the end of the study.

1.2 Summary of Theoretical Contributions

This study makes two theoretical contributions. First, it introduces the role of learning as a mediator between feedback and how an organisation responds to feedback by adapting its behaviour or goal. This finding contributes to organisational learning theory. Specifically, it contributes to the organisational learning literature on how organisations adapt their behaviour or goals based on performance feedback. Second, it integrates the organisational learning and escalation of commitment theoretical perspectives. This shows the use of these two theoretical lenses help to explain a part of the spinout development process.

1.3 Organisation of this Thesis

This thesis is organised in the following way. Chapter 2 (Literature Review & Theoretical Perspectives) is presented in two parts. The first part provides a review of the literature on university spinouts and leads to the research question. The second part provides literature reviews for the two theoretical perspectives (escalation of commitment and organisational learning) employed in the analysis of this study. The

two parts of this chapter are linked by an explanation of why the two theoretical perspectives were considered relevant and therefore employed in this study.

Chapter 3 (Methodology) describes and explains the methodological techniques employed in the study. The techniques are presented in five key sections: (1) research paradigm; (2) research design; (3) sample; (4) data collection; and (5) data analysis and theory building. The data analysis and theory building process is described in four steps (Step 1: Coding; Step 2: Within-case analysis; Step 3: Cross-case analysis; and Step 4: Construction of theoretical propositions). Step 4 includes an explanation of how the data was linked to the two theoretical perspectives.

Chapter 4 (Results & Analysis) first presents the findings from data collected in phase 1 that informed the research design for data collection in phases 2 and 3. The findings for phases 2 and 3 (the main study) are then presented in three parts. First, the results and analysis begin with a summary of the escalation of commitment and organisational learning theoretical perspectives and the measures used to interpret the data. Second, the findings are presented in the form of a process model of spinout development. Third, a detailed analysis of the results is presented using the two theoretical perspectives. This leads to the development of theoretical propositions.

Chapter 5 (Discussion & Conclusion) discusses the significance of the findings in detail and makes two theoretical contributions to organisational theory, a third contribution to the entrepreneurship literature and a fourth contribution to the venture capital literature. The study is concluded with a discussion of the implications for policy and practice, limitations and suggestions for future research.

2 LITERATURE REVIEW & THEORETICAL PERSPECTIVES

2.1 Introduction

The literature review for this study is presented in two parts. The first part (Section 2.2) reviews the literature on university spinouts and leads to the research question. The second part (Section 2.3) reviews the two theoretical perspectives employed in the analysis of the results (escalation of commitment and organisational learning). Although these theoretical perspectives are not utilised until the results and analysis of the study (Chapter 4), the literature reviews are presented here to provide orientation towards the findings. This follows the model used by Pratt et al. (2006) and is also supported by Gephart (2004). The layout of the study by Pratt et al. (2006) is discussed further in Section 2.3.

2.2 University Spinouts

The review of literature on university spinouts begins with an introduction to university technology transfer and spinouts. This is followed by five main sections: (1) a review of university spinouts definitions; (2) explanations for differences in formation rates; (3) a review of the existing models of spinout creation and development; (4) a framework for analysis of the key roles in the spinout process (based on Roberts & Malone, 1996); and (5) a review of literature on spinout performance. Lastly, the review is summarised and this leads to the research question.

2.2.1 Introduction to University Technology Transfer and Spinouts

University technology transfer is the process of transforming university research into marketable products (Powers & McDougall, 2005; Pries & Guild, 2007). The transfer of this technology can occur via two main routes (Colwell, 2002; Powers & McDougall, 2003; Roberts & Malone, 1996). One route is by licensing the technology to an existing company (Harmon et al., 1997; Colwell, 2002). The second route is by creating a spinout. This involves transferring a core technology from the university into a new company (Nicolaou & Birley, 2003a). When the licensing route is taken, the university receives royalties and when a spinout is created, the university gains an equity stake (Siegel at al., 2003). Some universities are more focused on one method of technology transfer than the other overall or at different times (Siegel et al., 2001). This depends on what the goals of the university are. For example, when the aim is to achieve a higher financial return, then it is more advisable for the university to take equity (Bray & Lee, 2000; Feldman et al., 2002; Wright et al., 2004b). Other advantages of spinouts over licensing are: (1) it gives the university access to the spinout's future income stream; (2) it helps align the goals of both university and the spinout towards commercialising the technology; and (3) it signals the university is entrepreneurial to the outside world and indicates they have confidence in the spinout (Feldman et al., 2002). The university however, may not always have a choice as the route may be dictated by the technology or the circumstances (Roberts & Malone, 1996). Of the two routes by which university technology transfer may occur, this review focuses on university spinouts.

In both the UK and US, university spinout activity changed significantly following changes in legislation. In the UK, this occurred in 1985 when the government granted the rights of commercialisation of technology previously held by British Technology Group (BTG) back to universities (Etzkowitz et al., 2000). This enabled universities to generate income and contribute to wealth creation and was a turning point for the activity of the entrepreneurial university in the UK (Etzkowitz et al., 2000). Consequently, when BTG was privatised in 1992, their activities of providing finance to academics for developing technology in institutions ceased (Roberts & Malone, 1996). In the US, the change in law occurred in 1980 with the introduction of the Bayh-Dole Act, which gave intellectual property ownership to universities. However, unlike the UK where there was no formal requirement for university faculty to disclose inventions, US universities were obligated to make an effort to commercialise the rights they held[9] (Chapple et al., 2005; Etzkowitz et al., 2000). The rise in university spinout activity in both the UK and US is also attributed to the growing importance of life sciences research, especially biotechnology at the same time. This occurred in the US in the 1970s and in the UK in the 1980s (Stankiewicz, 1994; Colyvas et al., 2002; Rogers et al., 2001).

Research into university spinouts began to grow in the late 1960's following Roberts & Wainer's (1968) first observation of the spinout phenomenon in 1964 (in the US). They observed spinouts forming from MIT and locating on Route 128[10] in

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[9] Debackere and Veugelers (2005) point out that the Bayh Dole Act has rarely had to be enforced.

[10] Route 128 is a motorway around the Boston-Cambridge area (Roberts & Wainer, 1968).

Boston and found these companies had a lower failure rate than was expected for new companies in the US. Cooper (1971) observed a similar phenomenon in San Francisco and highlighted the role of the originating organisation such as the university in spinout creation. The rise in university spinout creation in the late 1990s has also caused a recent increase in spinout research (Djokovic & Souitaris, 2007). However, although research into spinouts has grown, the level of academic investigation into this subject is virtually non-existent and comprises only a handful of research on the topic (Shane, 2004, p.2).

There have been a number of recent efforts to synthesise the research on the topic and provide the field with guidance and direction for future research e.g. Shane (2004), Rothaermel et al. (2007), Djokovic & Souitaris (2007) and O'Shea et al. (2007a). Among these studies, there appears to be some disagreement on the level of theory in the field. For example, following a systematic review of 146 articles on university entrepreneurship, Rothaermel et al. (2007) felt the research was atheoretical overall. On the other hand, Djokovic & Souitaris (2007) claim more recent research has been theoretical and the level of theory has increased from 5% to 48% in the last 4 years and is still moving towards more theory-driven research.

These literature reviews have attempted to guide and structure the field in different ways. For example, O'Shea et al. (2007a) focus on the determinants and consequences of spinout activity. Rothaermel et al. (2007) outline four areas that should be focused on in future research: (1) the entrepreneurial research university; (2) productivity of technology transfer offices (TTOs); (3) new firm creation; and (4) the environmental context. In contrast, Djokovic & Souitaris (2007) suggest future

research should be aimed at three levels: (1) macro-level studies to explore the role of industry and government policies and support mechanisms; (2) meso-level studies to explore how the roles of the university and TTO incentivise spinout creation; and (3) micro-level studies to explore the roles of firms and entrepreneurs in relation to their networks and human interactions in spinout formation. It remains to be seen how researchers in the field respond and will organise future research.

This section has given an introduction to university technology transfer, the two paths to research commercialisation that may be taken, a brief background to university spinouts and an overview of current debates to organise research in the field. Specific attention has been given to the US and UK as they have been given the most attention in university spinout research. The following sections will review the literature on university spinouts in more detail.

2.2.2 University Spinout Definitions

This section reviews the definitions of university spinouts leading to the choice of a definition to work with in this research. Nicolaou & Birley (2003b) state the nonuniversality of a definition has plagued spinout research and Pirnay et al. (2003) argue there are probably as many definitions as there are researchers in this area. Some researchers keep their definition of a university spinout deliberately broad e.g. Shane (2004, p.4) defines a university spinout as 'a new company founded to exploit a piece of intellectual property created in an academic institution.' Other researchers focus on the role of the university. For instance, Birley (2002) defines a spinout as 'a company that is created using the intellectual assets of the university but which is neither wholly

owned nor managed by the university'. De Coster & Butler (2005) define spinouts as 'high technology ventures that originate from research work in a university, resulting in the generation of intellectual property and, usually, the subsequent involvement of key researchers.' However, spinouts may not always be high technology e.g. Think Play Do[11] is a consultancy spinout from Imperial College London and University of Queensland. Wright et al. (2006) define a university spinout as 'a start-up company whose formation is dependent on the formal transfer of intellectual property rights from the university and in which the university holds an equity stake,' but this does not include the person who might take the venture forward.

There does now appear to be some degree of convergence towards an accepted definition of university spinouts between some authors in the field. For example, both Carayannis et al. (1998) and Steffensen et al. (1999) refined Smilor et al.'s (1990) definition. Nicolaou & Birley (2003a) took this definition a step further and included the variable role of the academic in a university spinout. They defined university spinouts as involving: (1) the transfer of a core technology from an academic institution into a new company; and (2) the founding member(s) may include the inventor academic(s) who may or may not be currently affiliated with the academic institution. This definition is employed in this research because it is the most encompassing and parsimonious (Nicolaou, 2004). This definition also receives support from Djokovic &

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[11] Think Play Do was formed to provide access to consultancy expertise to the Innovation Studies Centre of Imperial College London and the University of Queensland (Think Play Do, 2007).

Souitaris (2007) who argue the definition of a university spinout should include: (1) the outcome; (2) the core elements that are transferred; and (3) the key parties involved.

Meyer (2003) suggests in addition to including the individuals and technology from the parent organisation, the definition of a university spinout should account for other facilities that the parent organisation might provide such as management advice, venture capital, office space or any other form of support. A definition encompassing more of the elements involved in the university spinout process may develop with further research. Having chosen a definition of university spinouts which is to be applied and followed in this research, the current state of the existing literature is now examined leading to the identification of the research gap.

2.2.3 Variations in Spinout Creation

The frequency of university spinouts varies significantly across universities (Di Gregorio & Shane, 2002). Researchers have tried to explain these variations using a range of factors. For example, Di Gregorio & Shane (2002) found both the university's intellectual eminence and policy on taking equity increased firm creation. Both Di Gregorio & Shane (2002) and Lockett & Wright (2005) found the university's policies towards royalty were positively associated with spinout creation.

Powers & McDougall (2005) and O'Shea et al., (2005) looked at the effects of resources on spinout formation rates. Powers & McDougall (2005) found higher levels of R&D funding, higher faculty quality, older TTOs and universities located where venture capital was in abundance were associated with increased spinout formation. O'Shea et al. (2005) found different combinations of resource stocks explain the

variations in spinout creation between universities. Like Powers & McDougall (2005), O'Shea et al. (2005) found the presence of star scientists, the size and nature of financial resources a university has affect spinout formation rates. The TTO has been linked to spinout creation in terms of their resources (O'Shea et al., 2005) and their business development capabilities (Lockett & Wright, 2005). Several factors related to the nature of inventions and patents have also been linked to spinout creation such as inventions that are important, radical, have a broad scope of patent protection (Shane, 2001a), effective patent protection (Shane, 2001b) and expenditure on patent protection (Lockett & Wright, 2005).

2.2.4 Spinout Development Models

Some researchers have recently moved towards a previously neglected area of spinout development (Mustar et al., 2006) and have put forward several different phases of development that university spinouts go through. Roberts & Malone (1996) presented the most in-depth models describing spinout formation and development[12]. They identified four key roles[13] in the spinout process (the technology originator, the entrepreneur, the university and the venture investor) and put forward five structural

[12] The processes of spinout formation and development they described were from universities, government laboratories and other R&D organisations (Roberts & Malone, 1996).

[13] The existence of these four key roles in university spinouts was supported by Carayannis et al. (1998).

models to describe the stages[14] in which the parties interact to form spinouts, the nature of each party's involvement and the key outputs at each stage. The differences between the five models are outlined in Table 2.1.

Table 2.1 Roberts & Malone's (1996) five process models

Model	Description
1	▪ Involves the four key roles
2	▪ The roles of the technology originator and entrepreneur belong to the same individual or group i.e. the academic entrepreneur. Therefore, three key groups involved all the way through in this model
3	▪ The roles of the technology originator and entrepreneur belong to the same person, but the licensing office and venture investor roles are also combined into one body i.e. the licensing office has its own venture capital fund
4	▪ The licensing office and the venture investor are combined into one role, but the technologist and entrepreneur have separate roles
5	▪ All the four roles are involved similar to model 1 ▪ However this time, an alliance is formed between the experienced entrepreneur and the venture investor to exploit the opportunity

A number of recent studies have mapped the stages of spinout development along different dimensions. Several authors agree the process is iterative and non-

[14] These stages are: invention, disclosure, evaluation, protection, new venture creation, product development, incubation, business development stage and sale / IPO.

linear e.g. Vohora et al. (2004), Druilhe & Garnsey (2004) and Vanaelst et al. (2006). Vohora et al. (2004) demonstrated this sort of process in a cross-university study with data from seven of the top ten UK universities. All the spinouts in the study were actively seeking or had secured external equity finance and they found five distinct phases of development that the spinouts went through: (1) research; (2) opportunity framing; (3) pre-organisation; (4) re-orientation; and (5) sustainability. Between these phases, each spinout faced a critical juncture caused by deficient social capital, weak resources or inadequate resource capabilities, which had to be overcome before they could move onto the next stage of development. The critical junctures they faced were: (1) opportunity recognition; (2) entrepreneurial commitment; (3) credibility; and (4) sustainability. Like Vohora et al. (2004), Vanaelst et al. (2006) also found that spinouts had to pass through one phase before they could move on to the next one. Although the two studies shared this finding, Vanaelst et al. (2006) identified different set of phases in spinout development: (1) research commercialization and opportunity screening; (2) organization-in-gestation; (3) proof of viability of the newly established venture; and (4) the maturity phase. Druilhe & Garnsey (2004) showed that as spinouts pass from one phase to the next, their knowledge improves and the business model is modified, refined and developed. In some cases, the shift between phases is triggered by environmental shocks (Clarysse & Moray, 2004). Overall, these studies agree that not only is the spinout development process iterative and non-linear, but also requires prompts at certain stages to help progress development (Mustar et al., 2006). The next section focuses on the key roles in the spinout process.

2.2.5 Key Roles in the Spinout Process

This section uses the key roles identified by Roberts & Malone (1996) as a framework to review the literature. Roberts & Malone (1996) define four key roles that are involved in the university spinout process. Two of these roles (the technology originator and the entrepreneur) can be discussed together as they are often fulfilled by the same person. The other two roles are the university and the venture investor. This section therefore presents the literature on the three roles in turn: (1) the technology originator / entrepreneur; (2) the university; and (3) the venture investor.

2.2.5.1 The Technology Originator / Entrepreneur

The technology originator or inventor in the university spinout context is usually an academic researcher (Roberts & Malone, 1996). The entrepreneur is either an individual or an entrepreneurial team who takes the technology developed by the technology originator and attempts to form a company from it (Roberts & Malone, 1996). Academic researchers also assuming the role of entrepreneur by trying to commercialise their own inventions (Radosevich, 1995; Franklin et al., 2001) are referred to as academic entrepreneurs[15]. The alternative model is the surrogate entrepreneur, which occurs when it is difficult for the academic researcher to leave the university or to commercialise the technology themselves, so an entrepreneur is given

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[15] Meyer (2003) makes a distinction between the 'academic entrepreneur' and the 'entrepreneurial academic'. He finds academic entrepreneurs have a greater awareness of their innovation and development needs than entrepreneurial academics.

rights to the technology to form a company (Radosevich, 1995; Franklin et al., 2001). The motivations for an inventor / academic entrepreneur to start a company can be explained by: (1) psychological reasons such as a desire for wealth, independence or to bring technology into practice; or (2) career-related reasons such as reaching a high status in the university, achieving a level of entrepreneurial experience, being a 'star scientist' or reaching a certain stage in their career where other academic goals have been achieved (Shane, 2004, p.156).

Both the academic and surrogate entrepreneur models have associated advantages and disadvantages that have been described in the literature. For example, an advantage of the academic entrepreneur is that he / she can carry their technical knowledge through to the company, but a disadvantage is he / she may also be more technically focused rather than on business (Franklin et al., 2001). In the surrogate entrepreneur model, the advantage is, he / she is more motivated for financial gain and to build social networks, but the disadvantage is that the role of the university is passive making it more likely that investment will have to be sought from an external source (Franklin et al., 2001). The research on academic entrepreneurs has been considerably less compared with the role of the surrogate entrepreneur. This is surprising since studies have shown ventures created by 'outside entrepreneurs' and with faculty assistance were larger than those created by faculty themselves (Chrisman et al., 1995) and that they are preferred by more successful universities (Lockett et al., 2003).

The larger proportion of the research in this area has assumed the academic entrepreneur model. These studies show academics often try to balance both their academic and entrepreneurial roles and perhaps not surprisingly, the common theme

running through this stream of literature is the issue of commitment to both roles. For example, George et al. (2006) found university scientists prefer to be known as scientists rather than entrepreneurs and the latter was also a term they were reluctant to accept. Johansson et al. (2005) found three out of four founders in their study retained their academic positions as part-time or full-time while trying to form a company. Vanaelst et al. (2006) found some academic researchers are actively involved with a spinout while the market opportunity is being identified but choose to stay with the parent organisation before the spinout is formally created. When academics retain full-time positions, inventors carry their scientific knowledge into the new firm founded to commercialise their research by consulting to the firm, or if he / she leaves or is part-time, then they carry their knowledge through as Chief Scientific Officer (Murray, 2004). This has been shown to be a successful mechanism, whereby Samsom & Gurdon (1993) found academics able to be actively involved in creation of the new spinout were also able to lead the venture effectively in a board-level role. However, if an academic is over-involved, this can have negative consequences for the spinout (Nicolaou & Birley, 2003a). Working with the company full time however, does signal the academic's commitment to the company and this can be important from the stakeholders' point of view (Shane, 2004, p.272). In effect, university spinouts provide a mechanism for the university to retain faculty inventors rather than provide an incentive for them to leave (Wright et al., 2004a).

A large number of studies on academic entrepreneurs have also focused on their behaviour specifically in the life sciences industry. A number of these studies have found a link between university faculty and spinout formation. Louis et al. (1989) for

example, found productive faculty in life sciences departments were a stimulant of entrepreneurship. Zucker et al. (1998; 2002) more specifically showed a link between intellectual human capital and firm founding rates in the biotechnology industry. Similarly, Lowe (2006) found inventors with higher tacit knowledge in relation to their inventions were more likely to start-up a firm. Like Zucker et al. (1998), Stuart & Ding (2006) showed the most accomplished scientists were more likely to become entrepreneurs.

Peer influences also have an effect on university spinout activity in the life sciences. For example, Stuart & Ding (2006) found the likelihood of scientists engaging in entrepreneurship increased when other scientists from their academic departments had taken part in commercial activities before them or when their co-authors were entrepreneurs. Jong (2006) found the role of peers was important in developing organisational capabilities that scientists need when dealing with the challenges presented in forming a company.

Both academic and surrogate entrepreneurs can lead the formation of university spinouts. These fall under the categorisation of spinout formation leaders[16] put forward by Shane (2004, p.152). Shane (2004, p.163) argues spinout formation can be: (1) inventor-led: by the inventor / academic and are more likely to be set up when patent protection is weak and to be set up close to the university; (2) shopper-led: by a surrogate entrepreneur or the TTO (technology transfer office) and more likely to occur at universities with the highest rates of spinout formation; or (3) investor-led: by an

[16] Shane (2004, p.152) found all three types (inventor-led, shopper-led and investor-led) were almost equal in occurrence from spinouts formed at MIT.

investor who brings the technology and entrepreneur together and more likely to be found in major cities where there are higher concentrations of investors and technology managers.

2.2.5.2 The Role of the University

The literature on the role of the university is in two parts. The first part reviews the studies on policies and culture in the university and the second part reviews the studies on strategies and support.

2.2.5.2.1 University Policies and Entrepreneurial Culture

An increasing number of universities are adapting their policies to incorporate commercialisation activities. Overall, these studies show a strong entrepreneurial culture is important for spinout activity. For some universities, commercialisation activity is fully incorporated in their mission, which Etkowitz (1998) refers to as the 'entrepreneurial university'. In addition to their teaching and research missions, Etzkowitz (1998) describes this integration of entrepreneurial policy into the functions of the university is as the second revolution for universities. University cultures are still changing and university departments, especially science departments, are becoming increasingly accepting of entrepreneurship (Wright et al. 2004b). Universities with a weak entrepreneurial culture and infrastructure tend not to generate growth-oriented spinouts (Degroof & Roberts, 2004). They need to have a strong entrepreneurial culture by being highly selective and supportive in order to promote

growth in the spinouts they form (Degroof & Roberts, 2004). However, building an entrepreneurial culture can take time (Kirby, 2006) and needs to be managed carefully (Golob, 2006).

2.2.5.2.2 University Strategies and Support

This area can be divided into studies on: (1) university level support and strategies; and (2) intra-university level support for university spinouts. At the university level, support is defined as the '...level of managerial and financial assistance given to a venture...,' (Roberts & Malone, 1996, p.40). Along with policies and culture, the roles that universities are playing in spinout formation and development have shifted from passive to proactive (Smilor et al., 1990; George et al., 2006). Universities are implementing strategies and support mechanisms to develop entrepreneurial behaviour and encourage spinout formation and growth. Davenport et al. (2002) for example, showed the strategy of a research institute towards its spinouts can change over time and evolve in three stages, where the levels of support and strategies for creating spinouts become stronger and more formal over time. The three phases (Davenport et al., 2002) starting from the earliest are: (1) forming spinouts by exception: these may be unintentionally initiated by the entrepreneur and there is no support from the parent organisation; (2) forming spinouts by occasion: these may be intentionally initiated by the entrepreneur, and management and support are arranged as required; (3) forming spinouts as strategy: these are formed intentionally and formal strategies and procedures are in place and a proactive support role is taken. In a study on European Research Institutes (RIs), Clarysse et al. (2005) built a typology of

incubation strategies that the RIs provided for university spinouts. The three models they found were: (1) Low selective - RIs focus on creating a high number of spinouts that focus on raising public money as they are not attractive investments for private investors; (2) Supportive - RIs try to commercialise technology by alternative methods to licensing and therefore limit the number of spinouts created; and (3) Incubator – RIs follow due diligence procedures like VCs and provide significant in-house support. Steffensen et al. (1999) label spinouts that receive little encouragement or even discouragement from the university as spontaneous spinouts and those that resulted from an organised effort, as planned. They also relate the degree of support that spinouts receive to their success, which Meyer (2003) shows can be a negative impact on spinout growth. In a survey of 48 university spinouts in Italy, Chiesa & Piccaluga (2000) found very few spinouts had been formed as a result of the university's support.

Intra-university support levels can vary between different faculties. Different faculties lack support for one another and this can bring about situations of conflict between the more and less commercially-oriented departments and between university administration and faculty (Shane, 2004, p.277). Entrepreneurs with a predisposition towards entrepreneurial activity also need support from the parent institution (Kassicieh et al., 1996). When TTOs and departments appear to be receptive, scientists are more likely to become involved in technology transfer activity (George et al., 2006).

2.2.5.2.3 The Role of Technology Transfer Offices

University technology transfer offices are an intermediary in the process of technology transfer from the lab to the marketplace (Markman et al., 2005a). They are

commonly known as technology transfer offices (TTOs) in the UK and technology licensing offices (TLOs) in the US. Today, nearly all research universities in the US have a technology transfer office (Rogers et al., 2001) and their expertise is considered an important capability of the university (Lockett & Wright, 2005; Colwell, 2002). The number of technology transfer offices at universities is credited for the dramatic increase in university patenting and licensing activity following Bayh-Dole (Colyvas et al., 2002; Sampat, 2006). The rise in TTOs and university spinout activity is also attributed to the growing importance of life sciences research, especially biotechnology at the same time; in the 1970s in the US and in the 1980s in the UK (Stankiewicz, 1994; Colyvas et al., 2002; Rogers et al., 2001).

The role of the TTO is generally understood be one that identifies, protects and markets intellectual property developed in the university and exploits it in the way that will bring maximum benefit to the university inline with its goals (Roberts & Malone, 1996; Djokoivc & Souitaris, 2007). Roberts & Malone (1996) describe the TTOs role as beginning when an invention is disclosed to them. Following the disclosure, Roberts & Malone describe the TTO's involvement as: assuming the role of principal decision maker while they evaluate the invention, making arrangements for the legal protection of the technology, directing the entrepreneurs to VCs and establishing their representation on the board of the company. However, Colyvas et al. (2002) argue there is still little understanding how TTOs actually help to bring inventions into practice and that their role also varies from case to case.

The literature has assessed TTOs on the basis of their strategies, incentives and age. The studies on TTO strategy show clear strategies need to be in place to form

spinouts. For example, Markman et al. (2005a) found TTOs adapt their strategy and structure with the goals of increasing the number of spinouts they form. Lockett et al. (2003) found the universities that were more successful in spinning out new ventures had the clearest strategies for spinout development. The pay of TTO personnel has been found to be positively related to entrepreneurial activity in the university (Markman et al., 2004). Markman et al. (2005a) also found for-profit TTOs were positively related to new venture formation. Some studies have shown older and more experienced TTOs are less effective. For example, a UK based study (Chapple et al., 2005) showed older TTOs were less efficient and a US based study (Markman et al., 2004) showed more experienced TTOs were found to be negatively related to entrepreneurial activity. Most of the research on TTOs has been carried out at the organisational level and more research is needed at the personnel level (Rothaermel et al., 2007; Lockett et al., 2005).

2.2.5.3 The Venture Investor

Studies on investment sources for university spinouts have mainly focused on the venture capitalist because spinouts require large amounts of capital which venture capitalists have the ability to provide. For example, the development costs required by university spinouts can often reach into millions, which makes them difficult to self-finance and thereby makes the acquisition of capital a key activity in university spinout development (Shane, 2004, p.223). Their finance needs involve product development, salaries and equipment costs and as the firm is already losing money, the spinouts need to explore outside sources for finance (Roberts, 1991, p.127). If spinouts are unable to

acquire a sufficient amount of capital, this can hinder their development by affecting the time spent on raising capital rather than product development (Shane, 2004, p.255). The venture investor for a university spinout can take different forms including a venture capital fund, a government seed fund, family and friends, business angels or research grants. The source that spinouts try to raise finance from is influenced by the founder's goals and the spinout's attributes (Shane, 2004, p.238).

Lerner (2005) states 'Venture capitalists have long viewed universities as a fertile source of investment ideas.' However, a key study in this area shows venture capital is problematic area for university spinouts. Out of ten impeding factors in university spinout creation, access to venture capital was the most important resource constraint faced by spinouts (Wright et al., 2006). Wright et al. (2004a) suggest university spinouts can attempt to compensate for problems with their resources and capabilities that hinder their chances of raising venture capital by creating joint ventures with industrial partners. The introduction of the government University Challenge Fund[17] in the UK in 1999 allowed spinouts that received the fund to develop the companies further before going to venture capitalists (Wright et al., 2006). Yet it appears there is still some difficulty occurring when it comes to venture capital investment in university spinouts (Wright et al., 2006). Venture capital appears to be problematic for spinouts for two reasons. First, it is viewed as more important in the early stages than internal university funds by both TTOs and university spinouts; and second, TTOs often direct spinouts towards venture capital (Wright et al., 2006). This

[17] This only applies to the top UK universities that were granted University Challenge funding.

indicates there may be some degree of a 'push' towards venture capital from the spinouts and / or the TTO. It is possible that spinouts try and raise venture capital as they try to follow what is the 'normal' course of action rather than the 'best' course of action.

Angel investment is also an important source of financing and it has some key advantages over venture capital for university spinouts (Shane, 2004, p.236). The advantages are: (1) angels tend to be more patient than venture capitalists, which is important given the high level of uncertainty faced by spinouts at the early stages of development; (2) angels invest at an earlier stage; and (3) they require a lower rate of return (Shane, 2004, p.236).

2.2.6 Spinout Performance

A range of social factors have been linked to university spinout performance. These include social capital resources, teams and network capabilities. This area has been researched in an ad-hoc manner due to university spinout research still being considered a 'new' field (Djokovic & Souitaris, 2007). In a study of MIT spinouts formed between 1980 and 1996, Shane & Stuart (2002) looked at the effect of social capital resources on performance and found direct or indirect ties to investors before the spinouts were formed increased their chances of receiving external funding and decreased their chances of failure. Using matched samples, Ensley & Hmieleski (2005) found university-based start-ups had lower performance compared with new independent ventures. They highlighted the effect of teams on spinout performance, whereby the more developed teams in the independent ventures had better

performance. Ensley & Hmieleski (2005) suggested the teams of university-based start-ups could be less developed because it is more difficult for them to find the level of expertise they require on university campus. The link between networks and performance was also made in a study by Walter et al. (2006). They defined network capabilities as the ability to 'develop and utilise inter-organisational relationships' and found a positive relationship between these capabilities and spinout performance. Other factors that have been linked to the performance of university spinouts include human capital, strategy and technology (Shane, 2004, p.241).

2.2.6.1 Spinout Success and Failure

Some studies have focused their analysis on MIT to understand the success of spinouts although Niosi (2006) argues spinouts are far from being universally successful. O'Shea et al. (2007b) found a combination of factors were significant in explaining the success of MIT spinouts. They were: excellence in research, strong programs in entrepreneurship teaching, commitment to commercialisation with supporting policies, academics having positive attitudes to starting companies and the development of strong networks with government, industry and academia. Roberts (1991, p.127) argued few technology-based firms fail by exiting under desperate conditions or bankruptcy. However, large numbers become 'living dead' where they are unable to generate significant growth from one year to the next or they produce little profit, so they are unable to go public and no one is interested in buying it (Roberts, 1991, p.127).

Apart from one study which found a number of scientist-started ventures failed, there have been no studies that have explicitly examined the causes of university spinout failure. Samsom & Gurdon (2004) conducted a longitudinal study of 22 scientist-started ventures and found 6 of these failed over the 12 year period of their study due to a lack of business skills, inadequate constituency-building decisions and interrupted funding.

Other studies have shown factors that reduce the probability of failure. For example, Rothaermel & Thursby (2005) showed the probability of failure was reduced for firms housed by incubators when there was greater university faculty involvement. Nerkar & Shane (2003) analysed the survival of MIT spinouts formed between 1980 and 1996. They found chances of spinout failure were lower when a spinout had radical technology and a broad scope of patent protection (in the fragmented market context). In Vohora et al.'s (2004) spinout development model, they argue it is possible for spinouts to fail at any of the critical junctures if they are unable to develop the necessary resource stocks, capabilities and social capital to move to the next phase. An area outlined for future research by Wright et al. (2004b) is the study of when spinouts fail to develop further.

2.2.7 Summary and Research Question

This research was driven by the quantity versus quality debate that currently shadows university spinouts. This literature review was therefore organised to show the key areas of research in the life of university spinouts i.e. from spinout creation to spinout success and failure. The review began with an introduction to university

technology transfer and spinouts and was followed by a discussion of university spinout definitions. The literature review moved from university spinout creation, through to spinout development and ended with a review of literature on spinout performance. Using the key roles in the spinout process identified by Roberts & Malone (1996) as a framework, the roles of the technology originator / entrepreneur, the university and the venture investor were also reviewed.

It is clear from the review that some areas are well understood such as spinout creation, where a host of factors have been linked to formation (Shane, 2001a; Di Gregorio & Shane, 2002; O'Shea et al., 2005; Powers & McDougall, 2005). On the other hand, spinout development has been one area where research was lacking (Shane, 2004, p.3), although attention in this area has recently increased (Mustar et al., 2006). The studies in this area have sought to map the process into various stages (Clarysse & Moray, 2004; Druilhe & Garnsey, 2004; Vohora et al., 2004; Vanaelst et al., 2006) as opposed to understanding the influences on development. The discussion of the key roles in the spinout process (technology originator / entrepreneur, university and venture investor) highlights three sources of influence on university spinout development. There has however, been little research specifically examining factors that affect university spinout development. There has also been a clear emphasis on understanding spinout performance and success, rather than failure. The reason for these disparities in spinout research could be that it is still a relatively young area of research (Rothaermel et al., 2007). This study aims to address these research gaps in relation to the quality of university spinouts.

The review showed a key factor linked to both spinout development and success is venture capital. There is an issue surrounding venture capitalists in relation to university spinouts since on the one hand, technology transfer offices encourage university spinouts to raise venture capital (Roberts & Malone, 1996; Wright et al., 2006), yet on the other hand, it is a major hurdle faced by university spinouts (Wright et al., 2006). In the midst of these dynamics, there lies an unexplored set of university spinouts that try, but fail to raise venture capital. Therefore, to better understand university spinout quality, this study explores the influence that the failure to raise venture capital has on university spinout development. The research question is therefore:

How does the failure to raise venture capital affect the development of university spinouts?

The next section explains and reviews the two theoretical perspectives that were employed in the analysis of the results.

2.3 Theoretical Perspectives Employed in this Research

The two theoretical perspectives employed in this research are: escalation of commitment (Staw, 1976; Staw & Ross, 1978) and organisational learning (Argyris & Schön, 1978; Cyert & March, 1963). The data was linked to these theoretical perspectives during data analysis and theory building procedures (Chapter 3, Section 3.6) and a detailed explanation is given in Section 3.6.2.4.

The findings show that when university spinouts fail to raise venture capital, they act on VC feedback by either escalating commitment to raise finance or exiting. The escalation of commitment perspective helps to explain why some university spinouts continue to pursue other sources of finance despite failing to raise venture capital. The organisational learning perspective helps to explain how the spinouts interpret VC feedback and adapt their behaviour (escalate commitment) or adapt their goal (exit).

The theory built in this study is presented in Chapters 4 (Results & Analysis) and 5 (Discussion & Conclusion). However, literature reviews for the two theories are presented here. This follows the model used by Pratt et al. (2006) who took a theory building approach in their study on professional identity construction. They found three theories together (careers / role transitions, socialisation and identity work) helped to understand the process of identity construction as each held an important piece of the explanation (Pratt et al., 2006, p. 236). However, they were unaware of these theories at the start of their study and therefore presented reviews of these three theories at the start of their article to help orientate readers towards their findings (Pratt et al., 2006).

The approach of this study is similar to that of Pratt et al. (2006) because I took a theory building approach and when the study began, I was unfamiliar with the two theories that later helped explain the findings. I therefore follow the model they used in presenting their study by presenting reviews of the two theories in this chapter to help provide an orientation toward the findings. The next two sections present a review of the escalation of commitment (Section 2.3.1) and organisational learning (Section 2.3.2).

2.3.1 Escalation of Commitment Literature

This section presents a review of the literature on escalation of commitment. This is one of the two theoretical perspectives employed in the results and analysis of the study and provides an explanation for part of the findings. Specifically, this theory explains why spinouts that failed to raise venture capital adapted their behaviour in response to VC feedback by trying to raise finance from alternative sources. The second of the two theories that provides an explanation for part of the findings is organisational learning and its literature review is presented in the next section (Section 2.3.2).

2.3.1.1 Introduction

This literature review on escalation of commitment is organised into six parts: (1) definitions of escalation of commitment; (2) levels of study - studies have mainly been on escalation behaviour in individuals but organisation level studies are increasing; (3) determinants of escalation behaviour; (4) motivations for escalation behaviour; (5) the effect of feedback on escalation behaviour - this section also acknowledges the criticism of escalation research; and (6) escalation studies in entrepreneurship research.

2.3.1.2 Escalation of Commitment Definition

Escalation behaviour is essentially a counter-intuitive behaviour and was first observed in individuals (Staw, 1976). Following negative consequences, an individual would be expected to change their behaviour (Staw, 1976; Fox & Staw, 1979). However, when individuals continue with a course of action despite the negative consequences, this is known as an escalation of commitment (Staw, 1976). Often, the choice to follow a course of action can involve a series of decisions rather than a single choice (Staw, 1981). Escalations also tend to occur in a series of escalations rather than on an isolated occasion (Brockner, 1992).

A key element of the definition of an escalation of commitment is the allocation of resources to the course of action that in effect seals the commitment (Staw & Ross, 1978; Staw, 1976). An escalation situation is therefore one where it is possible to turn a situation around and attain a goal(s) by investing more effort, time, money or even self-identities in some cases, when a loss has resulted from the original course of action (Staw & Ross, 1989; Staw, 1981; Brockner, 1992).

The investment of resources into a course of action is usually unwarranted and a rational analysis of the situation might even recommend an exit from the course of action (McNamara et al., 2002). To ascertain whether an escalation of commitment has taken place, Staw (1981) argues it should be clear that it has occurred above and beyond the objective facts of the situation. It is also possible that the consequences of an escalation can be negative or positive (Staw, 1981). This can be referred to as a dysfunctional or functional escalation respectively (Staw & Ross, 1978). A

dysfunctional escalation can also become an extreme case of a cycle of escalating commitment (Staw, 1981; Staw & Ross, 1978).

2.3.1.3 Levels of Study

Although escalation behaviour was first observed in individuals, both individuals and organisations can become committed to losing courses of action (Staw & Ross, 1989). Early studies on escalations of commitment focused on escalations in the behaviour of individuals (e.g. Staw, 1976; Staw & Fox, 1977; Staw, 1981; Staw & Ross, 1978; Fox & Staw, 1979; Schwenk, 1986). For example, the earliest study on escalation of commitment showed when a person had personal responsibility for negative consequences, they would commit the greatest amount of resources to the same course of action (Staw, 1976). Some studies have looked at individual differences leading to escalation of commitment. For example, Whyte et al. (1997) found individuals with high levels of self-efficacy were more likely to escalate commitment. Studies in the field have now moved on towards escalation behaviour in organisations and the causes of escalation behaviour in organisations have been grouped into four categories (Ross & Staw, 1986).

2.3.1.4 Determinants of Escalations

There are four classes of determinants of escalation: (1) project - these are related to the nature of the project itself such as the size of the payoff or closing costs e.g. Northcraft & Wolf (1984); (2) psychological - these relate to cognitive behaviour

such as the need to justify behaviour or errors in decision-making e.g. Staw & Ross (1978) and Staw (1976); (3) social - these relate to interpersonal processes and relationships with other people such as situations that can bind people together or the need to save face in front of others e.g. Ross & Staw (1993); and (4) organisational - the level of support for a project within the organisation and alignment with the firms goals (Ross & Staw, 1986; Staw & Ross, 1989).

Some studies have emphasised the importance of the temporal element in escalations of commitment. For example, in a detailed case study of escalation in the Shoreham Nuclear Power Plant, Ross & Staw (1993) found the psychological and social variables were most important at the beginning of the escalation. Also in a study of Expo86[18], Ross & Staw (1986) found commitment evolves over time with the support of different variables (project, psychological, social, or organisational) at each stage (Ross & Staw, 1986; Staw and Ross, 1989). They found the escalation was caused by psychological and project variables but additional variables took effect later. These included structural variables such as relationships with groups and organisations that were relying on the event taking place e.g. restaurants and hotels (Ross & Staw, 1986). Over time, this made it difficult to reverse the course of action and the escalation of commitment to Expo86 continued (Ross & Staw, 1986). Staw & Ross (1989) put forward a dynamic view of escalations and found there were forces of different strengths that acted at different times causing a 'push' towards persistence and a 'pull' towards withdrawal. Staw & Fox (1977) also found escalations increased

[18] Expo86 was an example of a government funded fair which required that more money be put into it on a number of occasions beyond the initial estimated cost.

rather than decreased over time. A number of motives explaining why individuals and organisations escalate commitment have also been put forward.

2.3.1.4.1 Motivations for Escalation Behaviour

Of the psychological determinants of escalation, the most widely accepted explanation for why an individual engages in this behaviour is self-justification. The view of self-justification is based on decision makers trying to show they have not erred (Whyte, 1986; Brockner, 1992). Greater escalations are therefore associated with a greater need to justify actions (Brockner, 1992). If individuals are justifying their past behaviour to themselves, it is termed internal justification and if they are justifying it to others, it is termed external justification (Tang, 1988; Staw, 1981). However, although self-justification is accepted to provide an explanation for a large part of escalation theory, it does not account for all of it (Brockner, 1992).

Some of the other theories put forward provide alternative explanations to self-justification e.g. prospect theory. Whyte (1986) considered prospect theory from the field of cognitive psychology as an explanation for escalation of commitment. This theory takes the view that a decision to escalate commitment is based on framing the previous decision as a success or failure (Whyte, 1986). The application of this theory to situations of both success and failure is an advantage of explaining escalation by prospect theory over self-justification, whereas self-justification can only be applied to situations of failure. The use of this theory also builds on Staw & Ross's work (1978) that individuals process information differently after success and failure.

Behavioural explanations such as self-justification and prospect theory have received some criticism. For example, one criticism is that behavioural explanations assume the escalation of commitment is an error but it is possible an escalation could occur due to economic reasons (Tang, 1988). Tang (1988) modelled escalation of commitment behaviour using an economic perspective and found a firm is unlikely to change a strategy once an escalation begins, regardless of whether it occurred due to behavioural or economic reasons.

Other theories that have been used to study escalation are behavioural decision theory which looks at the effect of information on decision processes (Schwenk, 1986) and self-efficacy theory, which views escalations by individual differences (Whyte et al., 1997). Brockner (1992) suggested researchers should continue to explore escalation through different theories at the individual, inter-group and organisational levels and emphasised that longitudinal studies would be helpful in identifying causes of escalation situations while doing this. Several escalation effects have also been linked with negative feedback.

2.3.1.5 The Effect of Feedback on Escalation Behaviour

This section reviews how the concept of feedback has been utilised in escalation studies. Most of the research examining the effect of feedback on escalation behaviour has been on studies of individuals rather than the organisation. Failure to attain a goal has often been interpreted as negative feedback in studies of escalation (Brockner, 1992). Ilgen & Davis (2000) argue individuals can respond to feedback in two ways: they can either try to improve their performance or decide whether or not to continue at

all. The decision they make depends on how individuals frame negative feedback (Ilgen & Davis, 2000).

Brockner et al. (1986) found individuals were more likely to escalate commitment when they received constant negative feedback. When the need to justify actions is also high and feedback is negative, then an escalation tends to be greater (Brockner, 1992). Other ways negative feedback has been linked to escalation of commitment include the belief that future attempts would be unsuccessful (Zikmund-Fisher, 2004). This study was based on an Internet questionnaire where students were asked questions about the imaginary scenario of taking part in a lottery contest. Beeler & Hunton (1997) also used students in their study. They found negative feedback led to a greater escalation and increased the search for retrospective information, when an investment decision had been made public. This finding lent support to the self-justification explanation (Beeler & Hunton, 1997).

Some scholars argue the nature of feedback needs to be better explained in escalation of commitment studies (Bowen, 1987). Building on this, Hantula & Bragger (1999) and Brecher & Hantula (2005) examined the equivocality of feedback in relation to escalation decisions. They defined feedback equivocality based on Bowen's (1987) definition that feedback cannot be classified as negative or positive because the nature of the feedback is immeasurable, unclear or it cannot be compared against a credible measure (Hantula & Bragger, 1999). Equivocal feedback can also be from multiple sources (Hantula & Bragger, 1999). They found high equivocal feedback did lead to escalation behaviour compared with low equivocal feedback in respondents that did not lead to escalation behaviour. These findings were supported in a later study by

Brecher & Hantula (2005) who found the equivocality of feedback was linked to feelings of frustration, but they were unable to resolve the relationship between frustration and escalation.

2.3.1.5.1 Criticisms of Escalation Theory

The main criticisms of escalation theory have been made by Bowen (1987). For example, he suggested feedback had not been clearly articulated and questioned in the studies that had used it up to that point. He argued the literature tends to define feedback as either positive or negative, but the use of such terms may not be specific enough and needed to be defined more clearly by taking the equivocal nature of feedback into account. He therefore suggested an alternative explanation for escalation behaviour could be that it was more than just the decision to 'throw good money after bad' and it could occur when there was an interplay or dilemma between the level of feedback equivocality from prior investments and the level of commitment to a course of action (Bowen, 1987).

Another criticism of the research on escalation of commitment is that studies have not demonstrated escalation well because they have been experimental or lab based (Bowen, 1987; Zardookhi, 2004). Bowen (1987) also argued the use of such methods had meant they were unable to show how failure feedback is interpreted.

2.3.1.6 Escalation Studies in Entrepreneurship Research

Few studies have explored the escalation phenomenon in the entrepreneurship domain. For example, in a study of entrepreneur's reinvestment decisions, McCarthy et al. (1993) measured negative feedback as a decline in sales and found psychological factors such as feeling personally responsible had a greater effect on their escalation of commitment if the form of their decisions to reinvest.

There are some studies in entrepreneurship that allude to a similar phenomenon but do not directly examine an escalation of commitment. For example, Gimeno et al. (1997) and Gatewood et al. (1995) linked entrepreneurs with persistence behaviour. Gimeno et al. (1997) found some dimensions of human capital affect persistence and firms with low thresholds of performance could make the choice to continue or exit. Gatewood et al. (1995) found successful potential entrepreneurs were more willing to persist with activity to start a business. Markman et al. (2005b) also showed entrepreneurs were more inclined to persevere than non-entrepreneurs. Both Markman et al. (2005b) and Gimeno et al. (1997) suggested alternative explanations for their findings could be an escalation of commitment. Although these studies would imply there may be a tendency for entrepreneurs or new ventures to engage in escalation behaviour, the studies exploring this have been scarce.

2.3.1.7 Summary

Much of the past research on escalation behaviour has examined the phenomenon in individuals or in mature firms (Zardookhi, 2004). Zardookhi (2004)

suggests future research should explore the differences in escalation behaviour across different types of organisations such as government funded ventures to understand the differences made in escalation decisions between such firms vary (Zardookhi, 2004). This could be considered an invitation for studies on escalation in entrepreneurship research. As discussed in the literature review, some studies have begun to explore this (McCarthy et al., 1993; Markman et al, 2005b; Gimeno et al., 1997; Gatewood et al. 1995). However, more studies are needed. More studies based on real-life settings are also needed (Zardookhi, 2004). For example, most of the studies relating negative feedback to an escalation of commitment have been carried out on individuals and have been experimental.

The findings of this study show when university spinouts fail to raise venture capital, VC feedback can lead to an escalation of commitment to raising finance.

2.3.2 Organisational Learning Literature

This section presents a review of the literature on organisational learning. This theory was employed in the results and analysis of the study to explain how university spinouts adapt their behaviour or goals in response to VC feedback. Both escalation of commitment and organisational learning theory provide an explanation for part of the findings. Escalation of commitment theory provides an explanation for the part of the findings that show how spinouts adapt their behaviour in response to VC feedback. Organisational learning theory provides an explanation for the part of the findings that show VC feedback causes a spinout's behaviour or goals to adapt (Argyris & Schön, 1978, 1996; Cyert & March, 1963). The results build on Argyris & Schön's (1978;

1996) work to show the effect of VC feedback on a spinout's actions can be mediated by single-loop or inhibited double-loop learning.

2.3.2.1 Introduction

Organisational learning is denoted by a change in the knowledge of an organisation, usually by a transformation, addition or reduction (Schulz, 2002, p.415). The aim of theory in this field is to understand how changes in organisational knowledge occur and what the effects of learning are on organisational behaviour and outcomes (Schulz, 2002). Miner & Mezias (1996) described organisational learning as 'an ugly duckling in the pond of organisation theory: interesting, but living on the fringes.' Despite the topic being researched for over 30 years, Easterby-Smith et al. (2004) argue it still remains a 'black box' (p.378). Similarly, although research in this field has grown phenomenally in the 1990s and 2000s (Bapuji & Crossan, 2004; Crossan et al., 1999), some scholars argue a general theory still remains elusive (Crossan et al., 1999, p.522).

Several scholars have reviewed the organisational learning literature to assess and guide its direction e.g. Huber (1991), Bapuji & Crossan (2004), Fiol & Lyles (1985), Levitt & March (1988). Miner et al. (2001) argue earlier research on organisational learning was broad and has moved towards the generation of change. For example, different types such as trial-and-error learning, learning from experience and learning from experimentation have now been put forward (Miner et al., 2001). There has also been a move towards theories of organisational learning in the strategy literature. Examples include the use of organisational learning to explain a number of

concepts such as strategic alliances, innovation and technology adoption (Bapuji & Crossan, 2004).

This literature review of organisational learning is structured in six parts: (1) the key definitions of organisational learning are presented; (2) the major contributions to the field are highlighted; (3) the different types of organisational learning are discussed - single-loop and double-loop learning are highlighted here; (4) criticisms of organisational learning are discussed; (5) current debates in the field are described - performance feedback models in particular are highlighted; and (6) the literature is discussed in relation to studies in entrepreneurship.

2.3.2.2 Definitions of Organisational Learning

Some definitions of organisational learning have developed with the field and some have stood the test of time. The general consensus in these definitions is that actions or behaviour change based on knowledge or information. For example, Fiol & Lyles (1985, p.803) defined organisational learning as 'the process of improving actions through better knowledge and understanding,' whereas Huber (1991) stated 'an entity learns if, through its processing of information, the range of its potential behaviour is changed.' The characterisation of organisational routines as the rules, procedures, conventions or strategies based on an interpretation of the past around which organisations are constructed and operate, has also affected the field's development (Schulz, 2002; Levitt & March, 1988).

2.3.2.3 Major Contributions to the Field

Easterby-Smith et al. (2004) outline the seven major contributions to organisational learning research as: (1) espoused theory and theory-in-practice - this explained that negative views are not expressed in public and can differ from actions in practice; (2) the learning organisation (Senge, 1990) - this related to the practical problems that organisations can have; (3) a link between knowledge, learning and competitiveness (e.g. Cohen & Levinthal, 1990) - this bridged organisation learning with the resource-based view; (4) a socio-cultural perspective (Brown & Duguid, 1991) - this brought a cognitive psychology approach and accounted for human interaction involved in the learning process; (5) unlearning (Hedberg, 1981) - this highlighted the negative side of learning by pointing out that organisations sometimes need to forget; (6) learning across boundaries - this tied a number of existing strands together such as knowledge transfer and culture; and (7) single and double-loop learning (Argyris & Schön, 1978) - their contribution was that organisations learn from both incremental changes and improvements.

This literature review focuses on the last of the major contributions outlined by Easterby-Smith et al. (2004). Argyris & Schön's (1978; 1996) work has had a huge impact on academic studies in management (Easterby-Smith & Lyles, 2003, p.54). It is this stream of learning in particular that is later employed as a lens in the results and analysis of the study. This review will therefore provide a specific emphasis towards Argyris & Schön's (1978; 1996) work on organisational learning.

2.3.2.4 Types of Organisational Learning

Organisational learning has been categorised into several types. For example, Argyris & Schön (1978) developed single-loop and double-loop learning. Building on this, Fiol & Lyles (1985) categorised learning into lower level and higher level. More recently, these two types of learning have been referred to as incremental and radical learning (Miner & Mezias, 1996). Other types of organisational learning which describe patterns of change that can occur include first-order learning, which is a routine to maintain existing rules and second-order learning which involves exploring alternative routines and goals (Lant & Mezias, 1992). This review focuses on Argyris & Schön's (1978; 1996) theory of single-loop and double-loop learning.

2.3.2.4.1 Single-loop and Double-loop Learning

Argyris & Schön (1978, p.2) operationalised organisational learning as the detection and correction of error. This process of error detection and error correction can lead to single-loop or double-loop learning. Single-loop learning occurs 'when the error detected and corrected permits the organisation to carry on its present objectives,' (Argyris & Schön, 1978, p.2/3). Double-loop learning occurs 'when error is detected and corrected in ways that involve the modification of an organisation's underlying norms, policies, and objectives,' (Argyris & Schön, 1978, p.3). Argyris & Schön based these types of learning on their previous work (1974) on the theory of action. The theory of action suggests people act in a certain way to carry out their behaviour and they carry this with them and apply it in different situations (Argyris & Schön, 1974)

The Model I theory of action argues people are unable to reflect on their own governing values or the values of others (Argyris & Schön, 1974). With the definitions of single-loop and double-loop learning in organisations, it follows that the theory of action is unchanged in single-loop learning, but changes in double-loop learning (Argyris & Schön, 1996, p.21). A well-known example that Argyris & Schön (1978) gave for single-loop learning is when a thermostat detects it is too hot or cold and then takes corrective action to turn the heat on or off. If the thermostat could somehow question why it had been set at a particular temperature and change it, then this would be double-loop learning (Blackman et al., 2004). Single- or double-loop learning can be inhibited when either error detection or error correction do not occur (Argyris, 1976).

A third type of learning that Argyris & Schön (1978) identified is deutero-learning. This occurs when organisations are able to carry out both single-loop and double-loop learning (Argyris & Schön, 1978; 1996). Whereas the focus of single-loop and double-loop learning lies on action and behaviour, the focus of deutero-learning is more cognitive (Easterby-Smith & Lyles, 2003).

Although Argyris & Schön's theory of organisational learning still holds strong in the literature (Easterby-Smith et al., 2004), there has been some criticism of their work. For example, some argue that single-loop and double-loop learning are the same in practice (Easterby-Smith et al., 2000, p.786). Another criticism which has targeted their work and organisational learning in general is that it lacks emotion (Fineman, 1997).

2.3.2.5 Criticisms of Organisational Learning

Although they can be studied separately, some authors take the view that learning is inextricably linked with emotion and is unduly neglected by many studies (Antonacopoulou & Gabriel, 2001; Fineman, 1997; Vince, 2001). This is based on the view that emotions shape the learning process in individuals and organisations and are therefore associated with organisational change (Fineman, 1997; Antonacopoulou & Gabriel; Vince, 2001). Vince (2001) also argues the study of organisational learning should include power relations to help understand how organisational change occurs.

Another criticism is that organisational learning is studied separately from individual learning (Kim, 1993; Wang & Ahmed, 2003). Kim (1993) argued the study of organisational and individual learning should be integrated because organisational learning is built upon the learning of individuals. However, this is accounted for by Argyris & Schön in their work. For example, they state: 'Organisational learning occurs when individuals within an organisation experience a problematic situation and inquire into it on the organisation's behalf,' (Argyris & Schön, 1996, p.16).

2.3.2.6 Current Debates in Organisational Learning

New debates in organisational learning began with a special issue in the *Organization Science* journal in 1991 (Schulz, 2002). According to Schulz (2002), current areas of interest in the organisational learning literature are: (1) the adaptation of organisational rules and routines (Levitt & March, 1988); (2) learning myopia - this considers an organisation as a self-limiting process; (3) learning as communities

(Brown & Duguid, 1991); (4) the dissemination of knowledge between organisations; and (5) models of performance feedback - these models describe how organisations adapt based on feedback (Schulz, 2002).

2.3.2.6.1 Performance Feedback Models

Performance feedback models explain how learning is induced in an organisation when it has problems (Schulz, 2002, p.425). There are two streams of study in this area: (1) studies that look at how organisations adapt their behaviour; and (2) studies that look at how organisations adapt their aspirations or goals.

One of the theoretical contributions of this study is made in the area of adaptation to performance feedback and this literature will be discussed in depth in the Discussion and Conclusion (Chapter 5).

2.3.2.7 The Study of Organisational Learning in Entrepreneurship

Harrison & Leitch (2005) brought together a special issue on entrepreneurial learning as they believed it was time to begin merging discussion between the entrepreneurial learning and organisational learning literatures. They argue little research on organisational learning has been explored in the entrepreneurship context and equally, the organisational learning literature has been little informed by research from the entrepreneurship context (Harrison & Leitch, 2005). This section gives an overview of the entrepreneurial learning literature.

2.3.2.7.1 Entrepreneurial Learning

The study of organisational learning in entrepreneurial settings has recently grown in the entrepreneurship literature as 'entrepreneurial learning'. The early stage of development of this field is reflected by the diversity of definitions put forward. For example, Rae (2006, p.40) focuses on recognising opportunities. Politis (2005) defines entrepreneurial learning as a process of developing knowledge to make starting and managing ventures effective. Cope (2005) characterises entrepreneurial learning as an interactive and dynamic process that occurs between the entrepreneur, his / her business and the environment. The definitions also indicate the varied opinion of the direction that research in the field should take.

2.3.2.7.2 Streams of Research

Current directions for research in the field also appear to be divergent. For example, some authors suggest the focus should be on entrepreneurial learning as an experiential process e.g. Deakins & Freel (1998) and Politis (2005). Deakins & Freel (1998) studied small and medium sized enterprises and argued the learning process was integral to the evolution of these companies. They argued it is the entrepreneur who gains the ability to learn through experience and rather than being a planned process, it is driven by critical events. Cope (2003; 2005) built on Deakins & Freel's (1998) work to emphasise the importance of critical events for entrepreneurial learning and for future study in the field. Cope (2003) drew from Fiol & Lyle's (1985) work on higher-level and lower-level organisational learning to understand how discontinuous events

prompted learning in entrepreneurs. Corbett (2005) and Rae (2006) study entrepreneurial learning in the context of opportunity recognition. Rae (2006) also took a social constructionist perspective to analyse the narratives of entrepreneurs. Both Cope (2005) and Deakins & Freel (1998) suggest entrepreneurial learning is dynamic and should be studied to capture this process. Deakins & Freel (1998) linked the ability to learn to the growth process in SMEs. They found the critical factors for entrepreneurial learning were the abilities of the team, to access resources, reflect on mistakes, network and accumulate experience.

At this early stage, it is clear that the field's development is open to a number of directions for future research. For example, one of the important questions in the field is how can entrepreneurs develop knowledge that will positively impact venture performance (Politis, 2005, p.400), which is yet to be answered. Other authors have tried to build a general theory by modelling the learning process.

2.3.2.7.3 Models of Entrepreneurial Learning

The entrepreneurial learning literature is based on the assumption that the process is dynamic and models of this process have been put forward accordingly. For example, Minniti & Bygrave (2001) put forward a model to describe entrepreneurial learning that is informed by success and failure. This is based on the assumption that entrepreneurs only repeat actions that appear promising and discard all others. They focused their model on how entrepreneurs process information and use that to improve performance (Minniti & Bygrave, 2001). They found both failures and successes contributed to an entrepreneur's knowledge and this also impacts their decisions.

Parker's (2006) model supported Minniti & Bygrave's (2001) model by showing entrepreneurs use new information to make their decisions and also take past experience into account to guide their expectations. His study showed that entrepreneurs exploit new information and adjust their beliefs based on the new information by about 16% (Parker, 2006). A model put forward by Ravasi & Turati (2005) was also similar to Minniti & Bygrave's (2001) model. They argued entrepreneurial learning is affected by a high scarcity of money, time and attention, which continually force the venture to make decisions about terminating or continuing.

Overall, the field of entrepreneurial learning is at an embryonic stage compared with the stage of maturity that the organisational learning field has reached. However, the study of organisational theories in an entrepreneurial context can enrich both the fields of entrepreneurship and organisational learning (Harrison & Leitch, 2005),

2.3.2.8 Summary

This review of organisational learning has highlighted the key theories in the field. It has also described Argyris & Schön's (1978; 1996) theory of organisational learning based on the detection and correction of error in depth. Through the findings of this study, this theory of learning was linked to the literature on how performance feedback causes the behaviour or goals of an organisation to adapt. Specifically, single-loop and inhibited double-loop learning are defined as mediators in the relationship between feedback and the adaptation of an organisation's behaviour or goals.

2.4 Chapter Summary

This chapter was presented in two parts. The first part presented a literature review on university spinouts and led to the research question. The second part presented literature reviews of the two theoretical perspectives employed in the results and analysis of this study, while highlighting the research gaps and debates in these areas. Both the escalation of commitment and organisational learning perspectives were utilised in the results and analysis as neither one of the theories was able to explain the findings alone.

The following chapter will describe the methodological techniques used to answer the research question.

3 METHODOLOGY

3.1 Introduction

This chapter describes the methodological approach taken to answer the research question (How does the failure to raise venture capital affect the development of university spinouts?). The aim of this chapter is to provide a detailed account of *what* was done and *how* the findings came from the data (Dougherty, 2006; Gephart, 2004). This chapter is organised by five main sections: (1) research paradigm; (2) research design; (3) sample; (4) data collection; and (5) data analysis and theory building techniques used in the study.

3.2 Research Paradigm

The research paradigm may be simply defined as a worldview or the set of principles and assumptions underlying the research (Creswell, 1998, p.74; Denzin & Lincoln, 1998, p.200; Patton, 1990, p.37). The two main distinctions that are made in the types of research paradigm are between the positivist and phenomenological paradigm (Lincoln & Guba, 1985; Bryman, 1988). Within each research paradigm, the three sets of beliefs that need to be considered are: (1) the ontology; (2) the epistemology; and (3) the methodology (Creswell, 1998, p.74; Denzin & Lincoln, 1998, p.201). The ontology considers the nature and form of reality (Denzin & Lincoln, 1998, p.201). The epistemology considers the relationship between the researcher and what is being researched (Denzin & Lincoln, 1998, p.201). The methodology is the set of guidelines for the research process i.e. for the researcher to

find what they believe can be known (Creswell, 1998, p. 75; Denzin & Lincoln, 1998, p.201). Each holds a different belief in each of the two research paradigms. Table 3.1 shows the differences in ontology, epistemology and methodology that can occur in each paradigm (Sarantakos, 2005). The table is followed with explanations of each of the different types that can occur within the positivist and phenomenological paradigms.

Table 3.1 The three sets of beliefs in research paradigms
(Adapted from Sarantakos, 2005, p.31)

Research Paradigm	Positivist	Phenomenological
Ontology	Realist	Constructionist
Epistemology	Empiricist	Interpretivist
Methodology	Quantitative	Qualitative

3.2.1 Ontology

In the positivist paradigm, the ontology is realist (Sarantakos, 2005, p.31). A realist ontology holds the view that a single reality exists and this is external to the researcher (Lincoln & Guba, 1985, p.37; Bryman, 1988, p.94). This can result in generalisations that may have a causal nature (Denzin & Lincoln, 1998, p. 204). In the phenomenological paradigm, the ontology is constructionist (Sarantakos, 2005, p.31). This holds the view that multiple realities are constructed by the researcher, the individuals involved in the research and the readers of the study (Creswell, 1998, p.76). The researcher therefore needs to take these realities into account to reach a level of

understanding, 'verstehen,' between the different views (Creswell, 1998, p.76; Lincoln & Guba, 1985, p.37).

3.2.2 Epistemology

In a positivist paradigm, the epistemology is empiricist (Sarantakos, 2005, p.31). This holds the view that the researcher is independent of what is being researched i.e. there is a distant relationship (Lincoln & Guba, 1985, p.37; Bryman, 1988, p.94). The researcher is therefore able to research the subject without being influenced by it or having any influence upon it (Denzin & Lincoln, 1998, p. 204). In the phenomenological paradigm, the epistemology is interpretivist (Sarantakos, 2005, p.31). This holds the view that there is a level of interaction with the researcher and what is being researched i.e. there is a close relationship (Lincoln & Guba, 1985, p. 37; Bryman, 1988, p.94). There is a greater degree of contact than in an empiricist epistemology and a relationship is built between the two that helps the researcher understand the world through the eyes of their research subject (Bryman, 1988, p.96). Lincoln & Guba (1985, p.28) argue it is difficult to take the positivist i.e. empiricist assumption in qualitative research because it is difficult to maintain a separation between the researcher from what is being researched. Cassell & Symon (1994, p.15) also argue this relationship is inherent in conducting interviews in qualitative research.

3.2.3 Methodology

In the positivist research paradigm, the methodology tends to be quantitative and in the phenomenological paradigm, the methodology tends to be qualitative (Sarantakos, 2005, p.31; Easterby-Smith et al., 2003, p.42). Several differentiations can be made between the features that distinguish the two types of research. For example, qualitative research is inductive and allows theory building whereas quantitative is often deductive and allows theory testing (Lee, 1999, p.10). Quantitative research tends to be more structured whereas qualitative research tends to be more open (Bryman, 1988, p. 98-99). In quantitative research, the researcher constructs an instrument for research whereas in qualitative research, the researcher is the research instrument (Patton, 1990, p.14). Some authors e.g. Denzin & Lincoln (1998) define quantitative and qualitative research by the views of the ontology and epistemology they can have. They also make the distinction between quantitative researchers seeking to measure and analyse causal relationships whereas qualitative researchers try to understand processes and the meaning of a social experience and how it came to be (Denzin & Lincoln, 1998, p.8). It follows that quantitative researchers are also less concerned with detailed descriptions whereas qualitative researchers have more value for rich description (Denzin & Lincoln, 1998, p.11). The types of methods employed in quantitative research therefore tend to involve statistical methods, mathematic models whereas interviews, narratives and historical materials are among the key methods used by qualitative researchers (Denzin & Lincoln, 1998, p.11).

Having described the three sets of beliefs (ontology, epistemology and methodology) that occur in either a positivist or phenomenological research paradigm, the next section explains the stance that was taken in this research.

3.2.4 Stance Adopted in this Study

There is a generally accepted view in social science research of what both positivist and phenomenological research paradigms entail. However, exceptions do occur because in practice researchers are not always able to adhere fully to one approach (Easterby-Smith et al., 2003, p.41). Lee (1999, p.10) supports a middle ground between the two approaches and suggests this can be of value for organisational researchers. For example, Eisenhardt (1989) took a positivist approach to building theory from a case study research design, which is essentially used in a phenomenological approach. In this research, I took a similar approach to Eisenhardt (1989). The methodology I employed was qualitative, however the ontological view I took was realist and the epistemological view I took was mid-way between empiricist and interpretivist.

I chose this path for four reasons. First, the qualitative methodology allowed me to understand the spinout development process (Denzin & Lincoln, 1998, p.8). Second, the combination of a qualitative research design with a positivist research view allowed me to develop testable hypotheses or propositions and theory that is generalisable in different settings (Eisenhardt, 1989, p.546). Third, taking a realist ontology perspective allowed me to view the actors and spinouts in my sample objectively. I could therefore focus on understanding the spinout development process

as opposed to how they construct a reality of the spinout development process. Fourth, taking a mid-way stance on the epistemology between empiricist and interpretivist allowed me to be involved with the actors / respondents involved in the research while collecting data e.g. by meeting and interviewing them, yet it allowed me to view the data objectively during data analysis procedures.

3.3 Research Design

The research design enables the research question to be connected to the findings by organising the research activity in the best way to achieve the aims (Creswell, 1998, p.2; Easterby-Smith et al., 2003, p.43). There were five key design features in this research: (1) an event-driven design; (2) a process study; (3) a longitudinal design; (4) a multiple case study; and (5) a theory building approach. Each of the five design features and the reasons they were chosen are explained in detail.

3.3.1 Event-driven

The first feature was an event-driven design. Aldrich (2001) made the distinction between outcome- and event-driven explanations. When an explanation is built backward to events that have causal significance based on an observed outcome, this is termed outcome-driven (Aldrich, 2001, p.118). When an explanation is built forward from an observed event to an outcome, this is termed event-driven (Aldrich, 2001, p.118). These are depicted in the following figures:

Figure 3.1 Outcome-driven explanations
Aldrich (2001)

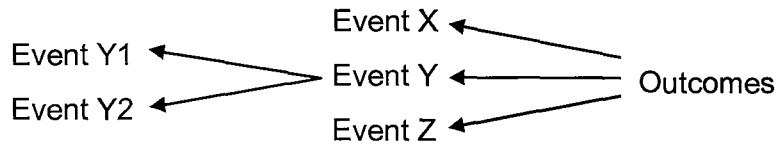
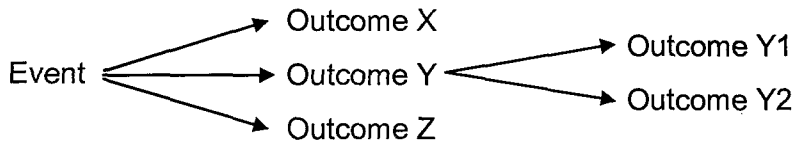


Figure 3.2 Event-driven explanations
Aldrich (2001)



Aldrich (2001, p.125) argues we should think forward rather than backward and build event-driven research rather than depend on outcome-driven research to build empirical generalisations. Van de Ven & Engleman (2004) built on Aldrich's (2001) work and argued that we see little event-driven explanations of entrepreneurship research even though there is a great need to understand entrepreneurship processes (p.346). They refer to outcome-driven and event-driven explanations as variance and process theories respectively (Van de Ven & Engleman, 2004). Whereas the variance approach allows researchers to explain change with causal explanations, the process approach allows development to be explained through narrative explanation (Van de Ven & Engleman, 2004). Van de Ven & Engleman (2004, p.355) argue the choice between the variance (outcome-driven explanation) or process approach (event-driven

explanation) should be determined by the research question. They argue there are two general types of questions in entrepreneurship research: (1) questions about the antecedents or consequences of entrepreneurship that foster the variance approach; and (2) questions about the entrepreneurship process over time that foster the process approach. The research question of this study asks '*How* does the failure to raise venture capital affect the development of university spinouts?' This is considered to fall under the second type of questions in entrepreneurship research according to Van de Ven & Engleman (2004). Therefore, in the choice between an outcome-driven (variance) versus an event-driven (process) design, this research fosters an event-driven design because an event ('the failure to raise venture capital') is present in the research question.

With the event-driven design, a process approach follows describing how a sequence of events unfolds over time (Van de Ven & Engleman, 2004). Van de Ven & Engleman (2004, p.356) recommend a narrative can be derived from the sequence of events and then guidelines by Pentland (1999) can be used to move from description to explanation in the narrative. The guidelines of Pentland (1999) are used to do this in the theory building stage of the research and are discussed in detail in Section 3.3.5

3.3.2 Process

The second feature was a process design. This is consistent with the event-driven design discussed in the previous section. This is also consistent with the research question because process studies focus on 'how' things happen rather than the outcome (Patton, 1990, p.94). Pettigrew (1997, p.338) defines process as 'a sequence

of individual and collective events, actions, and activities unfolding over time in context.' The reason for using this approach was to understand the event sequence and flow that occur in the development of university spinouts over time (Pettigrew, 1997, p.341). Studies taking a process research approach are also important in entrepreneurship research to help identify which variables are important in explaining an observed outcome (Zahra, 2007, p.451).

Pettigrew (1997, p.339) argues that a process researcher should aim to produce a case study. This allows the researcher to do three things: (1) search for patterns in a case and compare these across cases; (2) search for underlying mechanisms that shape the process; and (3) apply both induction and deduction to recognising the observed patterns (Pettigrew, 1997, p.339). Although Pettigrew (1997) explains that studying process through a case study allows a researcher to search for patterns and try to explain them, he does not provide any guidelines for doing this. Pentland (1999) however does provide detailed guidelines for moving from the observed i.e. description to recognising the patterns i.e. explanation. This is discussed in more detail in Section 3.3.5.

3.3.3 Longitudinal

The third feature was a longitudinal design. Longitudinal research methods can be applied to process studies to study the developmental of entrepreneurial ventures and the process of entrepreneurship (Van de Ven, 1992, p.214). This was included in the research design so the ongoing development of university spinouts could be

captured. Rich longitudinal research also helps provide details on how underlying dynamics play out over time (Siggelkow, 2007, p.22).

Although it can be argued that there is a longitudinal element in a process theory as it contains a temporal element, I define the use of a longitudinal design as the study of a research issue on more than one occasion (Sarantakos, 2005, p.10). I make this distinction because I did not find the literature to be clear on this point. For example, a mechanic could be asked once about the process of repairing a car and they could explain what they did at different time points. This might be considered longitudinal. However, according to the definition of 'longitudinal' that I used in this study, only if the mechanic was actually asked about the process of fixing the car on more than one occasion e.g. before, during and after he / she fixed the car, then this would be considered longitudinal.

3.3.4 Multiple Case Study

The fourth feature was a multiple case study design. This approach was chosen following an evaluation of other case study strategies. The two major strategies for case study research are by Yin (2003) and Stake (1995). Stake (1995) defines three types of case study which are: (1) intrinsic - a single case study used to gain an understanding of the individual case; (2) instrumental - also a single case and is used to support or refine a theory; and (3) collective case study - looks at a number of cases together to inquire into a phenomenon. Yin (2003, p.13) defines the case study 'as a method of inquiry that allows a contemporary phenomenon to be investigated in context,' and makes the distinction between the single and multiple case studies. A

single case study is used to test a well-formulated theory, where an extreme or unique case is represented or when the case is inaccessible to scientific investigation, but the multiple case study is regarded as being more robust overall (Yin, 2003). In the choice between the two strategies, Yin's (2003) multiple case strategy was chosen since this is the most highly regarded strategy for qualitative social science research (Ferlie, 2003). Stake (1995) is also less concerned with issues of validity (Easterby-Smith et al., 2003, p.50) compared to Yin (2003).

The multiple case study also has the following advantages: (i) it enables a deep understanding of the phenomenon (Yin, 2003, p.53; Patton, 1990, p.54); (ii) it enables study of the phenomenon over time (Gephart, 2004, p.458); (iii) the data and contextualisation provided by case studies helps develop causal inferences (Lee et al., 1999, p.60-61); (iv) the multiple case allows analytic generalisation, that is, the expansion and generalisation of theory (Yin, 2003, p.10); (v) it provides a basis from which to develop theory inductively and emphasises the rich, real-world context in which the phenomena occurs (Yin, 2003, p.13; Eisenhardt & Graebner, 2007, p. 25; Creswell, 1998, p.61); (vi) the theory resulting from cases is likely to be 'accurate, interesting and testable' as it is so deeply embedded in the data (Eisenhardt & Graebner, 2007, p.26); and (vii) it enables cross-comparison between the cases, which helps to build generalisability (Hakim, 1987, p.63-64) and can help build theoretical insights in combination with the use of other rigorous methods (Eisenhardt, 1991, p.626).

3.3.4.1 Unit of Analysis

Both the single and multiple case study choices (Yin, 2003) also allow the choice of a holistic or an embedded unit of analysis. This is essentially a differentiation between one or more than one unit of analysis. The former is an advantage when subunits of analysis cannot be logically identified (Yin, 2003, p.45). The latter allows access to different levels of each case (Yin, 2003, p.42). However, Patton (p.168) also states that: 'The key issue in selecting and making decisions about the appropriate unit of analysis is to decide what you want to be able to say something about at the end of the study'. The key focus of this study is the development process of university spinouts. This is consistent with a holistic design. Hence, the chosen unit of analysis was 'the university spinout' and this was also the primary focus of data collection (Patton, 1990, p.166).

3.3.4.2 Sources of Evidence

The strength of the case study lies in the opportunity to be able to collect and deal with multiple sources of evidence (Yin, 2003, p.97). Case study evidence may come from six sources: (1) interviews; (2) documents; (3) archival records; (4) direct observation; (5) participant-observation; and (6) physical artefacts (Yin, 2003, p.83). The opportunity to carry out any observation was discussed in the interviews carried out with Imperial College Innovations personnel in phase 1. This had to be ruled out as there were confidentiality issues to be considered in the nature of the discussions that took place between the spinout and Innovations. Interviews, documents and archives

were the three sources of data collection, where documents and archives provided corroborating evidence and helped verify details from the interviews (Yin, 2003, p.87).

3.3.4.2.1 Triangulation

The reason for using multiple sources of evidence was to obtain converging lines of inquiry i.e. triangulate the data (Yin, 2003, p.98; Marshall & Rossman, 1989, p.146; Patton, 1990). This helps to minimise bias that may arise from one source of data (Remenyi et al, 1998) and improve the credibility of the findings (Lincoln & Guba, 1985, p.305).

3.3.5 Theory Building

The fifth feature was a theory building design. A theory building approach can be justified when the research is phenomenon-driven (Eisenhardt & Graebner, 2007; Edmondson & McManus, 2007). The phenomenon that drove this research was the failure of spinouts to raise venture capital. A theory building approach is also suited to answering a 'how' research question (Eisenhardt & Graebner, 2007).

In this study, the reference to 'theory building' used by Eisenhardt (1989) is taken to have the same meaning as the term 'theory generation' used by Lee et al. (1999). The intention was to build new theory in the form of formal and testable research propositions (Eisenhardt, 1989, p.548; Lee et al., 1999, p.164). As theory building research should begin with no theory under consideration (Eisenhardt, 1989, p.536), an inductive approach was taken i.e. data was not collected or analysed with

any particular theory in mind (Eisenhardt & Graebner, 2007, p.25). An inductive research strategy is also valuable in allowing theory to emerge from the data, when limited theoretical knowledge on a topic exists (Siggelkow, 2007, p. 21). However, an attempt was made to bring structure to and focus to the research by defining the research questions and to prevent being overwhelmed by the volume of data (Eisenhardt, 1989, p.536; Langley, 1999). Therefore, the specific approach to theory building taken was to follow Pentland (1999) who describes how to build process theory from a narrative by moving from description to explanation and also Eisenhardt (1989) who describes how to build theory from case studies. Pentland's (1999) guidelines were applied to within-case analysis and Eisenhardt's (1989) guidelines were applied to the cross-case analysis. This is because one the criticisms of Eisenhardt's theory building method is that it does not provide enough depth to generate theory (Dyer Jr. & Wilkins, 1991)

Pentland (1999, p.717) argues 'stories can be understood as process theories.' A process theory can therefore be built by arranging data as a sequence of events to find the underlying process theory i.e. explanation for observed outcomes (Pentland, 1999). The sequence of events can be used to find the explanation that underlies the sequence of events by moving through four levels of narrative (Pentland, 1999). These four levels are: (1) the text - these are the actual details of the story in its original form; (2) the story - a specific point of view about the events that took place; (3) the fabula - a general description of the events that took place; and (4) the generating mechanisms - the overall underlying processes of the events that occurred. Moving through the text

this way allows an explanation to be built on the form of a process theory (Pentland, 1999).

Eisenhardt (1989) describes a method for inducing novel theory from case studies. This method of theory building allows a testable theory to be developed. The aim of the theory building approach was also to build 'strong theory' and explain *why* empirical patterns were observed (Sutton & Staw, 1995, p.375). Sutton & Staw (1995, p.378) argue strong theory explains underlying processes and why causal events occur.

Due to the theory building approach, the theory built in this study developed at a late stage. However, to present this research, this study followed a model by Pratt et al. (2006) and presented the literature review of the theories utilised in the theory building process by presenting literature reviews of these at the start of the study. This model is also supported by Gephart (2004).

3.3.6 Research Design Summary

I have described the five features of the research design in detail. This research took an event-driven, process, longitudinal, multiple case study and theory building design. These design features fit together and complement each other in the approach. Figure 3.3 summarises the design features, shows how they fit together to build theory and is followed by an explanation.

Figure 3.3 Research design summary

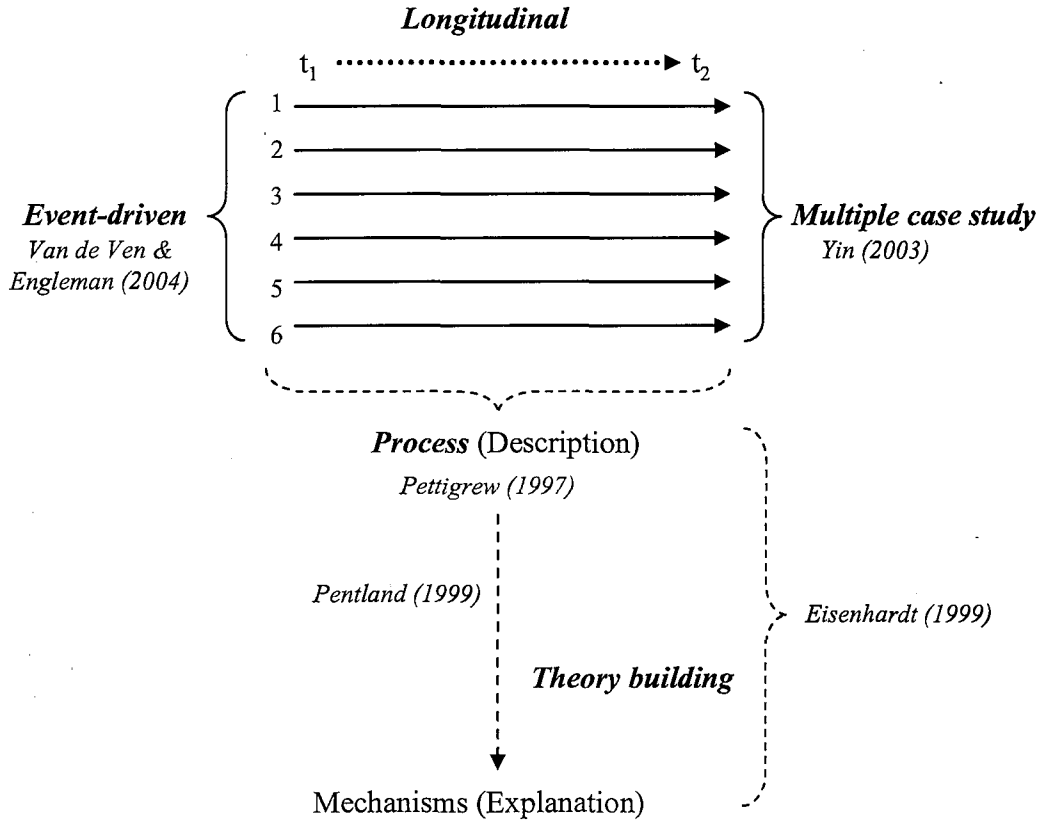


Figure 3.3 shows the event-driven design (Van de Ven & Engleman, 2004) allows data to be captured on how the failure to raise venture capital i.e. the event that affects university spinout development. This development process is captured both longitudinally and through a multiple case study design (Yin, 2003) resulting in data that is essentially descriptive. Pentand's (1999) guidelines for theory building from a sequence of events were followed to move from description to explanation within-case. Eisenhardt's (1989) guidelines were then followed to build theory across the cases.

3.4 Sample

The cases were selected by theoretical sampling. This makes them particularly 'suitable for illuminating and extending relationships and logic among constructs' (Eisenhardt & Graebner, 2007, p.27). That is, the cases were selected on the basis that they would be more likely to replicate the theory or findings (Eisenhardt, 1989, p.537; Eisenhardt & Graebner, 2007, p.27). This also employs replication logic whereby the cases are chosen so that similar results are expected (a literal replication), (Yin, 2003, p.47). Replication logic can also be applied to individual cases to seek corroboration of a proposition individually (Eisenhardt, 1991, p.620). The aim was to replicate theory for university spinouts that failed to raise venture capital.

Case studies give strong internal validity and weak external validity (Ferlie et al., 2005, p.119). The use of replication logic helps build external validity and enable generalisation further than the six cases in our study (Yin, 2003, p.37). Based on this principle, the spinouts were selected to minimise the variance between them. The spinouts were all from one university - Imperial College London.

3.4.1 Research Context

This section describes the context for: (1) the parent university of the spinouts in this study - Imperial College London; and (2) the technology transfer office of Imperial College London - Imperial Innovations.

3.4.1.1 Imperial College London

Imperial College London has a reputation as one of the best academic institutions in the world. It is consistently ranked in the top three UK institutions for research quality and has one of the highest research incomes in the UK; £204.8 million in 2005-06[i]. The strengths of Imperial College lie in technology, science and biomedicine. The Europe and World rankings by the Times show it was ranked 1st in Europe and 4th in the world for technology, 3rd in Europe and 9th in the world for science, and 3rd in Europe and 4th in the world for biomedicine[ii]. It has also been ranked 9th in the world overall by The Times in 2006[iii].

3.4.1.2 Imperial Innovations

Imperial Innovations is the technology transfer and commercialisation company for Imperial College London and is also one of the leading technology transfer companies in the UK[iv]. Imperial Innovations was founded in 1986 and established as a business in 1997. They have equity holdings in 70 spinouts and have completed 116 commercial agreements[v]. In 1999, Imperial Innovations raised £4.15 million government University Challenge Seed Funding to invest in spinouts. This made it possible to provide newly formed spinouts with 'Pathfinder' loans of up to £25,000 or seed funding of up to £250,000.

Until 2004, Imperial Innovations was wholly owned by Imperial College. In 2005, Imperial College sold 29% of Imperial Innovations to institutional investors, becoming the first university technology transfer company to do so[vi]. The 29% share

was sold for £20 million, of which £10 million was for investment into spinouts and developing technology[vii]. In early 2006, the BioIncubator[viii] was opened and managed by Imperial Innovations. It was designed to provide lab and office space and house up to 15 spinouts[ix]. In late 2006, Imperial Innovations floated on the Alternative Investment Market (AIM) of the London Stock Exchange raising £26 million[x]. Their revenue generation has exceeded £30 million and job creation exceeds 1000[xi]. Imperial Innovations also holds shares in four companies that are listed on the AIM[19],[xii].

When data collection started in 2003, Imperial Innovations was organised into teams by types of technology. For example, at the time they had a medical sciences team, a life sciences team, a physical sciences and engineering team, and an IT team. At that time, they also had just over 20 staff members and their website described their approach to spinouts as[xiii]:

> '...understanding the particular needs of embryonic companies and providing appropriate support. We can also provide access to an in-house investment fund for essential seed-funding. Even after company formation, Imperial Innovations' staff will continue to provide mentoring and guidance as required.'

By 2006, the number of employees at Imperial Innovations had grown to over 30[xiv]. Also by this time, they had restructured the organisation of their teams by stages of technology development which now consisted of a bioscience team, an engineering technology transfer team, a new ventures and asset management team[xv], with a business

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[19] AIM is the Alternative Investment Market of the London Stock Exchange.

support team running alongside these[xvi]. Their approach to spinouts on the website was described as[xvii]:

> 'We actively manage a growing portfolio of spin-out companies and assist them in achieving their highest potential. We also have a selected pool of potential directors and commercial managers who have been specifically chosen for their experience of working with spinouts.'

These excerpts from the Imperial Innovations website in 2003 and 2006 show a change in their role. The change is from an approach designed to directly provide support to spinouts with their full team involvement, to one where they have taken on more of an assisting role and tap into a pool of directors and managers for their expertise.

3.4.2 Case Selection

As discussed in Section 3.4, the aim was to select spinouts with minimal variance between them. The spinouts were therefore chosen to have similar stages of development, similar forms of seed funding prior to trying to raise venture capital and to be in one industry. The sample was selected based on company information gathered from the first phase of data collection and from information provided by Imperial Innovations in June 2004. Imperial College London held an equity stake in each of the companies and Imperial Innovations was formally involved with each company. Imperial Innovations provided a list of 58 spinouts. Each company was grouped by technology group e.g. biotechnology, medical devices, software etc. 16 of the 54 companies were classified as biotechnology. The reasons for choosing spinouts

from the biotechnology industry are explained in the next section. The 16 companies were arranged by year of formation and further information was gathered on each of the companies from company websites and internet search engines. The information gathered on these companies included the stage of development the companies were at, the amount of funding they had raised, and who the key individuals involved with each spinout were. This information for the 16 companies was compared across these dimensions. The highest number of cases that could be aligned to have the least variation between them was six. This number also satisfied the recommendation for an ideal number of cases to be between 4 and 10 (Eisenhardt, 1989, p.545; Langley, 1999). With fewer than 4 cases, generating theory is difficult and with more than 10 cases, it is difficult to cope with the complexity and volume of the data (Eisenhardt, 1989). The selected cases are presented in Section 3.4.3.

3.4.2.1 Research Setting: Biotechnology Industry

This section gives an overview of the biotechnology industry context and then explains why this industry sector was chosen.

3.4.2.1.1 Industry Context

Biotechnology companies have recently been successful in raising finance. In fact, 2006 was the best year for biotechnology companies raising finance since 2000 (Ernst & Young, 2007a. p.17). UK biotechnology companies raised €238 million of venture capital in 2006 (Ernst & Young, 2007b). Although the biotechnology industry

in the UK is not as developed as in the US (Coghlan, 2003; House of Commons, 2003), the UK is leading Europe with the highest share of public biotechnology companies at present (Ernst & Young, 2007b). There are over 100 biotechnology companies in London (Gateway to London, 2005; London Biotechnology Network, 2003). In fact, 28% of UK biotechnology companies are located in London (Ernst & Young, 2007b) and the dominant form of start-ups in this industry is university spinouts (Shane, 2004, p.16).

3.4.2.1.2 Reasons for Choosing this Industry

Spinouts from the biotechnology industry were chosen to carry out the study for three reasons. First, companies in this industry have a long process of development, typically 10+ years (Decarolis & Deeds, 1999; Lerner et al., 2003; Kleyn et al., 2007). This allows their early stage development processes to be studied in depth. Second, unlike the pharmaceutical industry which has resources to cope with the timeframes and costs required for drug development, the biotechnology industry relies heavily on venture capital for survival (House of Commons Report, 2002-03). This makes it ideal to study how the failure to raise venture capital affects spinout development. Third, universities and research institutes are leading biotechnology research in the UK (House of Commons, 2002-03), making the industry ideal to explore the process of technology transfer (Shohet & Prevezer, 1996).

3.4.3 Case Details

This section describes the features for each of the six spinouts that make up the case study. When data collection began (June 2004), the spinouts were either about to begin the process of trying to raise venture capital or had already started the process. These spinouts had already raised seed finance and were looking for first-round venture capital finance of over £1 million[20]. When the spinouts were selected for the study, it was not known how many would be unsuccessful in raising venture capital. However, I made the assumption that if up to two spinouts did successfully raise venture capital, there would still be four spinouts that I could include in the study to answer the research question that would still fulfil the requirements for a suitable number of cases (Eisenhardt, 1989). The characteristics of the six cases are summarised in Table 3.2. All the information presented in the table is supported by documents collected during phases 1, 2 and 3 of the research. Among the seed funding sources that each spinout received, five of the spinouts had been funded by government sourced seed funds allocated to universities[21]. The table aligns the following information for each of the cases:

- The year the company was founded
- The broad category it can be grouped under within the biotechnology sector
- The number of founders from Imperial College London
- The number of founders from other universities

[20] The exact amounts cannot be disclosed to protect confidentiality of the spinouts.

[21] The exact amounts or sources cannot be disclosed to protect confidentiality of the spinouts.

- The number of sources of seed funding
- The approximate[22] amount of seed funding

Table 3.2 Characteristics of selected cases

Case	Year founded	Technology	*Number of founders from:* Imperial College London	Other universities	*Seed funding:* Number of sources	Amount (£ mn approx.)
1. Alpha	2000	Drug discovery	3	0	3	1.25
2. Beta	2001	Drug discovery	1	2[23]	3	0.75
3. Omega	2002	Drug discovery	3	2	3	0.75
4. Sigma	2002	Drug discovery	2	0	1	0.25
5. Delta	2001	Drug discovery	0[24]	1	2	0.85
6. Theta	2002	Diagnostics	2	0	3	0.75

[22] The amount of seed funding is given as an approximate measure as the precise figures could lead to identification of the company.

[23] Although two of Beta's founders were from another University of London college, it is classed predominantly as an Imperial spinout as the other college did not have an active technology transfer office at the time of its formation. Imperial's technology transfer office therefore took lead involvement. Only one of the two founders from the other college was actively involved in the company since its formation.

[24] Delta was classed as a joint venture between Imperial College London and another University of London College. Although Delta does not have a founder from Imperial College and there was no technology spun-out from Imperial College, it is still classed as an Imperial College spinout as Imperial College laboratory space and resources were used in its formation, thus the college has an equity stake and had the right to an Observer on the board. The founder of this company was from the other University of London College and had interactions with the technology transfer offices of both Colleges.

3.4.3.1 Outlier Case

Case 6 (Theta) was excluded from the main results and analysis section because when the longitudinal study began, although they had planned to raise venture capital they decided to delay this process as the study proceeded. This was based on one of the founder's previous experiences with a start-up where he had been through the process of trying to raise venture capital before and failed. Based on that experience, the founders of Theta felt there were other ways to raise finance and decided it was best to delay the VC process for as long as possible and pursue other methods of raising finance. By the end of the data collection period (May 2006), Theta had still not begun to approach venture capitalists. It is therefore excluded from the rest of the study.

3.4.4 Confidentiality and Anonymity

During the data collection for this study, I assured all the respondents of confidentiality and anonymity. By ensuring confidentiality, this means any information made public will not include an individual respondent's name to prevent them being identified (Kvale, 1996, p.114). Anonymity ensures a respondents' name will not appear anywhere (Sarantakos, 2005, p.21). Following these guidelines, I have not taken the names of any respondents in this thesis.

All interview respondents were also promised that their company names would not be taken in any written work resulting from the study. I have kept details about each company to a minimum and have given each company a pseudonym to prevent

any of the details from leading to their identification. The specific type of technology, person names and seed investor names are not given for this reason.

3.4.5 Alternative Sampling Choices

The sampling method I chose was theoretical sampling (Eisenhardt & Graebner, 2007). Alternative qualitative sampling methods that I could have used include maximum variation sampling, snowball sampling or opportunistic sampling (Patton, 1990)[25]. Patton (1990, p.169) groups these different sampling methods under purposeful sampling methods as each strategy has a specific purpose with the aim for each case to be 'information-rich'.

The first sampling method that was considered was maximum variation sampling. The aim of this method is to capture and pursue any variant lines of inquiry that arose in the data (Patton, 1991, p.172). However, this method was not suitable because the aim of the study was to keep variance to a minimum so I could build generalisable theory (Eisenhardt, 1989).

The second sampling method that could be considered was snowball sampling. This involves the pursuit of informants as directed by other informants with the aim that this will lead to the most important cases as there will be convergence among recommended informants / cases (Patton, 1990, p.176). I did consider this method of sampling but it appeared to have a degree of uncertainty associated with it. As I was

[25] Patton (1990) does describe other methods of purposeful sampling. However, not all of these were appropriate considerations for the sampling choice. I have chosen to discuss the ones that were strong considerations for the sampling choice.

sampling all cases from one university, it was possible that the choices of informants / cases would be limited to a small number of cases.

The third sampling method considered was opportunistic sampling. This allows the sample to emerge while fieldwork is ongoing by following leads or opportunities as data is collected (Patton, 1990, p.179). However, this sampling strategy would not necessarily have captured spinouts that failed to raise venture capital.

3.5 Data Collection

Data collection took place in three phases over three years and from multiple sources of evidence. This phase was carried out for four reasons: (1) to find out whether the universities / TTOs encouraged the spinouts to raise venture capital; (2) to gain a better understanding of the university spinout process and milestones in the process; (3) to assess the methods by which data could be best collected; and (4) which companies could potentially be included in the study.

Phases 2 and 3 comprised the main study. In the main study, almost a two year period of events in the life of the spinouts was captured. This was the maximum development of spinouts over time that it was possible to capture within the research timeframe. The unit of analysis in the main study was the spinout. Multiple sources of evidence were collected which were interviews, documents and archives, so the data could be triangulated (Yin, 2003, p.83, p.98). The methods by which each source of evidence was collected in each phase are now described.

3.5.1 Interviews

Over the three phases of data collection, 60 interviews were conducted in total lasting approximately 50 hours. The interviews for all three phases ranged from about 30 to 90 minutes in duration and the average length of an interview was about 50 minutes. The interviews were recorded and later transcribed totalling 1375 pages.

In phase 1, the interviews were lightly structured (Wengraf, 2001, p.61) to gain an understanding of how the spinout process operated at different universities and at which university the research should be carried out. These interviews were carried out at three universities in London which were Imperial College London, Kings College London and University College London, as they were particularly active in their technology transfer processes from their science departments (Smaglik, 2002) and have well established technology transfer offices (Gateway to London, 2005). The interviews were with spinout founders and technology transfer personnel at each of the three universities. This phase consisted of 17 interviews (July to October 2003) and informed the data collection in phases 2 and 3. Of the 17 interviews, 12 were conducted in person and 5 were conducted over the phone. An example interview schedule used for interviews with technology transfer personnel in this phase can be viewed in Appendix 1.

In phases 2 and 3, the interviews were semi-structured to allow exploration of the spinout development process and also allow other issues to emerge and be explored if anything of interest or importance arose (Wengraf, 2001, p.60-61; Kvale, 1996, p.124). Wengraf (2001, p.5) and Lee (1999, p.62) emphasise the need to maintain the balance between preparation and improvisation in this type of interview. These

interviews were conducted with technology transfer office personnel, members of the spinouts and a selection of venture capitalists who the spinouts had presented to for funding. An example interview schedule used for interviews with academics in phase 2 can be viewed in Appendix 2a. An example interview schedule used for venture capitalists in phase 2 can be viewed in Appendix 2b.

Phases 2 and 3 comprised the longitudinal study and lasted 13 months (May 2004 to June 2005) and 3 months (March to May 2006) respectively. Phase 2 consisted of 32 interviews and phase 3 consisted of 11 interviews. Including the eight month interval between phases 2 and 3 (July 2005 to February 2006), the total period of development captured in the development of the spinouts was almost two years. During preparation for each interview in phase 2 and 3, the interview schedule was tailored based on background information for the company. For the interviews in phase 3, some questions were based on the respondents' previous interview and any press releases or updates on the company website about the company since the last interview. An example interview schedule used for interviews with academics in phase 3 can be viewed in Appendix 3.

Table 3.3 summarises the dates of data collection and the interviews carried out in each phase:

Table 3.3 Summary of interviews in each phase of data collection

Phase	Date collected	Number of interviews
1	July 2003 – October 2003	17
2	May 2004 – June 2005	32
3	March 2006 – May 2006	11
	Total	**60**

3.5.1.1 Interview Design

The interviews conducted in phases 1, 2 and 3 were recorded and then transcribed. 53 interviews were conducted in person and 7 were conducted over the telephone. Permission to record the interviews was requested before the interviews began and confidentiality was assured. Written notes were taken during the interviews in person and also during the interviews on the telephone, in case the recorder was to fail or the recording was not clear in places. The vast majority of the time, respondents appeared to be comfortable with the interview being recorded. Only a handful of times would they say something and ask for the recorder to be switched or say something like 'Please don't quote me on that!'

There are advantages and disadvantages to recording the interviews. For example, an advantage is it can allow the interviewer to concentrate on the questions they ask and listening rather than taking notes (Wengraf, 2001, p.203). A disadvantage is the awareness of the recorder may have an adverse effect on the interviewee (Saunders et al., 2003, p.264). It was explained to the respondents that recording the interview would be helpful as written notes could not be taken fast enough. It also

allowed me to think about the next question more carefully than would otherwise have been possible if the interview was not being recorded and more detailed notes had to be taken.

3.5.1.2 Ethical Considerations

The reason for carrying out an interview is for the researcher to gather data (Patton, 1990, p.353). However it is important to consider the ethical issues involved because interviews are a form of intervention with people and can have an effect on them (Patton, 1990, p.354). The researcher needs to be responsible for the data that he / she obtains and needs to care not to harm the interests of the research respondents in any way (Easterby-Smith et al., 2003, p.77). I took account of the ethical issues involved by informing the respondents their identities would be anonymised and taking care not to quote anything the respondents had specifically identified as 'off the record' (Creswell, 1998, p.132).

3.5.2 Documents & Archives

The collection of archives and documents took place in phases 2 and 3, for each of the spinouts and for Imperial Innovations. Care was taken to only include quality sources of data as a criterion for their authenticity and to screen out any unreliable sources (Scott, 1990). There was one archival source of data and four sources of other documents that were collected. The archival information was collected from

Companies House and the other four sources of documents were collected from: (1) newsletters; (2) press releases; (3) websites; and (4) official company literature.

The archival source of information was from Companies House which is an online repository for UK companies where limited companies are incorporated and dissolved. It is open to public access and companies are required to deposit their company information following the Companies Act 1985, which includes filing details of ownership and annual accounts. The types of documents I could access at Companies House were company accounts and Current Appointments reports. Of the four sources from which documents were obtained, the first is newsletters. Imperial Innovations started to publish spinout newsletters in July 2004, and all issues published from July 2004 to April 2006 were obtained. The second source of documents was press releases. These were collected relating to spinout and technology transfer activity at Imperial College London. The press releases collected were issued either by the College, Imperial Innovations or one of the six spinouts in the study. The third source of documents was website information, which came from the websites of Imperial College London, Imperial Innovations and each of the six spinouts. The information from the website of Imperial College London was used to gain background information on the founders and spinouts prior to interviewing them. The website of Imperial Innovations was also monitored and major changes in content and design from August 2003 to March 2006 were recorded. Information on all areas relating to each of the six spinouts in the study were also gathered from those websites in addition to collecting information directly from the websites of all six spinouts at the start and end of data collection. The fourth source of documents applies only to Imperial Innovations.

Copies of their Annual Review from 2003 / 04 to 2005 / 06, company brochures, their Mission Statement and four PowerPoint presentations reporting on their success (2003 - 2005) were obtained. In total, the documents and archives amounted to 1125 pages.

3.6 Data Analysis and Theory Building

This section describes the data analysis and theory building techniques employed in the study. This is described separately for phase 1 and then for the main study (phases 2 and 3).

3.6.1 Phase 1

For the data collected in phase 1, the interviews conducted with academics and technology transfer personnel at Kings College London, University College London and Imperial College London were transcribed and then analysed using guidelines for thematic analysis by Boyatzis (1998). Thematic analysis involves organising observations in the data by coding the emerging themes (Boyatzis, 1998, p.4). A theme is a pattern in the data that allows it be reduced to a lower level (Boyatzis, 1998, p.4). In this phase, the themes were induced from the data without the use of any existing theory (Boyatzis, 1998, p.4). This method of analysis was used to gain a sense of the possible phenomena that might have existed in the research context.

3.6.2 Phases 2 and 3

The data analysis and theory building process for the main study (phases 2 and 3) took place in four steps which were: (1) coding; (2) within-case analysis; (3) cross-case analysis; and (4) constructing the theoretical propositions. These steps are in line with three flows of analysis activity (data reduction, data display, conclusion drawing and verification) defined by Miles & Huberman (1994, p.10). In this research, step 1 corresponds with data reduction - a process of focusing and simplifying the data (Miles & Huberman, 1994, p.10); steps 2 and 3 correspond with data display - a method of organising the data into a compressed for so it allows preliminary conclusions to be drawn (Miles & Huberman, 1994, p.11); and step 4 corresponds with conclusion drawing and verification - building patterns, explanations, causal relationships and propositions while checking back with the data to seek verification (Miles & Huberman, 1994, p.11). Each of the four steps in data analysis is described in turn.

3.6.2.1 Step 1: Coding

Coding is a method of organising data to give it some theoretical meaning (Lee 1999, p.47). The coding process was started by transcribing the interviews while data collection continued (Miles & Huberman, 1994). To gain familiarity with the data, each transcript was read through at least once before it was coded in any way. Microsoft Word[26] was used to code each transcript once using a method of open coding

[26] Microsoft Word was used as an alternative to NVivo. I did try to use NVivo at first as it is a widely-used tool for data coding in qualitative research, but I did not find it user-friendly and I

(Strauss & Corbin, 1998). Open coding allows concepts in the data to be identified (Strauss & Corbin, 1998, p.101). The properties and dimensions of the concepts can also be identified and then used to categorise the data (Strauss & Corbin, 1998, p.101). Themes can be derived from the concepts by identifying relationships between them. This is termed axial coding (Strauss & Corbin, 1998, p. 123). The move from concepts to themes can also be termed as a move from 1st-order concepts to 2nd-order themes (Maitlis & Lawrence, 2007). Using Microsoft Word, a different colour was assigned to the text supporting the themes in each interview transcript.

3.6.2.2 Step 2: Within-case Analysis

From each interview transcript, the coloured text was cut and paste into a new Microsoft Word document bringing the data together from each of the interviews to case-level. Within the document for each case, the themes from all the transcripts were arranged in a sequence of events (Pentland, 1999). The colours assigned to the themes were retained within the sequences of events, so the points at which they occurred could be seen.

Arranging the data in a sequence of events is part of the narrative strategy, which is one way in which theory can be constructed from qualitative process data (Langley, 1999; DiMaggio, 1995). The event sequence is the core of narrative structure and the main aspect of analysis (Pentland, 1999, p.713). The narrative structure 'organises events into some arrangement of the past, present and future'

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felt it prevented me from getting close to the data. On both counts, I found Microsoft Word to be the better option, although it probably took much longer this way.

(Golden-Biddle & Locke, 2007, p.5). Pentland (1999) explains that narrative text provides an indication of the process theory that underlies it and a sequence of events in the narrative can be used to move toward the underlying (deep) structure and explanation. The explanation is basically the process theory, which can take the form of a hypothesis about a causal sequence of events (Pentland, 1999, p.721). The move from the surface level to deep structure goes through four levels which are the text, the story, the fabula and the generating mechanisms (Pentland, 1999, p.719). Narrative theory begins at the level of the fabula, which means relating a specific set of events and actors together (Pentland, 1999, p.720). The events and actors were related together by visually mapping the flow of events for each case (Miles & Huberman, 1994, p.111) and constructing a time-ordered meta-matrix display (Miles & Huberman, 1994, p. 200) in which the data was aligned by case and sequence of events. The themes earlier highlighted in colour during the coding stage were still visible in colour in the time-ordered display. By relating the events and actors for each case, this enabled theories about each case to be formed. The aim is also to compose a 'theorised storyline' that relates the narrative in the data to the academic theory (Golden-Biddle & Locke, 2007, p.6, p.26, p.52).

3.6.2.3 Step 3: Cross-case Analysis.

Analysis was moved from the within-case level to the cross-case level to move from the fabula to the deepest level of structure i.e. generating mechanisms (Pentland, 1999). The flow of events that had been mapped for each case was compared and the cases in the time-ordered display were also compared (Miles & Huberman, 1994).

Two tactics were used here following Eisenhardt's guidelines (1989, p.540). The first tactic was to use the themes that had been colour-coded earlier, so I could compare their occurrences across the cases. This was based on Eisenhardt's method of using selected dimensions to look for within-group similarities and intragroup differences. The second tactic was to compare cases in pairs and list the similarities and differences between them. These tactics help build accurate and reliable theory (Eisenhardt, 1989, p.541). They also allowed any differences and anomalies in the data to be viewed, so the original transcripts could be referred back to, to see why that was e.g. if any data had been missed or whether it was a genuine point of difference between the cases.

3.6.2.4 Step 4: Construction of Theoretical Propositions.

As relationships began to emerge that spanned more than one case, several comparisons were made between the data and propositions to ensure the propositions were accurately representing the data (Eisenhardt, 1989, p.541). The propositions were checked with each case resulting in revisions until they could all be confirmed (Eisenhardt, 1989, p.542). This stage also involved several iterations with the literature. As there was no particular theory under consideration (Eisenhardt, 1989, p.536), the literature was consulted for any existing constructs close to the identified themes. Following Gioia & Thomas (1996) and Corley & Gioia (2004), I constructed a map to represent the data structure, which is shown in Figure 3.4. More recently, such a figure has also been used by Pratt et al. (2006) and Maitlis & Lawrence (2007).

Figure 3.4 Data structure

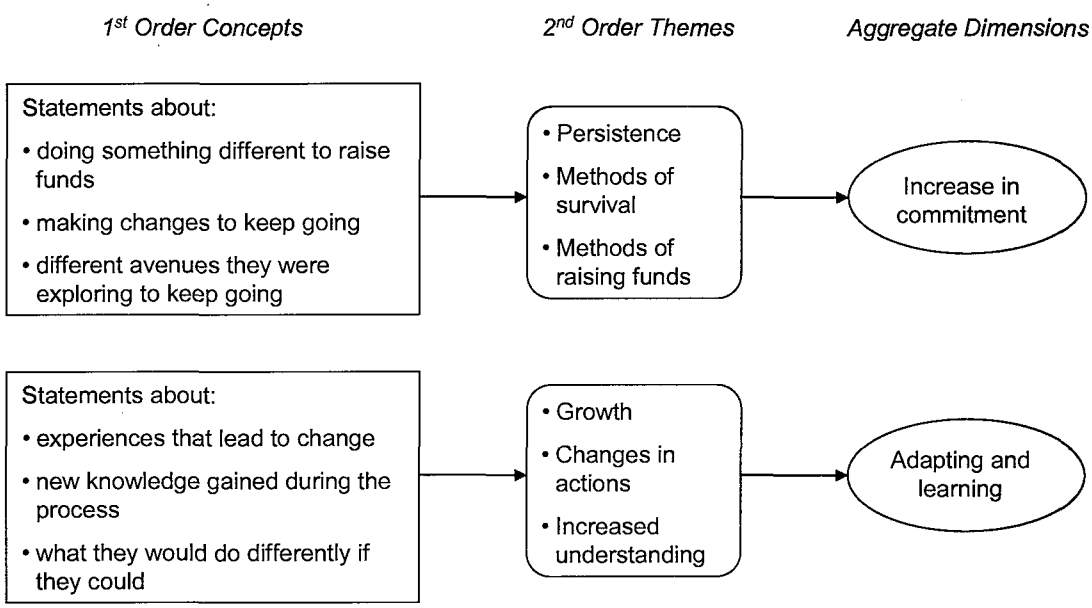


Figure 3.4 shows the path from the data to the literature by showing how the 2nd-order themes were derived from the 1st-order concepts (axial coding and open coding respectively, as described in step 1). It also shows how aggregate theoretical dimensions were drawn from the 2nd-order themes. The aggregate dimensions ('increase in commitment' and 'adapting and learning') facilitated the path to the literature on escalation of commitment and organisational learning.

The propositions involved several iterations between the data and the two theories identified from the literature and ensured a close fit between the two (Eisenhardt, 1989, p.541). The constructs were therefore built and developed through the analysis itself, which helps enhance construct validity (Eisenhardt, 1989, p.542). Obtaining such a closeness to the theoretical constructs is an advantage of case data and helps strengthen the argument for a causal relationship (Siggelkow, 2007, p.22-3). The

literature was also consulted for existing explanations of the relationships we observed (Eisenhardt, 1989, p.544). Relating the emergent theory to existing literature also helps build both internal validity and generalisability (Eisenhardt, 1989, p.545).

Using the existing theories of organisational learning and escalation of commitment, the findings are presented in the form of a model and formal propositions. The model connects the related variables, shows how they are related and enables propositions to be formed (Whetten, 1989, p. 491). Theory should explain why these connections occur (Sutton & Staw, 1995). Propositions were formed rather than hypotheses because hypotheses explain *what* rather than *why* a relationship occurs (Sutton & Staw, 1995, p.377). Theory was built by providing new insights about existing theories (Eisenhardt, 1989; Lee et al., 1999; Pentland, 1999). As Langley (1999, p.708) argues, there is room in process research to 'take ideas from the data and attach them to theoretical perspectives, enriching those theories as it goes along', and this is what I have done.

3.7 Research Quality

Yin (2003) suggests four ways research quality can be ensured: (1) construct validity; (2) internal validity; (3) external validity; and (4) reliability. An explanation of how each of these was addressed in the study is provided.

The first way research quality can be judged is construct validity. This ensures concepts have been operationalised correctly (Yin, 2003, p.34). One case study tactic for dealing with this is to gather multiple sources of evidence to make the constructs

stronger (Yin, 2003, p.34; Eisenhardt, 1989, p.538). I addressed this by collecting interviews, documents and archives as sources of evidence.

The second way research quality can be judged is internal validity. This allows a causal relationship between variables to be developed (Yin, 2003, p.34). One way this can be addressed is by explanation building (Yin, 2003). This involves using an iterative method to compare data with the theory built for each case (Yin, 2003, p.120). This was addressed using Eisenhardt's (1989, p. 541) guidelines of constant comparison between data and theory until the theory fits the data i.e. is empirically valid. These are addressed in the discussion chapter.

The third way research quality can be judge is by external validity. This is the extent to which the findings can be generalised (Yin, 2003, p.34). The use of multiple cases rather than a single case also helps to build external validity (Ferlie, 2005).

Lastly, the aim of reliability is to ensure the study can be repeated to provide the same results using the same cases (Yin, 2003, p.34). This can be addressed by making the steps taken in the research 'as operational as possible' (Yin, 2003, p.38). I have made every effort to describe and explain the methodology so it is transparent and could be followed by another researcher.

3.7.1 Limitations of Methodology

The methodology used in this study has some limitations. For example, a criticism of the case study method is the limited generalisability. However, the case study method is designed to provide generalisability to propositions rather than a population (Yin, 2003, p.10). Other authors argue the case study method lacks rigour,

however, this can be addressed by documenting the methods used so a trail is provided for a researcher to follow (Yin, 2003).

A limitation of the interview method is that the interviewer may have a bias towards the questions they ask (Easterby-Smith et al., 2003, p.93; Cassell & Symon, 1994, p.22). Also, the interview respondent may rationalise past events or tell the researcher what they think they want to hear (Yin, 2003, p.86). To help eliminate bias and to try and obtain honest answers, the interview questions were checked by the research supervisors before the interviews were conducted.

There are some critics of Eisenhardt's (1989) theory building approach who argue it may not reach 'deeper social dynamics' and provide a level of depth so this could be make it difficult to generate theory (Dyer Jr. & Wilkins[27], 1991, p.615). However, I would argue that I addressed this by also following Pentland's (1999) guidelines for theory building at the within-case stage to access as much depth as possible within each case.

Lastly, general criticisms of a qualitative methodology include researcher bias (Maxwell, 1996, p.70; Creswell, 1998, p.60). To remove this bias, I took a mid-way stance on the epistemology between empiricist and interpretivist. This allowed me to be involved with respondents while conducting interviews in the data collection stage, but to distance myself from the data during the data analysis process.

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[27] Please refer to Dyer Jr. & Wilkins (1991) for a detailed account of their views on Eisenhardt's (1989) approach and their argument for the 'classic case studies' to continue to be used.

3.8 Chapter Summary

In this chapter, I have articulated my stance as a researcher, described the research design in detail, explained how the spinouts in the sample were selected and explained how data was collected and analysed in phases 1, 2 and 3 of the study. In particular, the data analysis and theory building stage for phases 2 and 3 (the main study) explained how the data was linked to the two theoretical perspectives utilised in the results and analysis of the study. The next chapter provides a detailed account of the findings of this study.

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[i] Imperial College London Rankings. 2007. Imperial College Undergraduate Prospectus 2008 entry [online]. Accessed 19th June 2007. Available from World Wide Web at: http://www3.imperial.ac.uk/ugprospectus/imperialprofile/imperialsrankings [cited 20th June 2007].

[ii] The Times Higher Education Supplement. 2007. Accessed 19th June 2007. Available from World Wide Web at: http://www.thes.co.uk/.

[iii] The Times Higher Education Supplement. 2007. Accessed 19th June 2007. Available from World Wide Web at: http://www.thes.co.uk/.

[iv] Imperial Innovations. 2007. Accessed 19th June 2007. Available from World Wide Web at: http://www.imperialinnovations.co.uk/.

[v] Imperial Innovations Press Release. 2007. Midaz Laser Rights Issue: Notes to Editor. Accessed 13th June 2007. Available from World Wide Web at: http://www.imperialinnovations.co.uk/index.php?option=com_content&task=view&id=216&Itemid=118.

[vi] FT.com article. City Backing Imperial College by Fiona Harvey. Published 28 April 2005.

[vii] FT.com article. City Backing Imperial College by Fiona Harvey. Published 28 April 2005.

[viii] Imperial Innovations. 2006. Annual Report and Accounts: Valuing Innovation.

[ix] Imperial College London Press Release. 2005. Accessed 1st December 2005. Previously available on World Wide Web at: https://www.imperial.ac.uk/P7105.htm.

[x] Imperial Innovations Press Release. 2006. Annual Report & Accounts 2006. Accessed 19th June 2007. Available from World Wide Web at: http://www.imperialinnovations.co.uk/index.php?option=com_content&task=view&id=190&Itemid=118

[xi] Imperial College London Press Release. 2005. Accessed 1st December 2005. Previously available on World Wide Web at: https://www.imperial.ac.uk/P7105.htm.

[xii] Imperial Innovations. 2007. Accessed 18th June2007. Available from World Wide Web at: http://www.imperialinnovations.co.uk/.
[xiii] Imperial Innovations. 2003. Accessed 16th August 2003. Available from World Wide Web at: http://www.imperialinnovations.co.uk/.
[xiv] Imperial Innovations. 2006. Accessed 11th March 2006. Available from World Wide Web at: http://www.imperialinnovations.co.uk/.
[xv] Imperial Innovations. 2006. Accessed 11th March 2006. Available from World Wide Web at: http://www.imperialinnovations.co.uk/.
[xvi] Imperial College Innovations Limited Annual Report and Accounts for the year ended 31 July 2005.
[xvii] Imperial Innovations. 2006. Accessed 11th March 2006. Available from World Wide Web at: http://www.imperialinnovations.co.uk/.

4 RESULTS & ANALYSIS

4.1 Introduction

The data for this study was collected in three phases. Phase 1 was a preliminary round of interviews with academics and technology transfer personnel at three London universities about their university spinout experiences. Phases 2 and 3 comprised the main study and involved data collection on six university spinouts using multiple sources of evidence (Yin, 2003). Although data was collected on six spinouts, the results and analysis of this study focus on five of the spinouts because one of the spinouts did not go through the process of trying to raise venture capital. The results and analysis of phase 1 influenced the research design for the data collected in phases 2 and 3 (the main study). The results and analysis of phase 1 are therefore presented first and then followed by the results and analysis for the data collected in phases 2 and 3 together.

4.2 Overview of Findings

This section presents an overview of the findings for phase 1 and the main study (phases 2 and 3) separately and phases 2 and 3 together.

There were four findings from the results and analysis of the data collected in phase 1 that influenced the research design and data collection techniques utilised in phases 2 and 3. These were: (1) data could be collected from one or more of the three London universities as the TTO at each university encouraged a spinout development model which involved the pursuit of venture capital; (2) data should be collected

longitudinally rather than by a cross-sectional design; (3) data should be collected retrospectively rather than in real-time; and (4) data should be collected from only one university. Each of these will be explained in turn in the next section. The data collection in phases 2 and 3 took the findings from phase 1 into account.

The results and analysis of the main study (phases 2 and 3) include four components of the spinout process that are tied together. These are: (1) failure; (2) VC feedback; (3) escalation of commitment; and (4) learning. In this study, I define VC feedback as reasons given by VCs to the spinout explaining why they were unable to invest or suggestions for improvement so they could potentially invest. I classified VC feedback into three types: (1) *Type A: Inconsistent* - the feedback from VCs is varied, so the spinout is able to identify a range of problems with the spinout and makes some changes; (2) *Type B: Consistent and workable* - the feedback from VCs is clear and the spinout is able to identify the problems with the spinout and make the necessary changes; and (3) *Type C: Consistent and unworkable* - the feedback from VCs is clear and the spinout is able to identify the problems with the spinout but not able to make the necessary changes.

The findings focus on how the five cases; Alpha, Beta, Omega, Sigma and Delta developed following their failure to raise venture capital. The findings show when the spinouts fail to raise venture capital, they act on VC feedback by either adapting their behaviour or adapting their goal. The spinouts that adapt their behaviour do this by escalating commitment to raising finance (Alpha, Beta, Omega and Sigma) and the spinouts that adapt their goals do this by exiting (Delta).

This process between VC feedback and the escalation or exit action was also found to be mediated by learning; either single-loop learning (Alpha, Beta, Omega, Sigma) or inhibited double-loop learning (Delta). The findings are summarised in the form of a table, a model of spinout development (Eisenhardt & Graebner, 2007, p.30) and theoretical propositions.

4.3 Results and Analysis of Data Collected in Phase 1

The aim of phase 1 was to collect data on the universities and spinouts that could be included in the sample for the main stage of study (phases 2 and 3). A total of 17 interviews were carried out phase 1 (July to October 2003). The interviews were conducted with technology transfer personnel and academic founders of spinouts at Kings College London (Kings), University College London (UCL) and Imperial College London (Imperial). The analysis of this data led to four findings that informed the research design and data collection techniques utilised in phases 2 and 3.

The first finding was that the three TTOs (at Kings, UCL and Imperial) actively encouraged a spinout development model which involves the pursuit of venture capital[28]. This is shown by quotes from technology transfer personnel at each of the TTOs and a model developed in discussion. For example, a technology transfer officer at Kings describes:

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[28] It is possible that the university and / or TTO might have supported an alternative model.

> ...there's a lot of activity at the front end, when you're setting up the company, in terms of getting it established, having got it established, having got the people in place, having got that, you kind of then, to some degree leave it to the academic who'd probably spend a year or so, doing whatever work needs to be done, the research work that needs to be done and you can't kind of overly hurry that, that takes time, but **you have in mind that you need to go for a second round funding**, usually I would say in another two years and so towards the end of the period of activity, it tends again, because what you're doing then is developing a business plan, **second round which it will enable you go to and present to a range of venture capitalists seeking funding**, so I would say in terms of looking for the most activity, it tends to be right at the beginning, so young, so take them there and probably a year after its set up when you're starting to think about where the next round of money is coming from and developing, and in between generally what you have is a fairly lengthy period where basically research is being carried out...
>
> *(Technology Transfer Officer, Kings)*

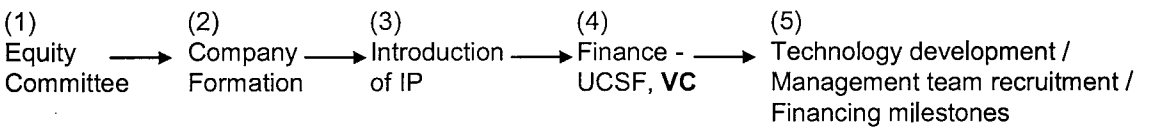
A similar quote from a technology transfer manager at UCL shows they would also approach venture capitalists for the second round of funding.

> So those are sort of initial ones we would use and **then we would start approaching institutions like VCs**...VCs tend to be looking at three to five million you know we can put in up to £250,000 from a seed fund or they can syndicate with other funds to put in up to £500,000 but there's that gap which, which I don't really think we've plugged, I mean we will use angel Investors but for the next, **we will also take it to the VCs**...
>
> *(Technology Transfer Officer, UCL)*

Venture capital was also highlighted at Imperial as being a key stage in the spinout development process. For example, in an interview with a Technology Transfer Manager at Imperial Innovations, the milestones / stages of the spinout process were drawn during discussion and defined as: (1) an 'Equity Committee' - requires approval by the Rector of Imperial College London for the company's formation; (2) company formation - includes a shareholders agreement and formal constitution of the Board; (3) introduction of intellectual property (IP) to the company

by licensing or transferring ownership of the IP to the company; (4) finance - either by a source of seed finance or venture capital (VC); and (5) some stages were described as occurring concurrently depending on the business plan (e.g. the development of company technology, recruitment of the management team and achieving milestones set by investors). These milestones are depicted in Figure 4.1.

Figure 4.1 Milestones in spinout development at Imperial College London



(Developed in interview with Technology Transfer Manager, Imperial)

This showed the TTOs at all three universities (Kings, UCL and Imperial) included venture capital finance in their spinout development models. This indicated the sample of spinouts for the main study could be studied at one or more of these universities.

The second finding was spinout development should be captured through a longitudinal rather than a cross-sectional design. This was because all the spinouts were at different stages of development and a cross-sectional design would have missed some aspects of their development. For example, as one technology transfer officer described the length of the spinout process:

> The time spent from the point of taking a company through the spinout route is a minimum of 6 months and can be ongoing to 5 years because they are still renting space or doing contracts with us, so ideally a year but on average maybe 1-2 years.
>
> *(Technology Transfer Officer, UCL)*

The third finding helped articulate the data collection techniques. This finding showed it would be difficult to follow development of the spinouts in real-time e.g. by capture data in meetings by observation. For example, a technology transfer officer argued certain stages related to a company's development can be of a sensitive nature, which would most likely be an issue for other parties involved.

> Well there clearly are critical times around the funding and of course you don't want to say to a third party investor, 'do you mind if X comes and sits in on this?' These meetings can be quite frank and open so to have somebody there writing things down, these things are quite private and **they don't want to even take a risk on somebody being in on the negotiations.**
>
> *(Technology Transfer Officer, Kings)*

He also felt spinout activity could occur infrequently making it difficult for me to be present at the right times. He explains:

> ...it is quite difficult where to get hold of the actual observation process unless you toddle around with somebody all the time but that would be very wasteful because for some weeks I don't have any contact with them at all.
>
> *(Technology Transfer Officer, Kings)*

This finding indicated that data for the main study would have to be collected retrospectively.

The fourth finding was data collection should be limited to one university as this would enable institutional factors to be reduced and provided a stronger basis for comparison of the spinouts' processes.

In addition to the four findings from phase 1 that directed the data collected in the longitudinal study, information was also gathered on: (1) the spinouts that could be included in the study sample; (2) the stage of development the spinouts were at; (3) the amount and sources of funding they had raised; and (4) who the key individuals in each spinout were. These results were incorporated in the sample selection stage (Chapter 3) for the main study. In summary, the data collected in phase 1 enabled some key aspects of the research design and data collection techniques for phases 2 and 3 to be defined.

4.4 Results and Analysis of Data Collected in Main Study (Phases 2 and 3)

The aim of collecting data in phases 2 and 3 was to capture the development of university spinouts that failed to raise venture capital. This data was captured for the five university spinouts (Alpha, Beta, Omega, Sigma and Delta) in a longitudinal study over a period of two years. This section presents the results and analysis for these five cases and is the main focus of this chapter.

This section has three main parts. First, a summary of the two theoretical perspectives and the measures used to capture each construct from the data are provided. Second, the results are presented in a process model of spinout development and a summary table. Third, the findings for each case are presented in detail leading to theoretical propositions.

4.4.1 Summaries of Theories Used and Measures for Constructs

The two theoretical perspectives employed in the analysis of the results are: (1) escalation of commitment (Staw, 1976; Staw & Ross, 1978); and (2) organisational learning (Argyris & Schön, 1978).

4.4.1.1 Escalation of Commitment Summary

An escalation of commitment occurs when there is a tendency for decision-makers to persist with a failing course of action (Brockner, 1992). Commitment can be escalated when a course of action is failing or has failed and more efforts and resources need to be committed to making that course of action pay off (Staw, 1981). Both individuals and organisations can become committed to this losing course of action (Ross & Staw, 1986). In assessing an escalation of commitment, the key question that needs to be answered is, whether this takes place 'above and beyond what would be warranted by the "objective facts" of the situation', to which the answer needs to be 'yes' (Staw, 1981). In this study, the spinouts' tendency to escalate commitment is examined when the course of action to raise finance fails.

4.4.1.1.1 Measure for Escalation of Commitment

The spinouts' escalation of commitment is measured by their 'commitment' to pursuing the same course of action. In this study, I defined the course of action as 'raising finance'. When the spinouts fail to raise venture capital, their commitment is measured by the resources they invest into pursuing finance from another source (Staw,

1976). I judged the size of a 'commitment' subjectively by the number of resources they invest in making changes to the spinout to continue and try to raise finance from alternative sources.

4.4.1.2 Organisational Learning Summary

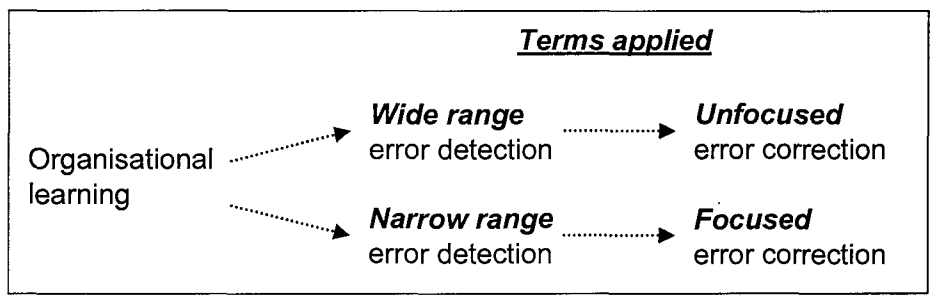
There are multiple streams of literature within the domain of organisational learning. The stream of organisational learning used in this research is Argyris & Schön's (1978) theory of learning based on the detection and correction of error. The two types of learning defined by Argyris & Schön (1978; 1996) are single and double-loop learning. Single-loop learning occurs when 'the error detected and corrected permits the organisation to carry on its present policies or achieve its present objectives' (Argyris & Schön, 1978, p.2). Double-loop learning occurs when 'error is detected and corrected in ways that involve the modification of an organisation's underlying norms, policies, and objectives,' (Argyris & Schön, 1978, p.3). In both single and double-loop learning, learning is inhibited when either error detection or error correction do not occur (Argyris, 1976). In this study, the spinouts' learning processes are observed by their detection and correction of errors in relation to their objective to raise finance.

4.4.1.2.1 Measure for Organisational Learning

I applied the following definitions of error detection and error correction in this study. I defined error detection as the recognition of an 'issue' with the spinout. I defined error correction as an action taken to modify that 'issue'.

I found different types of error detection and different types or error correction occurred which made it necessary to distinguish between them. I applied these as subjective measures to denote the differences I observed when analysing the data. To distinguish between the types of error detection, I applied the terms *narrow range* and *wide range.* To distinguish between the types of error correction I found in the results, I applied the terms *focused* and *unfocused.* I applied these terms so that I could distinguish between the differences I was observing in the data. Figure 4.2 shows the terms I applied to the existing terms of error detection and error correction.

Figure 4.2 Terms applied to error detection and error correction



The type of error correction is determined by the type of error detection that occurs. It is therefore not possible to have *wide range* error detection with *focused* error correction or *narrow range* error detection with *unfocused* error correction. The

definitions of error correction follow on from the type of error detection that takes place. The definitions I assigned to the terms for error detection and error correction are presented in Table 4.1.

Table 4.1 Definitions of terms applied to error detection and error correction

Error detection		Error correction
Wide range - a large number of different errors have been detected.	⟶	***Unfocused*** - a wide range of errors have been detected, it is unclear what the errors are, but some errors are still corrected.
Narrow range - a small number of errors have been detected, although the errors may have been detected more than once.	⟶	***Focused*** error correction - a narrow range of errors have been detected, it is clear what the errors are and they are corrected.

Argyris & Schön's definitions of single and double-loop learning include an understanding of whether or not the detection and correction of error has led to a change in the organisation's goals. Single-loop learning occurs when 'the error detected and corrected permits the organisation to carry on its present policies or achieve its present objectives' (Argyris & Schön, 1978, p.2). Double-loop learning occurs when 'error is detected and corrected in ways that involve the modification of an organisation's underlying norms, policies, and objectives,' (Argyris & Schön, 1978, p.3).

Based on the spinouts' efforts to try and raise venture capital, the objective for each of the five spinouts was defined as the goal of raising finance and whether this

was exhibited as single or double-loop learning. The next section presents a model of the findings and a table summarising the findings.

4.4.2 Process Model of Spinout Development

The findings of this study are depicted as a process model of spinout development. The model shows when the spinouts fail to raise venture capital, VC feedback affects the spinouts' action by causing an escalation of commitment or exit. The affect between VC feedback and the spinout's action was also found to be influenced by single-loop learning or inhibited double-loop learning respectively.

As there are two paths (the effect of VC feedback and the effect of learning) that link to the spinouts' action (escalation or exit), there are three variables depicted in the model (Baron & Kenny, 1986, p.1176). The three variables are: (1) VC feedback; (2) the spinout's action; and (3) learning. Learning is the mediator in this set of events because the results and analysis show there is a direct path from VC feedback to the spinout's action and there is also a path from: (a) VC feedback to learning; and (b) learning to the spinout's action (Baron & Kenny, 1986, p.1176). This is depicted in Figures 4.3, 4.4 and 4.5, where the model in each figure has the same arrangement but is drawn separately to show the variations based on VC feedback type.

Figure 4.3 is based on the findings from the spinouts Alpha and Beta who received Type A (Inconsistent) VC feedback. The figure shows when the spinouts failed to raise venture capital, they acted on the feedback by escalating commitment i.e. continuing with the same goal of raising finance. This relationship between feedback and the spinouts' action was found to be mediated by single-loop learning in the form of *wide range* error detection and *unfocused* error correction.

Figure 4.3 Spinout development model - based on VC Feedback Type A

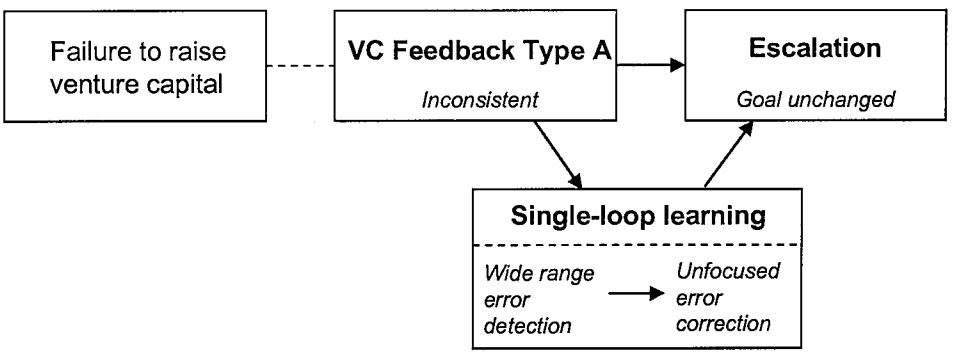


Figure 4.4 is based on the findings from the spinouts Omega and Sigma who received Type B (Consistent and workable) VC feedback. The figure shows when the spinouts failed to raise venture capital, like Alpha and Beta, they acted on the feedback by escalating commitment i.e. continued with the same goal of raising finance. However, for Omega and Sigma, the relationship between feedback and the spinouts' action was found to be mediated by single-loop learning in the form of *narrow range* error detection and *focused* error correction.

Figure 4.4 Spinout development model - based on VC Feedback Type B

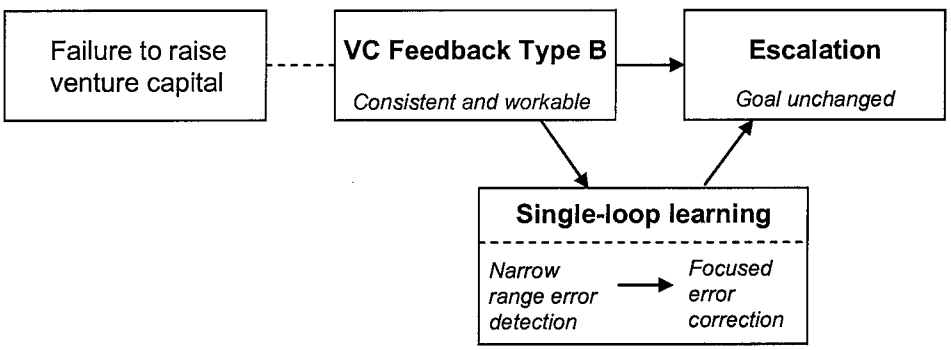
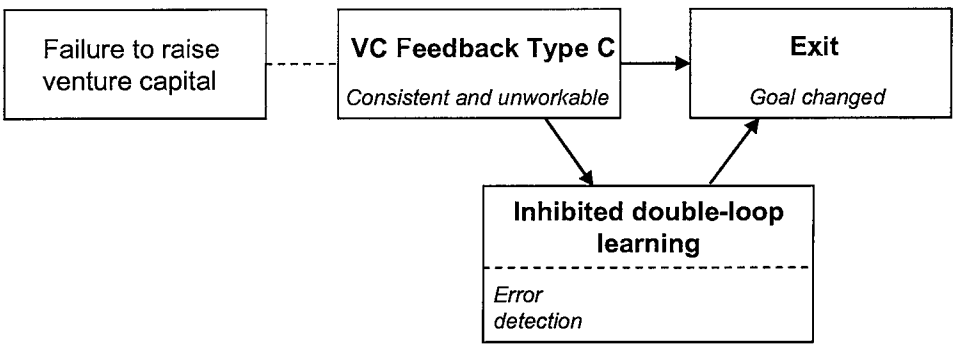


Figure 4.5 is based on the findings from the spinout Delta who received Type C (Consistent and unworkable) VC feedback. The figure shows when the Delta failed to raise venture capital, it acted on the feedback by exiting i.e. their goal of raising finance had changed. This relationship between feedback and the spinouts' action was found to be mediated by inhibited double-loop learning as error detection did take place, but error correction did not take place (Argyris, 1976).

Figure 4.5 Spinout development model - based on VC Feedback Type C



4.4.2.1 Table of Results and Spinout Typology

Table 4.2 summarises the findings and presents a typology of spinouts that results from their development processes. The table shows the effect each type of VC feedback has on the spinout's action when the spinout fails to raise venture capital. It also shows the type of learning for each spinout and whether the spinout's goal to raise finance was changed or unchanged.

I classified the spinouts into three types depending on the action they took towards achieving their goal. The first type is spinouts that received Type A (Inconsistent) VC feedback. These are termed ***persistent*** spinouts because they go through single-loop learning (based on a *wide range* of error detection and *unfocused* error correction) and show a greater escalation of commitment to raising finance. The second type is spinouts that received Type B (consistent and workable) VC feedback. These are called ***positive*** spinouts as they go through single-loop learning (based on a *narrow range* of error detection and *focused* error correction), but show a smaller escalation of commitment to raising finance. The third type is spinouts that received Type C (consistent and unworkable) VC feedback. These are called ***pragmatic*** spinouts as they go through inhibited double-loop learning (based on a *narrow range* of error detection, but no error correction), so their goal changes and they exit rather than escalate commitment to raising finance. These findings are summarised in Table 4.2.

Table 4.2 Summary of results

VC feedback type	Inconsistent (Type A)	Consistent and workable (Type B)	Consistent and unworkable (Type C)
Type of learning	Single-loop	Single-loop	Inhibited double-loop
Errors:			
Detected	*Yes (wide range)*	*Yes (narrow range)*	*Yes (narrow range)*
Corrected	*Yes (unfocused)*	*Yes (focused)*	*No*
Goal changed	*No (raise finance)*	*No (raise finance)*	*Yes (quit)*
Action taken to achieve goal	Greater escalation of commitment	Smaller escalation of commitment	Exit
Resulting spinout type	***Persistent***	***Positive***	***Pragmatic***

The next section presents the results and analysis for each stage of the model and table in detail.

4.4.3 Data Presentation

This section presents the results and analysis supporting the process model and table in three parts. In the first part, the failure to raise venture capital is discussed for the five cases (Alpha, Beta, Omega, Sigma and Delta). In the second part, the typology of VC feedback is presented. In the third part (Section 4.4.3.3), the results and analysis are presented for each case by showing the relationship between VC feedback and the

action taken by the spinout. For each case, this is followed by showing how the relationship was mediated by learning.

4.4.3.1 Failure to Raise Venture Capital

Failure is defined as the termination of an initiative that has fallen short of its goals (McGrath, 1999). I define the failure to raise venture capital for each spinout as occurring after it has been through a process of presenting to as many VCs as possible, but is unsuccessful. The five spinouts that are the focus of these results (Alpha, Beta, Omega, Sigma and Delta) each went through a process of trying to raise venture capital and failed. During this process, the spinouts received VC feedback which had an effect on their development. The types of VC feedback the spinouts received can be presented in a typology.

4.4.3.2 VC Feedback Typology

When the spinouts were trying to raise venture capital, they received VC feedback at different points during the process. Previous studies have explored feedback in terms of whether it is positive or negative (Gatewood et al., 2002), actionable (Cannon & Witherspoon, 2005), its specificity (Goodman & Wood, 2004), and its frequency, consistency and usefulness (Herold et al., 1987). Of these existing types, the two dimensions that corresponded with the types of feedback in the data were feedback consistency (Herold et al., 1987) and actionable feedback (Cannon & Witherspoon, 2005). Consistency is the extent to which feedback provided is

consistent (Herold et al., 1987). Actionable feedback produces learning and tangible results such as increasing effectiveness or improving performance (Cannon & Witherspoon, 2005). The term workable is similar to the term actionable, however I use the terms *workable and unworkable* as I found these better described the nature of the VC feedback in the data. Based on this, I classified the VC feedback received by the spinouts into three types:

(1) Inconsistent

(2) Consistent and workable

(3) Consistent and unworkable

Each type of VC feedback is presented along with its supporting data from interviews in Table 4.3. This is followed by an explanation for classifying the feedback into the different types.

Table 4.3 VC feedback types and supporting data

Spinout	VC feedback	VC feedback type
Alpha	that was the three main arms and **every time we went to [VC] to have meetings with them they would pick up on one of those arms and say that was the most important**, so we'd re-jig our business plan and re-discuss everything, make them understand that particular arm. The next time we'd go they'd say, ah we've spoken to a different person **now we don't think that arm is important now we think this arm is important**, ... this company doesn't seem to know where it's going, let's be cautious, and so we went up and down like this and in the end we didn't get any money out of it. ...they say well **your business plan should be a, b c or d**, so we say yeah we'll do that to get the money and then next time you go to a VC these people are in the ascendancy and they say **you should do d, e, f, or g**, change your business, so we never knew where we stood...	A - Inconsistent
Beta	...**come back when you have got more of this and more of that and more of the other**, when you have got a million come back and we might go with the next million, it was that sort of thing we'll spin off or spin out, you know, we'll take one bit of it and we'll spin it out into a very focused company because one of the messages that I think we got back was oh yeah, you guys have got these five patents, big deal, you know. **There's a little wrong here, a little wrong here, and a little wrong here**, and then they take cumulative weaknesses and say no, can't touch it. Or they say, you've got all these things going on, we don't understand what you're really trying to do... so **the message was a little bit diffused**	
Omega	...it became clear that the company was never going to be able to do this, it was never going to become the clincher that it thought it was going to be and the **business model was completely wrong**	B - Consistent and workable
Sigma	Three or four of them were interested, **the feedback we got from all of them was they liked it despite the flaws in the succession team**, and there was a clear leadership succession, **they liked the concept, they liked the leadership team, the business model, they just were not prepared to fund [reference to type of research] at that time.**	
Delta	with one exception, I remember exactly the occasion, with one exception nobody said to us this is crap. Everybody said this is **really interesting, very exciting, very early stage**, you know, either it's way too early for us or you know...when you're ready to raise money in the next round let us know, because it's something we'd be really interested in, but **almost everybody said** it was too early. it was **clear what they wanted**, they wanted to see that we could identify a single protein that had potent biological activity that was unique and that you could wrap lots of IP around... and at the end of the day we didn't probably find a novel protein the **unanimous view** that came back from all the VCs was **'identify the protein'**	C - Consistent and unworkable

4.4.3.2.1 Explanation

I classified the feedback for Alpha and Beta as 'inconsistent' because they were given different messages by VCs about what to change. The VC feedback they received on different occasions was to change different things, leaving an unclear message overall.

I classified the feedback for Omega, Sigma and Delta as 'consistent' but I was also able to separate this into two further types. I classified the VC feedback for Omega and Sigma as 'consistent *and* workable' because there was consistency in the overall message of the VC feedback *and* there were things they could work on i.e. something that could be modified or improved, such as the business model and the team. For example, Omega was told the business model was wrong - they later revised it. Sigma was told there were flaws in the leadership / team - they later hired a CEO and a non-executive director.

I classified the VC feedback Delta received as 'consistent *and* unworkable'. This was because as well as there being consistency in the overall message of the VC feedback, VCs suggested changes that Delta was unable to make. This is exemplified by the VCs asking Delta to identify a particular protein. However, although Delta tried, they were unable to identify this protein. The reason they were unable to identify this protein was not ascertainable from the data. It is possible this was due to their inability to work on the problem or due to the nature of the problem itself which may have been unsolvable. If Delta had been able to identify the protein, it is possible they may have acted differently.

Based on the differences between the types of feedback identified, I propose this typology of VC feedback:

(1) Type A: Inconsistent - the feedback from VCs is varied, so the spinout is able to identify a range of problems with the spinout and makes some changes (from the spinouts Alpha and Beta)

(2) Type B: Consistent and workable - the feedback from VCs is clear and the spinout is able to identify the problems with the spinout and make the necessary changes (from the spinouts Omega and Sigma)

(3) Type C: Consistent and unworkable - the feedback from VCs is clear and the spinout is able to identify the problems with the spinout but is unable (tried, but failed) to make the necessary changes (from the spinout Delta)

4.4.3.3 The Effects of VC Feedback

This section presents an in-depth analysis for each of the five cases leading to theoretical propositions. The results for Alpha and Beta are presented separately from Omega and Sigma because the former were found to have a greater escalation of commitment than the latter.

4.4.3.3.1 Case Results for Alpha and Beta

This section presents the results and analysis for Alpha and Beta. The findings show that they both received Type A (Inconsistent) VC feedback and this led to their escalation of commitment. The findings also show this relationship was mediated by single-loop learning.

Alpha

Alpha failed to raise venture capital after trying for ~12 months between 2002 and 2003. They saw about ten VCs and had negotiations lasting several months with one VC in particular. The feedback they gained from VCs during this process is classed as inconsistent (Type A). It involved being asked to change different things about their business plan each time they saw a different VC. The quotes presented show Alpha's next action followed on from VC feedback. This action was to raise finance through a second investment from the seed investor. As the founder describes in the two following quotes:

> ...they say well **your business plan should be a, b, c or d**, so we say yeah we'll do that to get the money and then **next time you go** to a VC these people are in the ascendancy and **they say you should do d, e, f, or g**, change your business, so we never knew where we stood...
> -So in a sense going through the process was what really put you off?
> Um, I think yeah, venture capitalists are to be avoided if at all possible...from the VC's we've learned we probably **won't go down the VC route** in the short term.
>
> *(Founder, Alpha)*

> **...every time the reason was slightly different... so ultimately the company ended up taking a new round of investment from the existing investor.**
>
> *(Founder, Alpha)*

This action of taking a second round of investment from the seed investor is considered to be an escalation of commitment because Alpha is persisting with the action of raising finance and they are investing a number of resources into this action (Staw, 1976). The resources invested in this action are as a result of the single-loop learning. Single-loop learning occurs when both error detection and error correction take place and the objectives of the organisation are not changed (Argyris & Schön, 1978). The founder's description of the VC feedback they received indicates Alpha have detected a *wide range* of problems / errors with Alpha. Following the detection of these errors, Alpha made some changes which can also be seen as attempts to correct these errors. These were:

Alpha's corrections[29]:

1. Chairman appointed
2. Chief Executive appointed
3. Business development person appointed

As there was a *wide range* of errors detected, but only three errors were corrected, Alpha's error corrections appear to be *unfocused.* These corrections are linked to the escalation of commitment because the corrections contribute resources to

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[29] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Section A.

the new strategies for raising finance. For example, the first change which is appointing the Chairman was linked to Alpha's decision to try and obtain a second round of seed investment. The Chairman was also working on a business case for another strategy. The Chief Executive that had been appointed was also working on the business case. The Business Development person appointed by Alpha was working on establishing contracts with pharmaceutical clients. In summary the corrected errors contributed to the escalation of commitment in the following way:

Alpha's contribution of corrections to raising finance from another source[30]:

1. Chairman appointed is (i) going for second round seed investment and (ii) working out business case
2. Chief Executive appointed is working out business case
3. Business development person appointed is working on building contracts with pharmaceutical clients

Beta

Beta failed to raise venture capital after trying for about eight months between 2003 and 2004 and meeting with around 15 VCs. The VC feedback they received from this process was classed as inconsistent (Type A). Beta described the VC feedback they received as there being 'a little wrong in different areas' and they felt the overall message of the feedback was diffused. Beta acted on the VC feedback by trying to license the technology to other companies (first quote) and do commercial deals (second quote) to raise finance. As the founder described:

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[30] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Quotes Ai, Aii, Aiii and Aiv.

> We just went down **the license route** and selling off bits and pieces of it to companies...because one of the messages that I think we got back was oh yeah, you guys have got these five patents, big deal, you know. **There's a little wrong here, a little wrong here, and a little wrong here**, and then they take cumulative weaknesses and say no, can't touch it. Or they say, you've got all these things going on, we don't understand what you're really trying to do or everybody is focused on this text book thing called focus so each one was highly focused and they did have a thread that held them together but we weren't typical, we weren't going to be a service company or we weren't going to just make one medicine or we weren't just going after cancer, you know, so **the message was a little bit diffused**
>
> *(Founder, Beta)*

> ...what we'll then do is approach the seller technology, not sell it but see if we can do some commercial deals with third party companies to use our technology and get some income that way which did work, because **for most of the VC's you are either too early, too late, too fat, too thin, too black, too white, too anything**
>
> *(Chairman, Beta)*

The actions Beta is taking form part of their escalation of commitment because they are continuing to raise finance and committing resources to it (Staw, 1976). The commitment of resources is a result of the single-loop learning based on both error detection and error correction. The inconsistency of the VC feedback Beta received enabled them to detect there was a *wide range* of errors with Beta. Beta then made some changes which can be seen as corrections of these errors. These corrections were:

Beta's corrections[31]**:**

1. Appointed new Directors (Chief Exec and business development person)
2. Appointed new business development persons (2 persons)

---

[31] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Section B.

As there was a *wide range* of error detection in Beta, it is not clear why Beta chose to correct these errors and not others, making Beta's error correction appear *unfocused.* This is also supported by the fact that they can be seen to have corrected one error twice i.e. by appointing two business development people. These corrections can be linked to Beta's strategies for raising finance because both new Directors appointed were involved in actively selling the business and the two business development people were also out looking for deals. The data shows:

Beta's contribution of corrections to raising finance from another source[32]:

1. The two new Directors appointed (Chief Executive and business development person) are actively selling the business with the Managing Director
2. The two new business development people are looking for deals

The learning that took place was single-loop as both error detection and error correction took place but Beta's goal of raising finance was unchanged.

4.4.3.3.2 Case Results for Omega and Sigma

This section will present the results and analysis for Omega and Sigma. The findings show that they both received consistent and workable VC feedback and this led to their escalation of commitment. The findings also show this relationship between VC feedback and the escalation of commitment in Omega and Sigma was

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[32] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Quote Bi.

mediated by single-loop learning. Whereas the single-loop learning for Alpha and Beta consisted of a *wide range* of error detection and *unfocused* error correction, the single-loop learning for Omega and Sigma is found to have a *narrow range* of error detection and *focused* error correction.

Omega

Omega failed to raise venture capital after trying for over a year in 2003-04 and seeing around 20 VCs. The VC feedback Omega received during the process was classified as consistent and workable (Type B). The feedback highlighted problems with the business model. Omega acted on the feedback by escalating commitment to raising finance. They did this by trying to create revenue through licensing opportunities. As the founder described the feedback and action:

> ...**it became clear** [from VC feedback] that the company was never going to be able to do this, it was never going to become the clincher that it thought it was going to be and the **business model was completely wrong**, the **revised business model** now is one much more about **creating the early revenues through licensing opportunities**
> *(Technology Transfer Officer, Omega)*

This method of trying to create revenue by licensing contributes to Omega's escalation of commitment. This is because it involved an investment of resources, which occurred as a result of the single-loop learning that took place. The VC feedback enabled Omega to detect a specific error with Omega which was that the business model was 'wrong'. Omega corrected this error by revising the business model. The revised business model i.e. the corrected error also contributed to Omega's

escalation of commitment, which was to raise finance by licensing out the technology. Omega's correction and its contribution to the escalation of commitment was:

Omega's corrections[33]:
1. Revised business model

Omega's contribution of corrections to raising finance from another source[34]:
1. Revised business model to license out the technology

In comparison with the errors detected from VC feedback by Alpha and Beta which were *wide range*, the errors detected by Omega are *narrow range*. As both error detection and error correction took place and Omega's objective of raising finance was unchanged, it was single-loop learning that took place (Argyris & Schön, 1978).

Sigma

Sigma failed to raise venture capital after trying for almost a year in 2004 and seeing around 15 VCs. The VC feedback Sigma received was consistent and workable (Type B). The feedback highlighted issues with the team. Following the feedback, Sigma's action was to pursue private investment. As the founder described:

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[33] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Section C.

[34] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Quote Ci.

> Three or four of them were interested, the feedback we got from all of them was they liked it despite the **flaws in the succession team**, and there was a clear leadership succession, they liked the concept, they liked the leadership team, the business model, they just were not prepared to fund [the type of] research at that time. **Then we went through several different rounds of private investors as well**
>
> *(Company Secretary, Sigma)*

The VC feedback was they liked certain things about Sigma such as the business model, the concept and the leadership, but there were some flaws in the succession team. This shows learning took place as Sigma detected the error from VC feedback which was with the team. Sigma then made an attempt to correct the error by appointing a CEO and non-executive director to the management team. The CEO and non-executive director were the resources invested in Sigma's escalation of commitment and they contributed to the achievement of Sigma receiving private investment. Sigma's corrections and their contribution to escalation of commitment was:

Sigma's corrections[35]:

1. Brought in CEO
2. Brought in non-executive director

Sigma's contribution of corrections to raising finance from another source[36]:

1. Changes in management structure led to getting external private investment

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[35] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Section D.

[36] This data is supported by interview quotes and can be viewed in Table 4.5 (page 149), Quote Di.

As Sigma's goal of raising finance was not changed by the error detection and error correction that took place, this was consistent with single-loop learning (Argyris & Schön, 1978).

4.4.3.3.3 Comparison of Escalations of Commitment

When the levels of commitment escalated by Alpha, Beta, Omega and Sigma are compared, a general difference can be observed. All four spinouts went through single-loop learning. However, there was a difference in the type of VC feedback they received. For both Alpha and Beta, it was inconsistent (Type A) and for Omega and Sigma, it was consistent and workable (Type B). There was also a difference in their single-loop learning. For Alpha and Beta, error detection was *wide range* and error correction was *unfocused* whereas for Omega and Sigma, error detection was *narrow range* and error correction was *focused.* As both VC feedback and learning have been found to have an effect on the spinouts' escalation of commitment, it follows that their escalation of commitment may also vary. The escalations of commitment made by Alpha, Beta, Omega and Sigma are compared by aligning their error corrections and methods of raising finance. Table 4.4 shows the comparison between the four spinouts.

Table 4.4 Data comparison of spinouts' corrections and contributions to the escalation of commitment of Alpha, Beta, Omega and Sigma

Spinout	Corrections	Contribution of corrections to raising finance from another source
Alpha	1. Chairman appointed 2. Chief Executive appointed 3. Business development person appointed	1. Chairman appointed is (i) going for second round seed investment and (ii) working out business case 2. Chief Executive appointed is working out business case 3. Business development person appointed is working on building contracts with pharmaceutical clients
Beta	1. Appointed new Directors (Chief Executive and business development person) 2. Appointed new business development persons (2 persons)	1. The two new Directors appointed (Chief Executive and business development person) are actively selling the business with the Managing Director 2. The two new business development people are looking for deals
Omega	1. Revised business model	1. Revised business model to license out the technology
Sigma	1. Brought in CEO 2. Brought in non-executive director	1. Changes in management structure led to getting external private investment

The general difference that can be observed in their levels of escalation is between the two spinouts that received Type A VC feedback (Alpha and Beta) and the two spinouts that received Type B VC feedback (Omega and Sigma). For Alpha and Beta, the escalation of commitment is greater than for Omega and Sigma. This is based on the observation that Alpha and Beta have made a higher number of error corrections on average than Omega and Sigma, which contribute to their escalation of commitment. The next section summarises and formalises the findings so far.

4.4.3.3.4 Summary Leading to Propositions

This section summarises the results of Alpha, Beta, Omega and Sigma and leads to theoretical propositions. All four spinouts tried to raise venture capital and failed. During this process, the VC feedback they received was shown to lead to their next action of escalating commitment, thereby continuing with their goal. The escalations of commitment were also indicated by the investment of resources (Staw, 1976) as a result of single-loop learning. The error detection part of learning was enabled by VC feedback. This was followed by error correction which enabled the investment of resources in the spinouts' pursuit of finance. A comparison between the spinouts also showed Alpha and Beta's escalation of commitment appeared to be greater than Omega and Sigma's. Based on these findings for Alpha, Beta, Omega and Sigma, I propose the following:

> ***Proposition 1. When the spinout fails to raise venture capital, inconsistent (Type A) VC feedback leads to a greater escalation of commitment to raising finance than consistent and workable (Type B) VC feedback***

> ***Proposition 2. Single-loop learning mediates the relationship between VC feedback and an escalation of commitment***

Table 4.5 on the following page provides details of the supporting data for Alpha, Beta, Omega and Sigma's corrections that contributed towards their efforts to raise finance from another source.

Table 4.5 Data supporting corrections and their contributions to raising finance by new methods for Alpha, Beta, Omega and Sigma

Spinout	Corrections	Contribution of corrections to raising finance from another source (with supporting quotes)
A. Alpha	1. Chairman appointed →	Chairman going for second round seed investment (quote Ai)
		Ai. We needed the bridging money otherwise we would have had to sell off the assets to pay off..., debts essentially, um so that was one thing, another thing was the unanimity at the board level that we needed to do this. The third thing was **[name of Chairman] coming on board**, that came as a tremendous boost and he agreed, when someone of his stature and track record in business says yes **this is the right thing to do and I'll help you** then that was also a major factor, so they were the things that you know, **made us regroup** *(Founder)*
	→	Chairman working out business case (quote Aii)
		Aii. the most recent course of action were we **put an extremely senior high profile person in as chairman and we got a chief executive** who had a good background in med**, they are now working out a business case** *(TTO)*
	2. Chief Executive appointed →	Chief Exec working out business case (quote Aii)
	3. Business development person appointed →	Business development person working on building contracts with pharmaceutical clients (quotes Aiii and Aiv)
		Aiii. ...**we appointed a business development person, ...we've repositioned the company slightly, changed our business model** (Founder)
		Aiv. ...we thought about it 6 months or a year ago and so the main thrust of the business is building some big contracts with Pharma clients ...**Our business development guy is working hard with his contacts at building some of those contracts** at the moment *(Chairman)*
B. Beta	1. Appointed new Directors (Chief Exec and business development person) →	One of the two Directors actively selling the business (quote Bi)
		Bi. What actually happened was that we realised that the board had to be changed, it was dysfunctional, it wasn't working and the upshot of it is that we appointed a representative of the venture capitalists as a part time chief executive two days a week ... **we appointed two new directors**. One was the business development guy from [name of academic institution] ... **So two employees and a managing director who is actively out there selling the business**... we're looking for one more board member ... We have also appointed two young women as our business development people, quite an impressive pair, and they work on a monthly retainer and **they are out there looking for deals** because one man can do it but three can do it better and we only need a couple of very good deals. *(Chairman)*
	2. Appointed new business development person (2 persons) →	The two new Directors appointed (Chief Exec and business development person) actively selling the business with the Managing Director (quote Bi)
C. Omega	1. Revised business model →	Revised business model – licensing out the technology (quote Ci)
		Ci. I think they've **changed their business model** recently and I think they're now looking for another small chunk of cash and they are going to **look to license out a lot of their programs** so they are not looking for a couple of million in VC funding, they see this more as a license outplay and maybe as a trade sale *(TTO)*
D. Sigma	1. Brought in CEO 2. Brought in non-executive director →	Changes in management structure led to getting external private investment (quote Di)
		Di. ...**changed the management structure...and then went straight to get [amount (in million)] funding which came from a private investor**. *(Company Secretary)*

4.4.3.3.5 Case Results for Delta and Propositions

The results and analysis for the fifth case Delta are presented in this section. In contrast to the four spinouts that went through a single-loop learning process, Delta went through an inhibited double-loop learning process.

Delta failed to raise venture capital after seeing around 45 VCs over more than a year in 2002-03. During this process, Delta had received consistent and unworkable (Type C) VC feedback. The feedback was to identify a particular protein but Delta was unable to do this. Rather than escalate commitment to raising finance, their action based on the feedback was to exit. As the following two quotes from the founder and TTO of Delta show:

> ...the **unanimous view that came back from all the VCs was 'identify the protein'...**
>
> *(Founder, Delta)*

> ...the scientists, you know this is their baby, you know just wanting more time and more money **to sort it out** [find the protein] and the more business oriented people so myself, said 'we need to sort it out, **we either sort it our or we wind it up'**
>
> *(Technology Transfer Officer, Delta)*

The relationship between VC feedback and the action (exit) in this case was found to be mediated by inhibited double-loop learning. This is because although error detection from VC feedback was able to take place, error correction was unable to take place and this lead to Delta's decision to go into hibernation i.e. exit. As the following quote shows:

> ...the technology had progressed but **we hadn't definitively identified this particular protein so basically we had to kind of go into hibernation**. We let all of our employees go...
>
> *(Founder, Delta)*

As error correction had not occurred in this case, the learning is inhibited (Argyris, 1976). Since the spinout's goal has also changed, it was double-loop (rather than single-loop) learning that has taken place (Argyris & Schön, 1978). Delta's goal became ceasing to operate rather than raising finance. The results and analysis of Delta leads to the following propositions:

> ***Proposition 3. When the spinout fails to raise venture capital, consistent and unworkable (Type C) VC feedback leads to an exit***

> ***Proposition 4. Inhibited double-loop learning mediates the relationship between VC feedback and exit***

4.5 Chapter Summary

This chapter presented the results and analysis for three phases of data collection. The data collected in phase 1 consisted of a preliminary round of interviews and the results and analysis of this phase informed the research design for the main study (phases 2 and 3). The results and analysis of phases 2 and 3 provided a process model and theoretical propositions for the development of university spinouts when they fail to raise venture capital. The findings showed VC feedback can be classified into three types: Type A - Inconsistent; Type B - Consistent and workable, and Type C - Consistent and unworkable. When the spinouts fail to raise venture capital, they act

on the type of VC feedback they received by adapting their behaviour or adapting their goal. The spinouts that received Type A and Type B VC feedback (Alpha, Beta, Omega and Sigma) adapted their behaviour and escalated commitment to raising finance. This relationship was mediated by single-loop learning. The spinout that received Type C VC feedback (Delta) adapted its goal and exited. This relationship was mediated by inhibited double-loop learning. The next chapter discusses the significance of these findings in relation to theory and existing literature.

5 DISCUSSION & CONCLUSION

5.1 Introduction

This study has built theory on how the failure to raise venture capital affects the development of university spinouts. The findings show that when spinouts fail to raise venture capital, they adapt their behaviour or goal based on VC feedback. University spinouts that received Type A (Inconsistent) or Type B (Consistent and workable) VC feedback adapted their behaviour i.e. escalated commitment to raising finance. This relationship was mediated by single-loop learning and was found in the spinouts Alpha, Beta, Omega and Sigma. The spinout that received Type C (Consistent and unworkable) VC feedback adapted its goal i.e. exited. This relationship was mediated by inhibited double-loop learning and was found in the spinout Delta. The theory built in this study was presented as theoretical propositions and a process model of spinout development.

This chapter discusses the significance of the key findings derived from the results and analysis of the main study (phases 2 and 3) in Chapter 4. This chapter is presented in the following way. First, I discuss the four contributions of this study in detail. Second, I discuss other research implications of this study. Third, I discuss the implications of this study for policy and practice. Fourth, I discuss the limitations of this study. Fifth, I present suggestions for future research and lastly, I make concluding remarks.

5.2 Contributions

In this section, I present a detailed discussion of the four contributions of this study. The first contribution is theoretical and contributes to organisational learning theory. The second contribution is also theoretical and contributes to both organisational learning and escalation of commitment theories. The third contribution is made to the entrepreneurship literature in general. The fourth contribution is made to the venture capital literature.

5.2.1 Learning as a Mediator

The first theoretical contribution of this study is the introduction of learning as a mediator between feedback and an organisation's action (behaviour or goal adaptation). This is based on the findings that: (1) single-loop learning mediated the relationship between VC feedback and an escalation of commitment i.e. adapted behaviour (Proposition 2); and (2) inhibited double-loop learning mediated the relationship between VC feedback and an exit i.e. adapted goal (Proposition 4). This constitutes a theoretical contribution to the organisational learning literature on performance feedback models in the following way.

Past studies on performance feedback models show that organisations act on feedback by adapting their behaviour or goal (e.g. Branzei et al., 2004; Lant & Hurley, 1999; Lant et al., 1992 and Mezias et al., 2002). My findings are consistent with this literature since they show feedback can cause an organisation to adapt its behaviour or goal. However, my findings also show that this relationship is mediated by single-loop

or inhibited double-loop learning. Based on the definition of learning in this study (the detection and correction of error), learning as a mediator shows that organisations interpret feedback by detecting and correcting error and this has an influence on their behaviour or goal. To articulate this contribution, I review the literature on performance feedback models. In this review, I highlight the aspects of these studies where the importance of *how* feedback is interpreted has been discussed.

5.2.1.1 Literature on Performance Feedback Studies

Performance feedback models explain that organisations adapt their behaviour or goal in response to performance feedback when they face problems (Schulz, 2002). Within this literature, there are studies that show how an organisation responds to positive performance feedback (e.g. Lant, 1992) and negative performance feedback (e.g. Lant & Hurley, 1999). I focus on the studies that show how organisations act on negative performance feedback. In all five cases, the spinouts failed to raise venture capital and this is reflected by VC feedback. Hence, VC feedback can also be classified as negative[37] performance feedback.

Therefore, the findings can be taken as: (1) negative performance feedback (in the cases of Alpha, Beta, Omega and Sigma) causes an organisation to adapt its behaviour; and (2) negative performance feedback (in the case of Delta) causes an

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[37] The literature in this area usually measures positive performance feedback as an increase in sales or a successful outcome. Therefore, I could have only classified any VC feedback types as positive if any of the cases had successfully raised venture capital.

organisation to adapt its goal. The studies relating to these two sets of findings are now discussed.

The first set of studies has shown that negative performance feedback causes an organisation's behaviour to adapt. The change in behaviour can either be an escalation of commitment (Branzei et al, 2004; Lant & Hurley, 1999), strategic persistence (Lant et al., 1992) or strategic reorientation (Lant et al., 1992). For example, Branzei et al. (2004) carried out a survey of 360 firms in China and looked at how different types of feedback affect the strategy formation process. They found leaders were more likely to escalate commitment to a losing course of action in light of negative performance feedback. In a study on resource allocation decisions of management teams, Lant & Hurley (1999) found negative performance feedback (operationalised as sales that did not meet the target level) could lead to an escalation of commitment. Lant et al. (1992) used a managerial learning perspective to explore how past performance influenced the likelihood of strategic persistence[38] or reorientation[39] in top management teams. They carried out a simulation study and found firms persisted with their past strategic orientations despite negative performance feedback. They also found a strong association between negative performance feedback and an organisation's reorientation in some companies (Lant et al., 1992).

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[38] Strategic persistence occurs when an organisation continues with their current strategic orientation (Lant et al., 1992).

[39] Strategic reorientation occurs when the organisations strategic course is altered (Lant et al., 1992).

In the second set of studies on how an organisation adapts its goal in response to performance feedback, there are fewer studies than there are on how organisations adapt their behaviour. One of these studies specifically looked at negative performance feedback. This study found negative performance feedback (operationalised as sales) led an organisation to change its goal to a lower level (Mezias et al., 2002).

Among the studies that show a relationship between negative performance feedback and an organisation's behaviour or goal change, the importance of interpreting feedback was highlighted by Lant et al. (1992). They used a learning perspective in their study because it enabled them to consider how managers interpret information about experience and performance to take action by persistence or reorientation (Lant et al., 1992). Specifically, they argued: 'We also do not fully understand when and why managers will interpret performance information in such a way that they escalate commitment to prior strategies' (Lant et al., 1992, p.604). Similarly, Lant & Hurley (1999, p.421) stated, 'To make strategic decisions, managers must interpret and respond to the performance outcomes of their organisations.' Although these two studies have discussed the importance of interpreting feedback for managers, there are no studies that show how organisations interpret this feedback, only that they adapt by a change in behaviour or goal.

5.2.1.2 Summary

I have made a theoretical contribution to the organisational learning literature on performance feedback models by identifying the role of learning as a mediator in the relationship between feedback and an organisation's action (behaviour or goal

adaptation). This contribution shows that organisations can interpret the feedback they receive through a process of detecting and correcting error.

As discussed, previous studies have shown the relationship between negative performance feedback and how an organisation adapts. These studies may have captured this relationship because organisations do adapt based on performance feedback such as sales figures. However, these organisations may not be interpreting the feedback by detecting and correcting error, or this interpretation has not been captured. My findings suggest that organisations can interpret feedback through single-loop or inhibited double-loop learning.

This might explain *why* some organisations adapt their behaviour in response to feedback but other organisations adapt their goals. Organisations that adapt their behaviour are more likely to be engaged in single-loop learning, whereas organisations that adapt their goals are more likely to be engaged in double-loop learning. This suggests that if an organisation were to consciously interpret feedback by error detection and error correction, it might adapt in a different way.

5.2.2 Integration of Learning and Escalation Theories

The second theoretical contribution of this study is an integration of the organisational learning and escalation of commitment theoretical perspectives. In the previous contribution, learning was linked to an organisation's behaviour or goal adaptation in general, whereas this contribution shows that learning is linked specifically to escalation of commitment behaviour. These theories have been integrated by showing that although VC feedback led to an escalation of commitment,

single-loop learning also influenced this escalation (see Figures 4.3, 4.4 and 4.5). This is based on the finding that in four spinouts (Alpha, Beta, Omega and Sigma), the relationship between VC feedback and an escalation of commitment was mediated by single-loop learning (Proposition 2). Without the use of both theoretical perspectives, it would not have been possible to capture the effect of single-loop learning on the spinouts' escalation of commitment. The integration of these two theories constitutes a theoretical contribution because it provides a better lens for specifically explaining the behaviour of university spinouts that was observed in this study, than either of the two theories could have done so alone (McGahan, 2007, p.750). This has an impact on both theoretical perspectives.

Schulz (2002, p.415) argues one of the aims of organisational learning theory is to understand what the effects of learning are on organisational behaviour and outcomes. In this respect, the integration of the two theories shows that one effect of learning on an organisation's behaviour can be an escalation of commitment. Similarly, for escalation of commitment theory, this shows that escalation behaviour could be influenced by single-loop learning. The use of an integrated perspective based on these two theories might therefore provide a better lens for understanding 'living dead' companies (Ruhnka et al., 1992; Roberts, 1991, p.127).

'Living dead' companies are referred to as such because they are in a middle ground between success and failure i.e. they are self-sustaining but do not fail or become big successes (Ruhnka et al., 1992; Roberts, 1991, p.127). It is possible that these companies are affected by single-loop learning, but as this does not allow them to adapt their goals (Argyris & Schön, 1978; 1996), they could actually be involved in a

cycle of escalating commitment (Staw, 1981; Staw & Ross, 1978). This would require the use of an integrated perspective between the two theories to explore this.

The integration of these two theories also articulates a relationship that has not been well documented. Aldrich (1999) did make a reference to these two theories together in a discussion of how organisations evolve. He explored a number of theoretical perspectives[40] that can be used to understand organisational change. One of the approaches he discussed was organisational learning (Aldrich, 1999, p.58). He argued that when procedures or performance levels fail, variations can occur depending on how an organisation adapts by either ignoring the failure or redefining their objectives (Aldrich, 1999, p.58). For the latter, Aldrich (1999) cites Staw's work[41] on escalation of commitment. This implies that an escalation of commitment could be related to learning, although he did not discuss this further. This study therefore makes this relationship explicit.

5.2.3 Process Model of Spinout Development

The third contribution of this study is made to the entrepreneurship literature. Building on studies of failure and feedback in the entrepreneurship process, I contribute to the entrepreneurship literature by presenting a process explanation of how the failure to raise venture capital affects spinout development (Propositions 1 and 3). The findings show that the five spinouts (Alpha, Beta, Omega, Sigma and Delta) acted on

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[40] Aldrich (1999, p.43) also explored other approaches including: population ecology, resource dependence, institutional theory, interpretive approach and transaction cost economics.

[41] Aldrich (1999) also cited Lant et al.'s (1992) work on strategic persistence and reorientation.

VC feedback by escalating commitment or exiting and this was mediated by single-loop or inhibited double-loop learning respectively. The process model of spinout development presented in this study is significant for three reasons. First, it is a process theory explanation of how early stage ventures develop. Shane (2006, p.158) for example, argues it is important to develop process theory explanations as these are rare in the entrepreneurship literature.

The second reason the process model of spinout development is significant is that it shows how early stage ventures respond to failure. The study of failure in entrepreneurship is important for two reasons: (1) to help build models of value creation (McGrath, 1999); and (2) to help both entrepreneurs and venture capitalists overcome the problems faced by new ventures (Zacharakis et al., 1999). The findings showed that it was only when Alpha, Beta, Omega, Sigma and Delta failed to raise venture capital that they acted on VC feedback. This is consistent with the view that failure stimulates action (Sitkin, 1992).

The third reason the process model of spinout development is significant is that it shows two ways early stage ventures can act on different feedback i.e. escalate commitment or exit, while mediated by learning. Although a few studies in the entrepreneurship literature have shown the role of feedback is important in the entrepreneurship process, this area has largely been neglected (Woo et al., 1994). In entrepreneurship studies, feedback has been discussed in relation to: (1) entrepreneurial behaviour (Woo et al., 1994; Aldrich & Martinez, 2001); (2) how entrepreneurs respond to feedback in the entrepreneurship process (Gatewood et al., 2002; McCarthy

et al., 1993); and (3) the process of new venture creation (Bhave, 1994). These three sets of studies will be outlined in turn in a review of this literature.

5.2.3.1 Literature on Feedback in the Entrepreneurship Process

The importance of feedback has been highlighted in two conceptual studies that discuss a relationship between feedback and entrepreneurial behaviour. For example, Woo et al. (1994) argue that how entrepreneurs acquire and use feedback is important to venture performance and success. Specifically, they state little is known about the process of '...how entrepreneurs *acquire and respond*[42] to feedback, and make adjustments which shape the eventual performance of the venture,' (Woo et al., 1994, p.515). Furthermore, 'Venture success depends on its capacity to acquire information and process feedback,' (Woo et al., 1994, p.524). Aldrich & Martinez (2001, p.52) argue while entrepreneurs construct their firms, they have the potential to learn based on feedback from their outcomes and this process still needs to be understood.

There are two empirical studies in the entrepreneurship literature that have linked feedback to the entrepreneurship process. Gatewood et al. (2002) showed that feedback has an effect on entrepreneurs' expectations of their entrepreneurial success. They carried out a study on a class of 179 MBA students and asked them complete a web-based questionnaire that assessed their entrepreneurial potential. The students that received positive feedback had higher entrepreneurial expectancies than those that received negative feedback (Gatewood et al., 2002). McCarthy et al. (1993) examined

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[42] Emphasis added.

reinvestment decisions of entrepreneurs relating to whether they should increase, decrease or maintain the size of their business by conducting a 3-year longitudinal survey of 1112 new firms. They operationalised feedback from the marketplace as financial feedback by a change in sales from one year to the next. Following negative feedback, they found escalation of commitment behaviour occurred in the form of reinvestment into the business (McCarthy et al., 1993).

In an empirical study, Bhave (1994) highlighted the importance of feedback to the entrepreneurship process by showing that feedback plays a role in the venture creation process. He found customers generated both strategic and operational feedback which acted as signals and allowed an interaction between variables in the model (such as business concept, product and customer) and the market. He developed a process model of entrepreneurial venture creation and described it as an 'iterative, nonlinear, feedback-driven, conceptual, and physical process' (Bhave, 1994, p.223).

These studies have shown: (a) the importance of understanding how feedback is used by ventures and entrepreneurs in the entrepreneurship process (Woo et al., 1994; Aldrich & Martinez, 2001); (b) how entrepreneurs behave in response to feedback, but not how ventures respond to feedback (McCarthy et al., 1993; Gatewood et al., 2002); and (c) feedback plays a role in the entrepreneurship process and specifically in the venture creation process (Bhave, 1994). The findings of this study add to this literature to show how early stage ventures use feedback in their development process.

5.2.3.2 Summary

Building on studies of failure and feedback in the entrepreneurship process, the third contribution of this study is a process explanation of how the failure to raise venture capital can stimulate early stage ventures to act on VC feedback.

5.2.4 VC Feedback Typology

The fourth contribution of this study is a classification of VC feedback into three types: (1) Inconsistent (Type A); (2) Consistent and workable (Type B); and (3) Consistent and unworkable (Type C). Type A and Type B VC feedback were both linked to an escalation of commitment action by the spinouts and Type C VC feedback was linked to an exit. Previous literature on feedback in the VC context relates to how feedback affects the entrepreneur-venture capitalist relationship or how it affects VCs themselves at the decision-making stage. For example, Sapienza & Korsgaard (1996) explored the effect of entrepreneurs providing timely feedback on the investor's decision making. When entrepreneurs did provide timely feedback to investors, VCs felt the entrepreneur was trustworthy and would consequently give more support to their decisions and monitor the venture less (Sapienza & Korsgaard, 1996). There are also studies that show VCs' feedback affects their own decision-making processes. For example, Shepherd & Zacharakis (2002) argue although outcome feedback is an effective learning mechanism, it can take up to seven years before VCs know whether or not they made the right decision. Therefore, they argue cognitive feedback can be

obtained in the short term by the use of decision aids such as bootstrapping models[43] (Shepherd & Zacharakis, 2002). They discuss the benefits of obtaining cognitive feedback for VCs to learn. However, as Zacharakis & Meyer (1998) argue, it is not only important for VCs to understand their own decision criteria, but it is also important for entrepreneurs seeking capital. Crucially, they add that without this understanding, '...entrepreneurs that spend most of their time and effort presenting the team, while neglecting other factors, may not obtain funding,' (p.72). By quoting Zacharakis & Meyer (1998), I do not mean to imply that the spinouts in this study neglected other factors while trying to raise venture capital, but my intention is to highlight how important it is for entrepreneurs to understand VC decisions and what can happen to a venture when they do not understand a VC's decision not to fund them.

There have not been any previous studies that have captured VC feedback in relation to the companies they screen or consider as potential investments i.e. at the pre-investment stage. This study adds to this stream of literature by showing feedback from VCs is communicated to ventures at the pre-investment stage and the different types these can be.

5.3 Other Research Implications of the Study

In addition to the four contributions of this study that I have discussed, this study also has implications for qualitative research design in entrepreneurship studies.

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[43] A bootstrapping model captures the decision maker's assessment policy by capturing cues and weights they used in past decisions (Shepherd & Zacharakis, 2002, p.6).

5.3.1 Research Design

This study had an event-driven, process and longitudinal research design. There has been a need for event-driven studies in entrepreneurship research to understand how events unfold in venture development over time (Van de Ven & Engleman, 2004). There has been a need for more process studies on university spinouts to understand spinout formation and development (Nicolaou, 2004; Nicolaou & Birley, 2003a; Mustar et al., 2006). There has also been a need for longitudinal studies in entrepreneurship to help find causal linkages between variables and help understand on-going adaptation processes (Aldrich & Martinez, 2001). This study has addressed these three needs in entrepreneurship studies.

5.4 Implications for Practice and Policy

The implications of this study are for venture capitalists, university spinouts, universities, technology transfer offices and governments.

For venture capitalists, the implication is they should take due care in the feedback they give to spinouts. It is important that venture capitalists give honest and detailed feedback about why they did not fund a venture, as their feedback can affect a spinout's action. For example, if a venture capitalist feels a spinout has the potential to be successful in the future, they should communicate how they feel the spinout can achieve this in their feedback, so the spinout's action and learning may lead to an escalation of commitment rather than an exit. Conversely, if a venture capitalist felt the

chances a spinout could be successful are extremely low, they should communicate this in their feedback to the spinout so it may be more likely that an exit would take place.

The implication for university spinouts is they should try to obtain honest and consistent feedback from VCs when they are not successful in raising venture capital. The spinouts can then analyse the feedback and decide what the best course of action for them is. The typology of VC feedback can be helpful for spinouts to do this.

For universities and technology transfer offices, the implication of this study is for them to be aware there are a number of university spinouts that may be trying to raise venture capital or other sources of funding that could be affecting their development. This would help them consider how best to support these spinouts and decide how the spinouts should adapt. Technology transfer offices that might be involved in encouraging spinouts to look for venture capital or making introductions to venture capitalists should consider VC feedback more carefully each time a spinout is not successful in raising venture capital. This would give the spinout time to work on VC feedback and help improve its chances of raising venture capital when they see the next venture capitalist.

The implication for governments is to more carefully consider the seed funds they provide to universities. Among the sources of seed funds that Alpha, Beta, Omega, Sigma and Delta received, government seed funds were a source of funding in four of these. Although the fates of Alpha, Beta, Omega and Sigma are not yet known, it is argued such seed funding has spurred university spinout creation (e.g. Lambert, 2003) and if these spinouts are not able to raise venture capital, it draws attention to their quality. The government may therefore need to shift their emphasis from

university spinout creation to university spinout development by providing mechanisms for support and nurturing the spinouts already created to improve their chances of success.

5.5 Limitations

The limitation of the study in phase 1 is only three universities in London were explored as potential choices for carrying out the main study (phases 2 and 3). Exploring a broader set of universities in England or the UK could have provided greater insight into university spinout processes and influenced the research design of the main study (phases 2 & 3) in a different way.

There are three limitations of the main study (phases 2 and 3). The first limitation is the extent to which the findings from this study can be generalised. Although an advantage of the case study methodology is high internal validity, the disadvantage is low external validity (Ferlie, 2005). This makes it difficult to generalise beyond the five cases on which the results are focused to university spinouts in any other setting. The focus of this study was on spinouts at one university (Imperial College London) and in one industry (biotechnology); therefore the findings are specific to these settings and should be replicated in other settings. Both these choices were however considered during the sample selection stage of the study and these choices were deliberately made to limit potential sources of variance that could affect the findings.

The second limitation of the study is that the findings of Delta were unique and unsupported by at least one more case. This was the only spinout in the dataset whose

founder was from another College of the University of London, although it was still considered a spinout of Imperial College London based on resources / facilities used at the College and Imperial Innovations also held an equity share in the company. It was also the spinout to see the highest number of venture capitalists (~45), whereas the other spinouts saw 10-20 venture capitalists. It is therefore possible that the findings from Delta are unique to its circumstances.

The third limitation is that the development processes of four of the spinouts (Alpha, Beta, Omega, Sigma) were not captured in their entirety. The focus of this study has been on a specific part of the university spinouts' development. Although data was collected over the maximum possible period given the timeframe of the research (a 2 year period in the life of the spinouts), it was not possible to capture how these spinouts continued to develop. After the data collection period ended, the spinouts were successful in raising alternative sources of finance. More specifically, it is not known for how long or to what extent they will be able to sustain themselves based on this funding, or for example, if they escalated commitment to raising finance again or will do so in the future. This makes it difficult to judge whether their escalation of commitment was a good use of their time and resources, how long they will survive or what level of success they will have in the future. For example, it is possible what is seen as failure at one point can be a prelude to success later (Kisfalvi, 2000).

5.6 Suggestions for Future Research

Based on this study, suggestions are made for future research in the area of university spinouts, entrepreneurship, escalation of commitment and organisational learning.

5.6.1 University Spinouts

Future research should examine the development processes of university spinouts in more detail. For example, it would be interesting to observe how the four spinouts that went through the single-loop learning process (Alpha, Beta, Omega and Sigma) developed in the future and what other processes they went through. For example, is there a middle ground (Ruhnka et al., 1992; Roberts, 1991) in which they continue to survive or at what point do they fail completely?

This research echoes existing calls in the literature for more research on TTOs (Rothaermel et al, 2007; Locket & Wright, 2005; Wright et al., 2006). However, the results of this study call for the role of the TTO to be explored specifically in relation to the finance-seeking behaviour of university spinouts. For example, to what extent does the 'push' to raise venture capital or other sources of funding come from the TTO and why?

5.6.2 Entrepreneurship

Studies on failure tend to explore failure as the final outcome of a venture. As this study has shown, the failure to raise venture capital can affect early stage venture

development. Future studies should look at how other interim failures that affect venture development. There may be a number of failures that occur at different stages before the venture fails completely. This research could also overlap with studies on the factors or processes that lead to an entrepreneurial exit, about which there is little documented in the literature.

The effect of VC feedback on the actions of early stage firms seeking venture capital should be explored further. Data should be gathered from early stage ventures trying to raise venture capital in different industries to see whether the VC feedback types are supported. Feedback from other investment sources could also be explored to see how it affects new venture development and whether it can be categorised the same way e.g. feedback from government seed funds, business angels or private investors.

5.6.3 Escalation of Commitment

This study has shown the process of raising finance can provide a rich ground to explore escalation behaviour. Further studies can be carried out on the size and types of escalations that occur for ventures trying to raise finance and overcoming other hurdles. Process and longitudinal studies of new ventures can also help to learn how the sizes of escalations in a series of commitments might vary over time.

In this study, the escalation behaviour of university spinouts was explored. Future studies in entrepreneurship research should explore the escalations of commitment experienced by different stakeholders of new ventures. For example, do entrepreneurs, entrepreneurial teams, TTOs or venture capitalists escalate commitment

at any stage of a venture's development, what do they escalate commitment to, when and how?

5.6.4 Organisational Learning

Future studies on organisational learning should use statistical methods to test the effects of learning as a mediator in the relationship between performance feedback and an organisation's behaviour or goal change. Although this relationship has been discussed in terms of negative feedback, this could be tested in regard to both negative and positive performance feedback.

Researchers should also explore the process of how organisations interpret performance feedback. For example, do some organisations have processes in place to interpret feedback e.g. by detecting and correcting error, or do they simply react and make a decision based on a performance measure?

The integrated perspective of organisational learning and escalation of commitment theories should be applied to developing ventures or organisations to investigate the influence that learning processes based on feedback have on escalation behaviour.

5.7 Concluding Remarks

This study has attempted to assess the quality of university spinouts by answering the research question of how the failure to raise venture capital affects their development. The findings have shown that when university spinouts fail to raise

venture capital, VC feedback affects their development by leading to an escalation of commitment or exit. Single-loop or inhibited double-loop learning was found to mediate the relationship between VC feedback and the spinouts' action. The findings were presented in the form of a process model of spinout development and theoretical propositions. The study made two contributions to theory, one contribution to the entrepreneurship literature and one contribution to the venture capital literature. The first theoretical contribution was that learning mediates the relationship between feedback and whether an organisation adapts its behaviour or goal. The second theoretical contribution was an integration of organisational learning and the escalation of commitment theories. The third contribution of this study was a process model of spinout development that shows how the failure to raise venture capital stimulates early stage ventures to act on VC feedback. The fourth contribution was a typology of VC feedback. The implications of the study for policy, practice and future research were discussed. Based on this research, my view on the quantity versus quality debate of university spinouts is that industry attention needs to shift heavily away from spinout creation and focus on developing the spinouts that have already been created.

6 REFERENCES AND APPENDICES

References

Aldrich, H. 1999. ***Organizations Evolving***. London: SAGE.

Aldrich, H. E. 2001. Who wants to be an Evolutionary Theorist? ***Journal of management Inquiry***, 10: 115-127.

Aldrich, H. E., & Martinez, M. A. 2001. Many are Called, but Few are Chosen: An Evolutionary Perspective for the Study of Entrepreneurship. ***Entrepreneurship Theory and Practice***, 25: 41-56.

Antonacopoulou, E. P., & Gabriel, Y. 2001. Emotion, Learning and Organizational Change. ***Journal of Organizational Change Management***, 14(5): 435-451.

Argyris, C. 1976. Single-Loop and Double-Loop Models in Research on Decision Making. ***Administrative Science Quarterly***, 21(3): 363-375.

Argyris, C., & Schön, D. A. 1974. ***Theory in Practice: Increasing Professional Effectiveness***. San Francisco: Jossey-Bass.

Argyris, C., & Schön, D. A. 1978. ***Organizational Learning: A Theory of Action Perspective***. Reading, MA: Addison-Wesley.

Argyris, C., & Schön, D. A. 1996. ***Organizational Learning II: Theory, Method and Practice***. Reading: Addison-Wesley Publishing Company.

Atun, R., Harvey, I., & Wild, J. 2007. Innovation, Patents and Economic Growth. ***International Journal of Innovation Management***, 11(2): 279-297.

AUTM. 2003. AUTM Licensing Survey, FY 2002 Survey Summary: Association of University Technology Managers.

AUTM. 2004. AUTM Licensing Survey, FY 2003 Survey Summary. Edited by: Stevens, A. J., Toneguzzo, F.: Association of University Technology Managers.

AUTM. 2005. AUTM U.S. Licensing Survey: FY 2004 Survey Summary. Edited by: Stevens, A. J., Toneguzzo, F., Bostrom, D.: Association of University Technology Managers.

AUTM. 2006. AUTM U.S. Licensing Survey, FY 2005 Survey Summary. Edited by: Bostrom, D., Tieckelmann, R.: Association of University Technology Managers.

Bapuji, H., & Crossan, M. 2004. From Questions to Answers: Reviewing Organizational Learning Research. ***Management Learning***, 35(4): 397-417.

Baron, R. M., & Kenny, D. A. 1986. The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. ***Journal of Personality and Social Psychology***, 51(6): 1173-1182.

Beeler, J. D., & Hunton, J. E. 1997. The Influence of Compensation Method and Disclosure Level on Information Search Strategy and Escalation of Commitment. ***Journal of Behavioral Decision Making***, 10: 77-91.

Bhave, M. P. 1994. A Process Model of Entrepreneurial Venture Creation. ***Journal of Business Venturing***, 9: 223-242.

Binks, M., Wright, M., Lockett, A., & Vohora, A. 2004. Venture Capital Finance and University Spin-outs: Nottingham University Business School, The University of Nottingham, UNIEI.

Birley, S. 2002. Universities, Academics, and Spinout Companies: Lessons from Imperial. ***International Journal of Entrepreneurship Education***, 1(1): 1-21.

Blackman, D., Connelly, J., & Henderson, S. 2004. Does Double Loop Learning Create Reliable Knowledge? ***The Learning Organization***, 11(1): 11-27.

Bowen, M. G. 1987. The Escalation Phenomenon Reconsidered: Decision Dilemmas or Decision Errors? ***Academy of Management Review***, 12(1): 52-66.

Boyatzis, R. E. 1998. ***Transforming Qualitative Information Thematic Analysis and Code Development***. Thousand Oaks: SAGE Publications, Inc.

Branzei, O., Ursacki-Bryant, T. J., Vertinsky, I., & Zhang, W. 2004. The Formation of Green Strategies in Chinese Firms: Matching Corporate Environmental Responses and Individual Principles. ***Strategic Management Journal***, 25: 1075-1095.

Bray, M. J., & Lee, J. N. 2000. University Revenues from Technology Transfer: Licensing Fees vs. Equity Positions. ***Journal of Business Venturing***, 15(5-6): 385-392.

Brecher, E. G., & Hantula, D. A. 2005. Equivocality and Escalation: A Replication and Preliminary Examination of Frustration. ***Journal of Applied Social Psychology***, 35(12): 2606-2619.

Brockner, J. 1992. The Escalation of Commitment to a Failing Course of Action: Toward Theoretical Progress. ***Academy of Management Review***, 17(1): 39-61.

Brockner, J., Houser, R., Birnbaum, G., Lloyd, K., Deitcher, J., Nathanson, S., & Rubin, J. Z. 1986. Escalation of Commitment to an Ineffective Course of Action: the Effect of Feedback Having Negative Implications for Self-Identity. ***Administrative Science Quarterly***, 31: 109-126.

Brown, J. S., & Duguid, P. 1991. Organizational Learning and Communities-of-Practice: Towards a Unified View of Working Learning and Innovation. ***Organization Science***, 2(1): 40-47.

Bryman, A. 1988. ***Quantity and Quality in Social Research***. London and New York: Routledge.

BVCA, & Library House. 2005. Creating Success from University Spin-outs: A Review Conducted by Library House on behalf of the BVCA: Library House.

Cannon, M. D., & Witherspoon, R. 2005. Actionable Feedback: Unlocking the Power of Learning and Performance Improvement. ***Academy of Management Executive***, 19(2): 120-134.

Carayannis, E. G., Rogers, E. M., Kurihara, K., & Allbritton, M. M. 1998. High-Technology Spin-offs from Government R&D Laboratories and Research Universities. ***Technovation***, 18(1): 1-11.

Cassell, C., & Symon, G. 1994. ***Qualitative Methods in Organizational Research: A Practical Guide***. London: SAGE Publications.

Chapple, W., Lockett, A., Siegel, D., & Wright, M. 2005. Assessing the Relative Performance of U.K. University Technology Transfer Offices: Parametric and Non-Parametric Evidence. ***Research Policy***, 34: 369-384.

Chiesa, V., & Piccaluga, A. 2000. Exploitation and Diffusion of public Research: the Case of Academic Spin-off Companies in Italy. ***R&D Management***, 30(4): 329-339.

Chrisman, J. J., Hynes, T., & Fraser, S. 1995. Faculty Entrepreneurship and Economic Development: The Case of the University of Calgary. ***Journal of Business Venturing***, 10(4): 267-281.

Clarysse, B., & Moray, N. 2004. A Process Study of Entrepreneurial Team Formation: the Case of a Research-based Spin-off. ***Journal of Business Venturing***, 19(1): 55-79.

Clarysse, B., Wright, M., Lockett, A., Van de Velde, E., & Vohora, A. 2005. Spinning Out New Ventures: A Typology of Incubation Strategies from European Research Institutions. ***Journal of Business Venturing***, 20: 183-216.

Coghlan, A. 2003. Special Report: UK Biotech: Island of Discovery. ***New Scientist Jobs The Insider Online***, 12 April.

Cohen, W. M., & Levinthal, D. A. 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. ***Administrative Science Quarterly***, 35(1): 128-152.

Colwell, K. A. 2002. ***Testing the Effectiveness of Organizational Practices in University Technology Transfer Programs***. Paper Presented at the Academy of Management Annual Conference Proceedings Best Paper Index A1-A6, Denver, Colorado.

Colyvas, J., Crow, M., Gelijns, A., Mazzoleni, R., Nelson, R. R., Rosenberg, N., & Sampat, B. N. 2002. How do University Inventions get into Practice? ***Management Science***, 48(1): 61-72.

Cooper, A. C. 1971. Spin-offs and Technical Entrepreneurship. ***IEEE Transactions on Engineering Management***, EM-18(1): 2-6.

Cope, J. 2003. Entrepreneurial Learning and Critical Reflection. ***Management Learning***, 34(4): 429-450.

Cope, J. 2005. Toward a Dynamic Learning Perspective of Entrepreneurship. ***Entrepreneurship Theory & Practice***, 29(4): 373-397.

Corbett, A. C. 2005. Experiential Learning Within the Process of Opportunity Identification and Exploitation. ***Entrepreneurship Theory and Practice***, 29(4): 473-491.

Corley, K. G., & Gioia, D. A. 2004. Identity Ambiguity and Change in the Wake of a Corporate Spin-off. ***Administrative Science Quarterly***, 49: 173-208.

Creswell, J. W. 1998. ***Qualitative Inquiry and Research Design: Choosing Among Five Traditions***. London: SAGE Publications Ltd.

Crossan, M. M., Lane, H. W., & White, R. E. 1999. An Organizational Learning Framework: From Intuition to Institution. ***Academy of Management Review***, 24(3): 522-537.

Cyert, R. M., & March, J. G. 1963. ***A Behavioral Theory of the Firm*** (Second ed.). New Jersey: Prentice Hall.

Davenport, S., Carr, A., & Bibby, D. 2002. Leveraging Talent: Spin-off Strategy at Industrial Research. ***R & D Management***, 32(3): 241-254.

Deakins, D., & Freel, M. 1998. Entrepreneurial Learning and the Growth Process in SMEs. ***The Learning Organization***, 5(3): 144-155.

Decarolis, D. M., & Deeds, D. L. 1999. The Impact of Stocks and Flows of Organizational Knowledge on Firm Performance: An Empirical Investigation of the Biotechnology Industry. ***Strategic Management Journal***, 20: 953-968.

De Coster, R., & Butler, C. 2005. Assessment of Proposals for New Technology Ventures in the UK: Characteristics of University Spin-off Companies. ***Technovation***, 25(5): 535-543.

Degroof, J.-J., & Roberts, E. B. 2004. Overcoming Weak Entrepreneurial Infrastructures for Academic Spin-off Ventures. ***Journal of Technology Transfer***, 29(3-4): 327-354.

Denzin, E. N. K., & Lincoln, Y. S. 1998. ***The Landscape of Qualitative Research: Theories and Issues***. Thousand Oaks, California: SAGE Publications Ltd.

Di Gregorio, D., & Shane, S. 2002. Why Do Some Universities Generate More Start-ups Than Others? ***Research Policy***, 32(2): 209-227.

DiMaggio, P. J. 1995. Comments on "What Theory is Not". ***Administrative Science Quarterly***, 40(3): 391-397.

Djokovic, D., & Souitaris, V. 2007. Spinouts from Academic Institutions: A Literature Review with Suggestions for Further Research. ***Journal of Technology Transfer***, In press.

Dougherty, D. 2006. Publishing Qualitative Journal Papers. Seminar Presented at Tanaka Business School, Imperial College London, 16th March.

Druilhe, C., & Garnsey, E. 2004. Do Academic Spin-outs Differ and Does it Matter? ***Journal of Technology Transfer***, 29(3-4): 269-285.

Dyer Jr., W. G., & Wilkins, A. L. 1991. Better Stories, Not Better Constructs, to Generate Better Theory: A Rejoinder to Eisenhardt. ***Academy of Management Review***, 16(3): 613-619.

Easterby-Smith, M., Antonacopoulou, E., Simm, D., & Lyles, M. 2004. Constructing Contributions to Organizational Learning: Argyris and the Next Generation. ***Management Learning***, 35(4): 371-380.

Easterby-Smith, M., Crossan, M., & Nicolini, D. 2000. Organizational Learning: Debates Past, Present and Future. ***Journal of Management Studies***, 37(6): 783-796.

Easterby-Smith, M., & Lyles, M. 2003. Re-Reading Organizational Learning: Selective Memory, Forgetting, and Adaptation. ***Academy of Management Executive***, 17(2): 51-55.

Easterby-Smith, M., Thorpe, R., & Lowe, A. 2003. ***Management Research*** (2nd ed.). London: SAGE Publications.

Edmondson, A. C., & McManus, S. E. 2007. Methodological Fit in Management Research. ***Academy of Management Review***, 32(4): 1155-1179.

Eisenhardt, K. M. 1989. Building Theories from Case Study Research. ***Academy of Management Review***, 14(4): 532-550.

Eisenhardt, K. M. 1991. Better Stories and Better Constructs: The Case for Rigor and Comparative Logic. ***Academy of Management Review***, 16(3): 620-627.

Eisenhardt, K. M., & Graebner, M. E. 2007. Theory Building from Cases: Opportunities and Challenges. ***Academy of Management Journal***, 50(1): 25-32.

Ensley, M. D., & Hmieleski, K. M. 2005. A Comparative Study of New Venture Top Management Team Composition, Dynamics and Performance Between University-based and Independent Start-ups. ***Research Policy***, 34(7): 1091-1105.

Ernst & Young. 2007a. Beyond Borders Global Biotechnology Report 2007: Global Biotechnology Center.

Ernst & Young. 2007b. European Country Profiles A Supplement to Beyond Borders: Global Biotechnology Report: Global Biotechnology Center.

Etzkowitz, H. 1998. The Norms of Entrepreneurial Science: Cognitive Effects of the New University-Industry Linkages. ***Research Policy***, 27: 823-833.

Etzkowitz, H., Webster, A., Gebhardt, C., & Terra, B. R. C. 2000. The Future of the University and the University of the Future: Evolution of the Ivory Tower to Entrepreneurial Paradigm. ***Research Policy***, 29: 313-330.

Feldman, M., Feller, I., Bercowicz, J., & Burton, R. 2002. Equity and the Technology Transfer Strategies of American Research Universities. ***Management Science***, 48(1): 105-121.

Ferlie, E. 2003. Personal Communication: Discussion on Qualitative Research Methods. Tanaka Business School, Imperial College London, 11th July.

Ferlie, E., Fitzgerald, L., Wood, M., & Hawkins, C. 2005. The Nonspread of Innovations: The Mediating Role of Professionals. ***Academy of Management Journal***, 48(1): 117-134.

Fineman, S. 1997. Emotion and Management Learning. ***Management Learning***, 28(13): 13-25.

Fiol, C. M., & Lyles, M. A. 1985. Organizational Learning. ***Academy of Management Review***, 10(4): 803-813.

Fox, F. V., & Staw, B. M. 1979. The Trapped Administrator: Effects of Job Insecurity and Policy Resistance Upon Commitment to a Course of Action. ***Administrative Science Quarterly***, 24: 449-471.

Franklin, R., Holi, M., & Lapinski, J. 2007. Spinning Out Quality: University Spin-out Companies in the UK: Library House.

Franklin, S. J., Wright, M., & Lockett, A. 2001. Academic and Surrogate Entrepreneurs in University Spin-out Companies. ***Journal of Technology Transfer***, 26(1-2): 127-141.

Gateway to London. 2005. Gateway to Knowledge Newsletter, R&D opportunities in Thames Gateway London [online]. Accessed 20th November 2005 and 20th July 2007. Available from World Wide Web at: http://www.gtlon.co.uk/pdfs/Gateway%20to%20Knowledge.pdf [cited 2nd September 2007].

Gatewood, E. J., Shaver, K. J., & Gartner, W. B. 1995. A Longitudinal Study of Cognitive Factors Influencing Start-up Behaviors and Success at Venture Creation. ***Journal of Business Venturing***, 10(5): 371-391.

Gatewood, E. J., Shaver, K. G., Powers, J. B., & Gartner, W. B. 2002. Entrepreneurial Expectancy, Task Effort, and Performance. ***Entrepreneurship Theory and Practice***, 27(2): 187-206.

George, G., Jain, S., & Maltarich, M. A. 2006. ***Academics or Entrepreneurs? Entrepreneurial Identity and Invention Disclosure Behavior of University Scientists***. Paper presented at the University Technology Transfer and Commercialization of Research: Antecedents and Consequences Symposium, Academy of Management Conference, Atlanta, USA.

Gephart Jr., R. P. 2004. From the Editors: Qualitative Research and the Academy of Management Journal. ***Academy of Management Journal***, 47(4): 454-462.

Gimeno, J., Folta, T. B., Cooper, A. C., & Woo, C. Y. 1997. Survival of the Fittest? Entrepreneurial Human Capital and the Persistence of Underperforming Firms. ***Administrative Science Quarterly***, 42: 750-783.

Gioia, D. A., & Thomas, J. B. 1996. Identity, Image, and Issue Interpretation: Sensemaking during Strategic Change. ***Administrative Science Quarterly***, 41: 370-403.

Golden-Biddle, K., & Locke, K. 2007. ***Composing Qualitative Research*** (Second ed.). Thousand Oaks: SAGE Publications, Inc.

Golob, E. 2006. Capturing the Regional Economic Benefits of University Technology Transfer: A Case Study. ***Journal of Technology Transfer***, 31(6): 685-695.

Goodman, J. S., & Wood, R. E. 2004. Feedback Specificity, Learning Opportunities, and Learning. ***Journal of Applied Psychology***, 89(5): 809-821.

Hakim, C. 1987. ***Research Design: Strategies and Choices in the Design of Social Research***. London: Routledge.

Hantula, D. A., & Bragger, J. L. D. B. 1999. The Effects of Feedback Equivocality on Escalation of Commitment: An Empirical Investigation of Decision Dilemma Theory. ***Journal of Applied Social Psychology***, 29(2): 424-444.

Harmon, B., Ardishvili, A., Cardozo, R., Elder, T., Leuthold, J., Parshall, J., Raghian, M., & Smith, D. 1997. Mapping the University Technology Transfer Process. ***Journal of Business Venturing***, 12(6): 423-434.

Harrison, R. T., & Leitch, C. M. 2005. Entrepreneurial Learning: Researching the Interface Between Learning and the Entrepreneurial Context. ***Entrepreneurship Theory and Practice***, 29(4): 351-371.

Hedberg, B. 1981. How Organizations Learn and Unlearn. In P. C. Nystrom, & W. H. Starbuck (Eds.), ***Handbook of Organizational Design***. London: Oxford University Press.

Herold, D. M., Liden, R. C., & Leatherwood, M. L. 1987. Using Multiple Attributes to Assess Sources of Performance Feedback. ***Academy of Management Journal***, 30(4): 826-835.

House of Commons. 2002-03. UK Biotechnology Industry: Twelfth Report of Session, 1-50. London: Trade and Industry Committee.

Huber, G. P. 1991. Organizational Learning: the Contributing Processes and the Literatures. ***Organization Science***, 2(1): 88-115.

Ilgen, D. R., & Davis, C. A. 2000. Bearing Bad News: Reactions to Negative Performance Feedback. ***Applied Psychology: An International Review***, 49(3): 550-565.

Johansson, M., Jacob, M., & Hellström, T. 2005. The Strength of Strong Ties: University Spin-offs and the Significance of Historical Relations. ***Journal of Technology Transfer***, 30(3): 271-286.

Jong, S. 2006. How Organizational Structures in Science Shape Spin-off Firms: the Biochemistry Departments of Berkeley, Stanford, and UCSF and the Birth of the Biotech Industry. ***Industrial and Corporate Change***, 15(2): 251-283.

Kassicieh, S. K., Radosevich, R., & Umbarger, J. 1996. A Comparative Study of Entrepreneurship Incidence Among Inventors on National Laboratories. ***Entrepreneurship Theory and Practice***, 20(3): 33-49.

Kim, D. H. 1993. The Link between Individual and Organizational Learning. ***Sloan Management Review***, 35(1): 37-50.

Kirby, D. A. 2006. Creating Entrepreneurial Universities in the UK: Applying Entrepreneurship Theory to Practice. ***Journal of Technology Transfer***, 31(5): 599-603.

Kisfalvi, V. 2000. The Threat of Failure, the Perils of Success and CEO Characters Sources of Strategic Persistence. ***Organization Studies***, 21(3): 611-639.

Kleyn, D., Kitney, R., & Atun, R. 2007. Partnership and Innovation in the Life Sciences. ***International Journal of Innovation Management***, 11(2): 323-347.

Kvale, S. 1996. ***Interviews: An Introduction to Qualitative Research Interviewing.*** Thousand Oaks: Sage Publications, Inc.

Lambert, R. 2003. Lambert Review of Business-University Collaboration: Final report. London: HM Treasury.

Langley, A. 1999. Strategies for Theorizing from Process Data. ***Academy of Management Review***, 24(4): 691.

Lant, T. K. 1992. Aspiration Level Adaptation: An Empirical Exploration. ***Management Science***, 38(5): 623-644.

Lant, T. K., & Hurley, A. E. 1999. A Contingency Model of Response to Performance Feedback. ***Group & Organization Management***, 24(4): 421-437.

Lant, T. K., & Mezias, S. J. 1992. An Organizational Model of Convergence and Reorientation. ***Organization Science***, 3(1): 47-71.

Lant, T. K., Milliken, F. J., & Batra, B. 1992. The Role of Managerial Learning and Interpretation in Strategic Persistence and Reorientation: An Empirical Exploration. ***Strategic Management Journal***, 13: 585-608.

Lee, T. W. 1999. ***Using Qualitative Methods in Organizational Research***. Thousand Oaks: SAGE Publications, Inc.

Lee, T. W., Mitchell, T. R., & Sablynski, C. J. 1999. Qualitative Research in Organizational and Vocational Psychology, 1979-1999. ***Journal of Vocational Behavior***, 55: 161-187.

Lerner, J. 2005. The University and the Start-up: Lessons from the Past Two Decades. ***Journal of Technology Transfer***, 30(1-2): 49-56.

Lerner, J., Shane, H., & Tsai, A. 2003. Do Equity Financing Cycles Matter? Evidence from Biotechnology Alliances. ***Journal of Financial Economics***, 67: 411-446.

Levitt, B., & March, J. G. 1988. Organizational Learning. ***Annual Review of Sociology***, 14: 319-340.

Lincoln, Y. S., & Guba, E. G. 1985. ***Naturalistic Inquiry***. Newbury Park: SAGE Publications.

Lockett, A., & Wright, M. 2005. Resources, Capabilities, Risk Capital and the Creation of University Spin-out Companies. ***Research Policy***, 34(7): 1043-1057.

Lockett, A., Siegel, D., Wright, M., & Ensley, M. D. 2005. The Creation of Spin-off Firms at Public Research Institutions: Managerial and Policy Implications. ***Research Policy***, 34(7): 981-993.

Lockett, A., Wright, M., & Franklin, S. 2003. Technology Transfer and Universities' Spin-out Strategies. ***Small Business Economics***, 20(2): 185-200.

London Biotechnology Network. 2003. The London Biotechnology Network Report: London's Biotechnology Cluster: 11. London.

Louis, K. S., Blumenthal, D., Gluck, M. E., & Stoto, M. A. 1989. Entrepreneurs in Academe: An Exploration of Behaviors Among Life Scientists. ***Administrative Science Quarterly***, 34(1): 110-131.

Lowe, R. A. 2006. Who Develops a University Invention? The Impact of Tacit Knowledge and Licensing Policies. ***Journal of Technology Transfer***, 31(4): 415-429.

Maitlis, S., & Lawrence, T. B. 2007. Triggers and Enablers of Sensegiving in Organizations. ***Academy of Management Journal***, 50(1): 57-84.

Markman, G. D., Baron, R. A., & Balkin, D. B. 2005b. Are Perseverance and Self-Efficacy Costless? Assessing Entrepreneurs' Regretful Thinking. ***Journal of Organizational Behavior***, 16: 1-19.

Markman, G. D., Gianiodis, P. T., Phan, P. H., & Balkin, D. B. 2004. Entrepreneurship from the Ivory Tower: Do Incentive Systems Matter? ***Journal of Technology Transfer***, 29(3-4): 353-364.

Markman, G. D., Phan, P. H., Balkin, D. B., & Gianiodis, P. T. 2005a. Entrepreneurship and University-Based Technology Transfer. ***Journal of Business Venturing***, 20: 241-263.

Marshall, C., & Rossman, G. B. 1989. ***Designing Qualitative Research***. Newbury Park, California: SAGE.

Maxwell, J. A. 1996. ***Qualitative Research Design***. Thousand Oaks: SAGE Publications, Inc.

McCarthy, A. M., Schoorman, F. D., & Cooper, A. C. 1993. Reinvestment Decisions by Entrepreneurs: Rational Decision-Making or Escalation of Commitment. ***Journal of Business Venturing***, 8: 9-24.

McGahan, A. M. 2007. Academic Research that Matters to Managers: On Zebras, Dogs, Lemmings, Hammers, and Turnips. ***Academy of Management Journal***, 50(4): 748-753.

McGrath, R. G. 1999. Falling Forward: Real Options Reasoning and Entrepreneurial Failure. ***Academy of Management Review***, 24(1): 13-30.

McNamara, G., Moon, H., & Bromiley, P. 2002. Banking on Commitment: Intended and Unintended Consequences of an Organization's Attempt to Attenuate Escalation of Commitment. ***Academy of Management Journal***, 45(2): 443-452.

Meyer, M. 2003. Academic Entrepreneurs or Entrepreneurial Academics? Research-based Ventures and Public Support Mechanisms. ***R&D Management***, 33(2): 107-115.

Mezias, S. J., Chen, Y.-R., & Murphy, P. R. 2002. Aspiration-Level Adaptation in an American Financial Services Organization: A Field Study. ***Management Science***, 48(10): 1285-1300.

Miles, M. B., & Huberman, A. M. 1994. ***Qualitative Data Analysis: An Expanded Sourcebook*** (Second ed.). Thousand Oaks: SAGE Publications, Inc.

Miner, A. S., & Mezias, S. J. 1996. Ugly Duckling No More: Pasts and Futures of Organizational Learning Research. ***Organization Science***, 7(1): 88-99.

Miner, A. S., Bassoff, P., & Moorman, C. 2001. Organizational Improvisation and Learning: A Field Study. ***Administrative Science Quarterly***, 46(2): 304-337.

Minniti, M., & Bygrave, W. 2001. A Dynamic Model of Entrepreneurial Learning. ***Entrepreneurship Theory & Practice***, 25: 5-16.

Minshall, T., & Wicksteed, B. 2005. University Spin-out Companies: Starting to Fill the Evidence Gap: A Report on a Pilot Research Project Commissioned by the Gatsby Charitable Foundation. Cambridge, U.K.: St. John's Innovation Centre Ltd.

Murray, F. 2004. The Role of Academic Inventors in Entrepreneurial Firms: Sharing the Laboratory Life. ***Research Policy***, 33(4): 643-659.

Mustar, P., Renualt, M., Colombo, M. G., Piva, E., Fontes, M., Lockett, A., Wright, M., Clarysse, B., & Moray, N. 2006. Conceptualising the Heterogeneity of Research-based Spin-offs: A Multi-dimensional Taxonomy. ***Research Policy***, 35(2): 289-308.

Nerkar, A., & Shane, S. 2003. When do Start-ups that Exploit Patented Academic Knowledge Survive? ***International Journal of Industrial Organization***, 21(9): 1391-1410.

Nicolaou, N. 2004. ***The University Spinout Phenomenon: A Social Network Perspective***. Unpublished Doctorate, Imperial College London, London.

Nicolaou, N., & Birley, S. 2003a. Academic Networks in a Trichotomous Categorisation of University Spinouts. ***Journal of Business Venturing***, 18(3): 333-359.

Nicolaou, N., & Birley, S. 2003b. Social Networks in Organizational Emergence: The University Spinout Phenomenon. ***Management Science***, 49(12): 1702-1725.

Niosi, J. 2006. Introduction to the Symposium: Universities as a Source of Commercial Technology. ***Journal of Technology Transfer***, 31: 399-402.

Northcraft, G. B., & Wolf, G. 1984. Dollars, Sense, and Sunk Costs: A Life Cycle Model of Resource Allocation Decisions." ***Academy of Management Review***, 9(2): 225-234.

O'Shea, R. P., Allen, T. J., Chevalier, A., & Roche, F. 2005. Entrepreneurial Orientation, Technology Transfer and Spinoff Performance of U.S. Universities. ***Research Policy***, 34(7): 994-1009.

O'Shea, R. P., Allen, T. J., Morse, K. P., O'Gorman, C., & Roche, F. 2007b. Delineating the Anatomy of an Entrepreneurial University: the Massachusetts Institute of Technology Experience. ***R & D Management***, 37(1): 1-16.

O'Shea, R. P., Chugh, H., & Allen, T. J. 2007a. Determinants and Consequences of University Spinoff Activity: A Conceptual Framework. ***Journal of Technology Transfer***, In press.

Parker, S. C. 2006. Learning About the Unknown: How Fast do Entrepreneurs Adjust their Beliefs? ***Journal of Business Venturing***, 21(1): 1-26.

Patton, M. Q. 1990. ***Qualitative Evaluation and Research Methods*** (Second ed.). London: SAGE Publications Ltd.

Pearce, R., & Barnes, S. 2006. ***Raising Venture Capital***. Chichester: John Wiley & Sons, Ltd.

Pentland, B. T. 1999. Building Process Theory with Narrative: From Description to Explanation. ***Academy of Management Review***, 24(4): 711-724.

Pettigrew, A. M. 1997. What is a Processual Analysis? ***Scandinavian Journal of Management***, 13(4): 337-348.

Pirnay, F., Surlemont, B., & Nlemvo, F. 2003. Toward a Typology of University Spin-offs. ***Small Business Economics***, 21(4): 355-369.

Politis, D. 2005. The Process of Entrepreneurial Learning: A Conceptual Framework. ***Entrepreneurship Theory & Practice***, 29(4): 399-424.

Powers, J. B., & McDougall, P. P. 2005. University Start-up Formation and Technology Licensing with Firms that go Public: A Resource-Based View of Academic Entrepreneurship. ***Journal of Business Venturing***, 20(3): 291-311.

Pratt, M. G., Rockman, K. W., & Kauffman, J. B. 2006. Constructing Professional Identity: The Role of Work and Identity Learning Cycles in the Customization of Identity among Medical Residents. ***Academy of Management Journal***, 49(2): 235-262.

Pries, F., & Guild, P. 2007. Commercial Exploitation of New Technologies Arising from University Research: Start-ups and Markets for Technology. ***R&D Management***, 37(4): 319-328.

Radosevich, R. 1995. A Model for Entrepreneurial Spin-offs from Public Technology Sources. ***International Journal of Technology Management***, 10(7/8): 879-893.

Rae, D. 2006. Entrepreneurial Learning: A Conceptual Framework for Technology-Based Enterprise. ***Technology Analysis & Strategic Management***, 18(1): 39-56.

Rappert, B., & Webster, A. 1998. Links Between Universities and Their Spin-offs. ***Industry & Higher Education***, 12(6): 332-338.

Ravasi, D., & Turati, C. 2005. Exploring Entrepreneurial Learning: A Comparative Study of Technology Projects. ***Journal of Business Venturing***, 20: 137-164.

Remenyi, D., Williams, B., Money, A., & Swartz, E. 1998. ***Doing Research in Business and Management: An Introduction to Process and Method.*** London: SAGE Publications Ltd.

Roberts, E. B. 1991. ***Entrepreneurs in High Technology: Lessons from MIT and Beyond.*** New York: Oxford University Press.

Roberts, E. B., & Malone, D. E. 1996. Policies and Structures for Spinning Off New Companies from Research and Development Organizations. ***R & D Management***, 26(1): 17-48.

Roberts, E. B., & Wainer, H. A. 1968. New Enterprises on Route 128. ***Science Journal***, 412: 78-83.

Rogers, E. M., Takegami, S., & Yin, J. 2001. Lessons Learned About Technology Transfer. ***Technovation***, 21(4): 253-261.

Ross, J., & Staw, B. M. 1986. Expo 86: An Escalation Prototype. ***Administrative Science Quarterly***, 31: 274-297.

Ross, J., & Staw, B. M. 1993. Organizational Escalation and Exit: Lessons from the Shoreham Nuclear Power Plant. ***Academy of Management Journal***, 36(4): 701-732.

Rothaermel, F. T., & Thursby, M. 2005. Incubator Firm Failure or Graduation? The Role of University Linkages. ***Research Policy***, 34: 1076-1090.

Rothaermel, F. T., Agung, S. D., & Jiang, L. 2007. University Entrepreneurship: A Taxonomy of the Literature. ***Industrial and Corporate Change***, In press.

Ruhnka, J. C., Feldman, H. D., & Dean, T. J. 1992. The "Living Dead" Phenomenon in Venture Capital Investments. ***Journal of Business Venturing***, 7(2): 137-155.

Sampat, B. N. 2006. Patenting and US Academic Research in the 20th Century: The World Before and After Bayh-Dole. ***Research Policy***, 35: 772-789.

Samsom, K. J., & Gurdon, M. A. 1993. University Scientists as Entrepreneurs: a Special Case of Technology Transfer and High-Tech Venturing. ***Technovation***, 13(2): 63-71.

Samsom, K., & Gurdon, M. A. 2004. ***A Longitudinal Study of Success and Failure among Scientist-Started Ventures***. Paper presented at the Babson Kauffman Entrepreneurship Research Conference, University of Strathclyde, Glasgow, UK.

Sapienza, H. J., & Korsgaard, M. A. 1996. Procedural Justice in Entrepreneur-Investor Relations. ***Academy of Management Journal***, 39(3): 544-574.

Sarantakos, S. 2005. ***Social Research*** (Third ed.). Hampshire: Palgrave Macmillan.

Saunders, M., Lewis, P., & Thornhill, A. 2003. ***Research Methods for Business Students*** (3rd ed.). Essex, England: Prentice Hall FT.

Schulz, M. 2002. Organizational Learning. In J. A. C. Baum (Ed.), ***The Blackwell Companion to Organizations***: 415-441. Oxford: Blackwell.

Schwenk, C. R. 1986. Information, Cognitive Biases, and Commitment to a Course of Action. ***Academy of Management Review***, 11(2): 298-310.

Scott, J. 1990. ***A Matter of Record: Documentary Sources in Social Research.*** Cambridge: Basil Blackwell.

Senge, P. M. 1990. ***The Fifth Discipline: The Art and Practice of the Learning Organisation***. New York: Currency Doubleday.

Shane, S. 2001a. Technological Opportunities and New Firm Creation. ***Management Science***, 47(2): 205-220.

Shane, S. 2001b. Technology Regimes and New Firm Formation. ***Management Science***, 47(9): 1173-1190.

Shane, S. 2004. ***Academic Entrepreneurship: University Spinoffs and Wealth Creation***. Cheltenham, UK: Edward Elgar.

Shane, S. 2006. Introduction to the Focused Issue on Entrepreneurship. ***Management Science***, 52(2): 155-159.

Shane, S., & Cable, D. 2002. Network Ties, Reputation, and the Financing of New Ventures. ***Management Science***, 48(3): 364-381.

Shane, S., & Stuart, T. 2002. Organizational Endowments and the Performance of University Start-ups. ***Management Science***, 48(1): 154-170.

Shepherd, D. A., & Zacharakis, A. 2002. Venture Capitalists' Expertise A Call for Research into Decision Aids and Cognitive Feedback. ***Journal of Business Venturing***, 17: 1-20.

Shohet, S., & Prevezer, M. 1996. UK Biotechnology: Institutional Linkages, Technology Transfer and the Role of Intermediaries. ***R & D Management***, 26(3): 283-298.

Siegel, D. S., Thursby, J. G., Thursby, M. C., & Ziedonis, A. A. 2001. Organizational Issues in University-Industry Technology Transfer: An Overview of the Symposium Issue. ***Journal of Technology Transfer***, 26(1-2): 5-11.

Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. 2003. Commercial Knowledge Transfers from Universities to Firms: Improving the Effectiveness of University-Industry Collaboration. ***Journal of High Technology Management Research***, 14: 111-133.

Siggelkow, N. 2007. Persuasion with Case Studies. ***Academy of Management Journal***, 50(1): 2-24.

Sitkin, S. B. 1992. Learning through failure: The strategy of small losses. ***Research in Organizational Behavior***, 14: 231-266.

Smaglik, P. 2002. Calling for Entrepreneurs London. ***Nature***, 419(6904): 4-5.

Smilor, R. W., Gibson, D. V., & Dietrich, G. B. 1990. University Spin-out Companies: Technology Start-ups from UT-Austin. ***Journal of Business Venturing***, 5(1): 63-76.

Stake, R. E. 1995. ***The Art of Case Study Research***. London: Sage Publications, Inc.

Stankiewicz, R. 1994. Spin-off Companies from Universities. ***Science and Public Policy***, 21(2): 99-107.

Staw, B. M. 1976. Knee-deep in the Big Muddy: A study of Escalating Commitment to a Chosen Course of Action. ***Organizational Behavior and Human Performance***, 16(1): 27-44.

Staw, B. M. 1981. The Escalation of Commitment to a Course of Action. ***Academy of Management Review***, 6(4): 577-587.

Staw, B. M., & Fox, F. V. 1977. Escalation: The Determinants to a Chosen Course of Action. ***Human Relations***, 30(5): 431-450.

Staw, B. M., & Ross, J. 1978. Commitment to a Policy Decision: A Multi-Theoretical Perspective. ***Administrative Science Quarterly***, 23: 40-64.

Staw, B. M., & Ross, J. 1989. Understanding Behavior in Escalation Situations. ***Science***, 246(4927): 213-220.

Steffensen, M., Rogers, E. M., & Speakman, K. 1999. Spin-offs from Research Centers at a Research University. ***Journal of Business Venturing***, 15(1): 93-111.

Strauss, A., & Corbin, J. 1998. ***Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*** (Second ed.). Thousand Oaks, California: SAGE Publications, Inc.

Stuart, T. E., & Ding, W. W. 2006. When do Scientists Become Entrepreneurs? The Social Structural Antecedents of Commercial Activity in the Academic Life Sciences. ***American Journal of Sociology***, 112(1): 97-144.

Sutton, R. I., & Staw, B. M. 1995. What Theory is Not. ***Administrative Science Quarterly***, 40: 371-384.

Tang, M.-J. 1988. An Economic Perspective on Escalating Commitment. ***Strategic Management Journal***, 9: 79-92.

Think Play Do. 2007. What is think, play, do [online]. Accessed 2nd September 2007. Available from World Wide Web: http://www.thinkplaydo.com/content.php?i=1&c=1 [cited 2nd September 2007].

Thornhill, S., & Amit, R. 2003. Learning About Failure: Bankruptcy, Firm Age, and the Resource-Based View. ***Organization Science***, 14(5): 497-509.

UNICO. 2003. UK University Commercialisation Survey: Financial Year 2002: AURIL, Nottingham University Business School.

UNICO. 2004. UK University Commercialisation Survey: Financial Year 2003: experian.

UNICO. 2005. UK University Commercialisation Survey: Financial Year 2004.

Van de Ven, A. H. 1992. Longitudinal Methods for Studying the Process of Entrepreneurship. In D. L. Sexton, & J. D. Kasarda (Eds.), ***The State and the Art of Entrepreneurship***. Boston: PWS-KENT Publishing Company.

Van de Ven, A. H., & Engleman, R. M. 2004. Event- and Outcome-Driven Explanations of Entrepreneurship. ***Journal of Business Venturing***, 19: 343-358.

Vanaelst, I., Clarysse, B., Wright, M., Lockett, A., Moray, N., & S'Jegers, R. 2006. Entrepreneurial Team Development in Academic Spinouts: An Examination of Team Heterogeneity. ***Entrepreneurship Theory and Practice***, 30(2): 249-271.

Vince, R. 2001. Power and Emotion in Organizational Learning. ***Human Relations***, 54(10): 1325-1351.

Vohora, A., Wright, M., & Lockett, A. 2004. Critical Junctures in the Development of University High-Tech Spinout Companies. ***Research Policy***, 33(1): 147-175.

Walter, A., Auer, M., & Ritter, T. 2006. The Impact of Network Capabilities and Entrepreneurial Orientation on University Spin-off Performance. ***Journal of Business Venturing***, 21(4): 541-567.

Wang, C. L., & Ahmed, P. K. 2003. Organisational Learning: A Critical Review. ***The Learning Organization***, 10(1): 8-17.

Wengraf, T. 2001. ***Qualitative Research Interviewing: Biographic Narrative and Semi-structured Methods***. London: Sage Publications Inc.

Whetten, D. A. 1989. What Constitutes a Theoretical Contribution? ***Academy of Management Review***, 14(4): 490-495.

Whyte, G. 1986. Escalating Commitment to a Course of Action: A Reinterpretation. ***Academy of Management Review***, 11(2): 311-321.

Whyte, G., Saks, A. M., & Hook, S. 1997. When Success Breeds Failure: The Role of Self-efficacy in Ecalating Commitment to a Losing Course of Action. ***Journal of Organizational Behavior***, 18(5): 415-432.

Woo, C. Y., Daellenbach, U., & Nicholls-Nixon, C. 1994. Theory Building in the Presence of 'Randomness': The Case of Venture Creation and Performance. ***Journal of Management Studies***, 31(4): 507-524.

Wright, M., Birley, S., & Mosey, S. 2004b. Entrepreneurship and University Technology Transfer. ***Journal of Technology Transfer***, 29(3-4): 235-246.

Wright, M., Clarysse, B., Mustar, P., & Lockett, A. 2007. ***Academic Entrepreneurship in Europe.*** Cheltenham: Edward Elgar.

Wright, M., Lockett, A., Clarysse, B., & Binks, M. 2006. University Spin-out Companies and Venture Capital. ***Research Policy***, 35(4): 481-501.

Wright, M., Vohora, A., & Lockett, A. 2002. Annual UNICO-NUBS Survey on University Commercialisation Activities: Financial Year 2001: Nottingham University Business School, Grant Thornton, ESRC.

Wright, M., Vohora, A., & Lockett, A. 2004a. The Formation of High-Tech University Spinouts: The Role of Joint Ventures and Venture Capital Investors. ***Journal of Technology Transfer***, 29(3-4): 287-301.

Yin, R. K. 2003. ***Case Study Research: Design and Methods*** (Third ed.). Thousand Oaks: Sage Publications, Inc.

Zacharakis, A. L., & Meyer, G. D. 1998. A Lack of Insight: Do Venture Capitalists Really Understand Their Own Decision Process? ***Journal of Business Venturing***, 13: 57-76.

Zacharakis, A. L., Meyer, G. D., & DeCastro, J. 1999. Differing perceptions of new venture failure: A matched exploratory study of venture capitalists and entrepreneurs. ***Journal of Small Business Management***: 1-14.

Zahra, S. A. 2007. Contextualizing Theory Building in Entrepreneurship Research. ***Journal of Business Venturing***, 22: 443-452.

Zardookhi, A. 2004. Do Real Options Lead to Escalation of Commitment. ***Academy of Management Review***, 29(1): 111-119.

Zikmund-Fisher, B. J. 2004. De-escalation after Repeated Negative Feedback: Emergent Expectations of Failure. ***Journal of Behavioral Decision Making***, 17: 365-379.

Zucker, L. G., Darby, M. R., & Armstrong, J. S. 2002. Commercializing Knowledge: University Science, Knowledge Capture, and Firm Performance in Biotechnology. ***Management Science***, 48(1): 138-153.

Zucker, L. G., Darby, M. R., & Brewer, M. B. 1998. Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises. ***American Economic Review***, 88(1): 190-305.

Appendices

Appendix 1: Example Interview Schedule for TTO in Phase 1[44]

1. Describe research
    a. Background / Overview
    b. Can you tell me about your role?
    c. Can you tell me how [the TTO] works with regard to spinouts?

2. Spinout process
    a. How would you describe the spinout process you foster?
    b. What are the key milestones in the spinout process?
    c. What are the timescales involved?

3. Potential sample
    a. Can you tell me about the spinouts are you currently working with?
    b. What stages they are at?

4. Potential issues
    a. Have you faced any problems with any of the spinouts you are working with?

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[44] The schedule varied slightly depending on the TTO / university (KCL Enterprises at Kings College London, UCL Biomedica and UCL Ventures at UCL or Imperial Innovations at Imperial College London).

b. How have you overcome them?

5. Access

   a. Would it be possible to observe any meetings or any part of the spinout process?

   b. Would it be possible to see documents e.g. minutes of meetings? What other types of documents might be available?

Appendix 2a: Example Interview Schedule for Academics in Phase 2[45] [46]

1. Describe research stage
    - Explain about confidentiality
    - Ask about recording the interview
    - Offer report of findings

2. Company formation
    a. If founder: Can you tell me how you got from your lab / idea to forming the company?
    b. If other: Can you tell me how your involvement with the company began?
    c. Can you describe your role with the company?

3. Development
    a. Can you describe how the company has developed?
    b. What stages / milestones have you been through?

4. Funding
    a. How has the company been funded so far (seed)?
        i. How did they come about?
        ii. Has the TTO helped / been involved with this?

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[45] This schedule varied depending on the spinout in question.

[46] This schedule was adapted for interviews with technology transfer officers about the spinouts.

b. What are your future plans for funding?

5. Venture capital

   a. Has your business plan been passed on to any venture capitalists (by the TTO / members of the spinout)?

   b. Have you been introduced to any venture capitalists?

      i. What kind of responses have you got?

      ii. Have they asked for more information (how many?)

      iii. Have they asked to meet (how many?)

   c. Can you describe what the meetings have been like?

6. Overall spinout experience to date

   a. Are any other events you recall that have affected the way things were progressing with the company?

   b. If you could change one thing that the company has done so far, what would it be and why?

   c. When you look back now at your spinout experience, what is your overall assessment of the experience?

Appendix 2b: Example Interview Schedule for VC in Phase 2

1. How do you come to know about university spinouts?
    a. Who approaches who? How?

2. Are there any particular universities you are in touch with about their spinouts?
    a. Are there some that you try to avoid? Imperial?

3. Do you specify your requirements to universities about the types of spinouts you are interested in?
    a. Do you feel they are met or unmet? Imperial?

4. Of the university spinouts you come to be aware of, how many do you look into further e.g. have phone contact with or meet with? Imperial?

5. When you meet with university spinouts, what makes them 'ready' to invest in?

6. Would you be able to say how many spinouts from Imperial you have seen while you have been with [name of VC firm]?
    a. Have you invested in any spinouts from Imperial?
    b. *Refer to list of spinouts under study*
        i. Which of these have you seen / met with?
        ii. How far did meetings / discussions with them go?

iii. Why didn't you invest?

7. How do you feel spinouts from Imperial compare to other spinouts that you have seen?

8. If a colleague asked you for your advice about investing in a spinout from Imperial, what advice would you give him / her?

Appendix 3: Example Interview Schedule for Academics in Phase 3

1. Recap on the interview from phase 2
    - *Notes from interview in phase 2*
    a. Clarify / refer to specific events from interview in phase 2

2. Company Development
    a. Can you take me through how the company has progressed since we last met?
    b. What have the major events been? - Probe / Explore details

3. Venture Capital
    a. Last time we spoke, you were going through the VC process / about to go last time spoke [depending on spinout], can you describe how that progressed?
    b. How long would you say the VC process lasted?
    c. How many VCs did you see during that time?
    d. Can you describe what the meetings were like?
    e. How did the decision to stop the VC process come about?
    f. What did you do next (other strategies for finance)?
        i. How did this come about?
        ii. What made this possible?
    g. What do you think would have happened if you hadn't done that?
    h. What do you think you learned from the VC process?

4. Overview of spinout experience
    a. What do you think have been the biggest learning points for you since the beginning?
    b. If you had a second chance, what would you do differently with the company?
    c. What advice would you give someone who was thinking about starting their own spinout – at Imperial? / In general?
