The London School of Economics and Political Science

Collaborative Venture Capital Activity in the London Metropolitan Region: Entrepreneurial Capacity Building through Corporate Partnering?

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A thesis submitted to the Department of Geography and Environment of the London School of Economics and Political Science for the degree of Doctor of Philosophy in Regional Planning, London, August 20, 2013

Declaration

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I declare that my thesis consists of **86,406** words.

Abstract

Venture capital firms are collaborative and location specific actors. A significant source of specialised factor inputs (knowledge, expertise, resources, and finance) for investing in new high tech companies are large corporations, making them potentially complementary partners for independent venture capital firms in collaborations from which considerable value adding capacity might be derived. Employing a qualitative approach based on in-depth interviews with 30 London based technology oriented venture capital firm, this study (1) captures and explains the how, why, and under what circumstances do venture capital firms collaborate with large corporations and their corporate venturing divisions, and (2) the role that geographic proximity plays in facilitating this collaboration. Using a cross sector comparison, the core of the research inquires as to the structures employed, and the motivations and conditions for which this collaborative activity is pursued. In addition, it assesses the facilitating role that geographic proximity, and the opportunities and capacities of the London metropolitan region might play.

The findings demonstrate that collaboration between venture capital firms and large corporations is increasingly common, but more formal collaborative structures are the exception. Driving this collaboration is the exchange of complementary knowledge for purposes of better investment selection and for improving options for investment exit. Geographic proximity plays a facilitating role and is particularly important during the investment selection phase. While the significance of co-location is somewhat downplayed, collaboration is indirectly facilitated through the innovation capacities and the opportunities for network interaction and international knowledge exchange which the London metropolitan region offers.

Acknowledgements

While the PhD is an individual endeavour, it cannot be accomplished without the support of others. First and foremost, I give much thanks and appreciation to the guidance, support, and patience of my supervisor, Professor Ian Gordon of the Department of Geography and Environment, LSE. This thesis is my own, but his tireless encouragement and unbounded insight both challenged me and pushed me along this path toward completion. Many thanks also to my examiners, Professor Helen Lawton Smith and Professor Colin Mason, both of whom provided necessary and constructive criticism, leading to an improved final submission. I would also like to thank the BVCA for supporting my research aims and assisting me in gaining access to my research subjects - this could not have been done without their support. Additionally, I would like thank a number of colleagues both at the LSE and elsewhere -- Dr Sabina Uffer, Dr David Grover, Dr Cristina Inclan-Valadez, Dr. Christopher Johnson, Dr. Robert Barnes, and Dr. Jannika Mattes -- all of whom have provided me with intellectual and emotional support, as well as friendship, throughout this endeavour.

I would also like to thank Mona Morgan-Collins, my partner, friend, and colleague, who has supported me, and put up with me, over the past four years - always providing me with encouragement, always challenging my ideas, and profoundly changing my perspective.

Finally, I would like to thank my parents and family who have been there for me from day one. My parents, both educators, have always encouraged me to seek out and value knowledge and the process of learning. Over the past five years, they have been a willing sounding board for both my aspirations and frustrations, always grounding me and pointing me in the right direction. I am forever grateful for their love and support.

Andrew Watkins London, November 2013

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1. Collaborative Venture Capital: Corporate Partnering and Geographic Proximity

Innovation is a highly uncertain process both for those who pursue innovation and for those that finance them. A pervasive belief is that new high tech companies (NHTCs) engaged in the development and commercialisation of new technology based products generally will require the specially structured finance of venture capital investment. Studies point to a positive correlation between venture capital investment and innovation (e.g. Kortum & Lerner, 2000)[1] and the subsequent development of technologically innovative industries, with the likes of Microsoft, Apple, Oracle, Intel, Genentech, and Google all being former venture capital backed companies (Audretsch & Lehmann, 2004; Florida & Kenny, 1988; Mann & Sager, 2007). Defined here as 'independent, professionally managed, dedicated pools of capital that focus on equity or equity linked investments in privately held, high growth companies' (Gompers & Lerner, 2001, p. 146), venture capital is viewed, unlike traditional banks, as particularly adept at managing the inherent uncertainty, related asymmetries, and agency costs associated with early stage technological innovation as they pertain to NHTCs (Bygrave & Timmons, 1986; Florida & Kenny, 1988; Gompers & Lerner, 2004).

Seen as integral to venture capital's effectiveness is its ability to combine a variety of entrepreneurial insight, industry expertise, and market knowledge toward first identifying potential high growth companies and then developing these into successful NHTCs (Zook, 2005).

This dissertation aims to capture and understand the specific sources and processes through which independent venture capital firms (VC firms) obtain and then apply this expertise and knowledge toward the capacity building of their portfolio companies. In particular, *the research identifies and explores expertise and knowledge exchange between independent VC firms and large corporations*.

[1] An influential study by Kortum and Lerner (2000) suggests a positive correlation between venture capital investment and patent production (an imperfect yet commonly used measure of innovation output). Their study examines U.S. patent production in 20 industries over a three decade period characterised by increasing venture capital investment. Their findings indicate that venture capital investment leads to higher patenting rates, suggesting that from 1983–1992 venture capital investment was responsible for 8% of innovation output in the industries studied.

Although these potentially complementary partnerships are widely acknowledged in the venture capital and corporate venturing literature, little is verified or understood as to the extent of interaction between these two actors, the collaborative structures employed, the motivations for collaboration, and the conditions under which collaboration occurs. Therefore, the combination of these two threads through an interface of collaboration is an important missing piece in the understanding of venture capital investment behaviour.

As such, the research presented here further illuminates the venture capital investment process, providing valuable insight into how independent VC firms — through collaboration with corporate partners — select, develop, and position portfolio companies for both profitable investment exits and post investment success. With global venture capital activity concentrated in a limited number of metropolitan regions, *this research focuses on collaborative venture capital activity in the London metropolitan region (LMR).* A leading global centre of venture capital activity, the LMR is home to the majority of venture capital investment in the United Kingdom and attracts considerable venture capital investment from Europe and abroad (British Venture Capital Association [BVCA], 2010). A secondary objective of the research is, therefore, to provide insight as to how this innovative region may facilitate collaboration between London based VC firms and large corporations operating within the LMR.

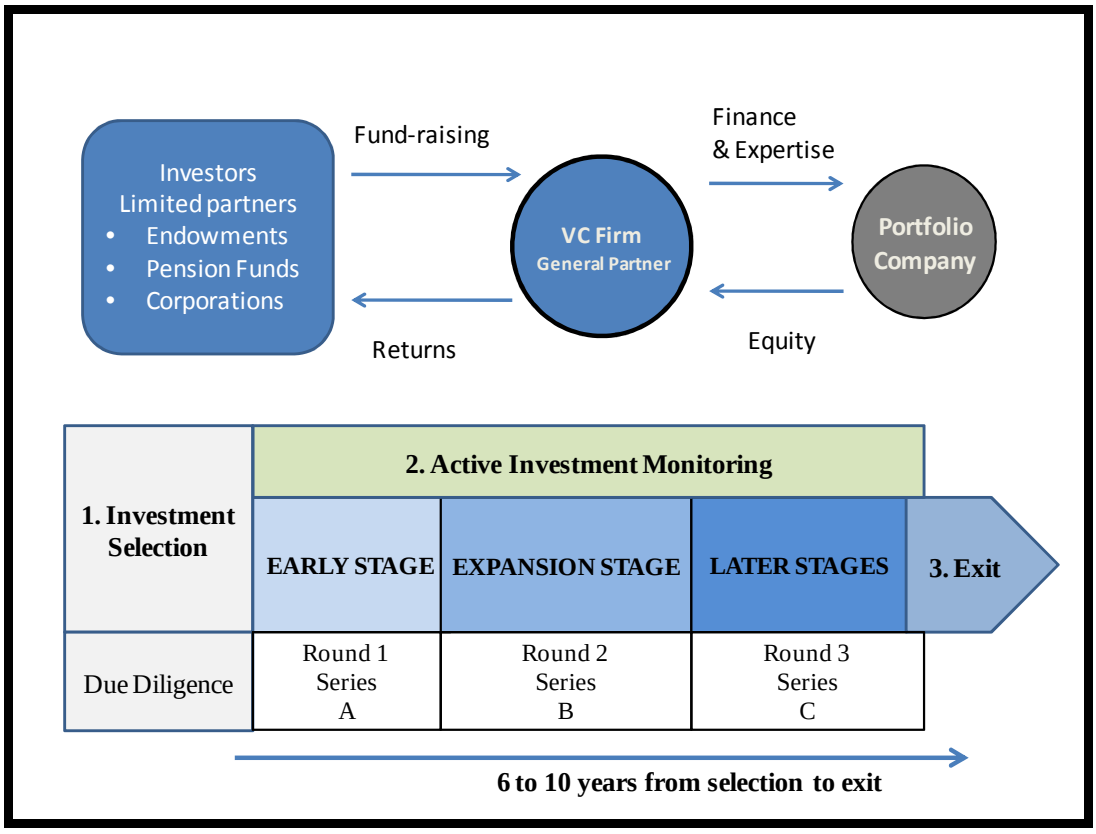
This introductory chapter presents a brief overview of the venture capital investment cycle (Sect. 1.1), followed by a discussion of the value added that venture capital presumably provides portfolio companies and the role that geographic proximity plays in facilitating these value adding processes (Sect. 1.2) and informing public policy (Sect. 1.3). Large corporations are then introduced as potential collaborative partners for VC firms, positioning such collaboration as a source of complementary asset exchange toward the development of NHTCs (Sect. 1.4). The primary research questions along with the main theoretical constructs are then introduced (Sect. 1.5). This is followed by a discussion of the main research parameters and context involving a focus on early stage investment in the United Kingdom, within key high-tech sectors, invested in NHTCs located in the LMR (Sect. 1.6). Finally, hypotheses, assumptions, and the research approach are

briefly explained (Sect. 1.7), followed by an outline of the ensuing chapters (Sect. 1.8).

1.1. The Venture Capital Cycle: From Investment Selection to Exit

Research questions regarding collaboration between VC firms and large corporations are grounded in the complexities of the venture capital investment cycle and the complementary factor inputs each phase of the cycle requires for successfully investing in and developing NHTCs (Gompers & Lerner, 2004). As shown in Figure 1, these phases are comprised of (1) fundraising and investment selection, (2) post selection investment monitoring, and (3) investment exit.

Figure 1: Overview of the Venture Capital Cycle



Source: Own interpretation based on Gompers and Lerner (2004)

These phases correspond broadly to the staged funding structure practiced by VC firms, beginning with early stage funding, through expansion stage funding, and then to later and exit stage funding, respectively (Metrick & Yasuda, 2010).

1.1.1. Fundraising and Investment Selection

First, VC firms raise funds from institutional investors such as public and private pension funds, insurance companies, university endowments, and foundations. They also raise funds from wealthy individuals and other sources such as mutual funds (Gorman & Sahlman, 1989). These investors are limited partners in the fund, having no role in either the management of the fund or individual portfolio companies (Gompers & Lerner, 2004). Second, VC firms select portfolio companies through an intense process of screening and due diligence. This screening process supposedly uses deep industry-specific knowledge and entrepreneurial insight to identify the commercial potential of emerging ideas and technology and the quality (i.e. degree of leadership, expertise, and business acumen) of the entrepreneurs involved. From this, a very limited number of companies are selected with the assessed quality of the entrepreneurs and degree of investment uncertainty very much determining the extent to which the venture capital firm is involved in the management and oversight of the portfolio company (Gompers & Lerner, 2004).

1.1.2. Post-selection Investment Monitoring

Third, VC firms actively invest in their portfolio companies, thus distinguishing them from most other forms of investment finance. This active investment involving the oversight and rigorous revaluation of portfolio companies allows venture capitalists to manage and navigate the inherently great asymmetries involved and lessen potential agency costs (Sapienza, 1992). To facilitate this process, VC firms apply an investment structure characterised by definite funding lives, multiple funding rounds, and investment syndication with other VC firms. Venture capital funds, comprised of multiple portfolio companies (i.e. investment portfolio), generally have a maximum life of 10 years, with most investments in individual portfolio companies exiting within 5 to 7 years. Investment in individual companies is done in stages or rounds occurring over the life span of the investment (Gompers & Lerner, 2004). This structure allows investment performance to be evaluated and adjustments to be made (e.g. funding amount, duration of round, benchmarks, personnel). The real power of this structure, however, is that it also allows VC firms to efficiently terminate funding to

underperforming portfolio companies before serious capital losses mount and frees funds for better performing or new investments (Gompers & Lerner, 2004).

Intrinsic to this staged structure is the common practice of syndicating or co-investing with other VC firms (Sorenson & Stuart, 2001, 2008). Syndication usually involves a lead venture capital firm and several participating VC firms, these technically being general partners, but the degree to which they are actively involved with the portfolio company(s) vary (De Clercq & Dimov, 2004). Syndication is used to spread risk, increase investment opportunities (deal flow), and to access different knowledge and expertise (e.g. technology, commercial, marketing), applying it to the development of portfolio companies (Manigart et al., 2006). Over the life of an investment syndications can be fluid, with participating VC firms entering and exiting the syndicate as one funding round ends and another begins. Not only does syndication allow for VC firms with different levels of risk tolerance to achieve their expected investment returns, but, more important, it also allows for different expertise to be applied appropriately and in a timely manner over the life of the investment (Gompers & Lerner, 2004).

1.1.3. Investment Exit

Finally, for venture capitalists to fully profit from their investments, a successful investment exit must occur (Gompers & Lerner 2004). Traditionally, the most profitable investment exit has been an initial public offering (IPO) in which the portfolio company offers shares to the public via a public stock exchange (Metrick & Yasuda, 2010). For a successful IPO, though, timing is everything: public markets are fickle. Although a bull market can offer venture capitalists abundant opportunities for highly profitable IPOs (e.g. the tech boom of the 1990s), industry downturns and bear markets can prove disastrous (e.g. the recession of 2008–2009), making successful exits via an IPO nearly impossible (BVCA, 2010).

In such cases venture capitalists seek alternative exits, making merger and acquisition (i.e. allowing portfolio companies to be bought by another company) particularly attractive (Gompers & Lerner, 2001). Although generally not as lucrative as an IPO, selling an investee firm to the likes of Microsoft can be significantly profitable, particularly if the potential for acquisition is developed

very early in the investment process by adjusting funding and deal structure to better meet the expectations of a merger or acquisition exit. That being said, planning for a certain type of desired exit is very difficult given the uncertainties of both the development trajectories of portfolio companies and market demand, taking a considerable degree of strategic planning, aligned interests, and luck. Regardless of the expectations or plans for exit, however, setting up and executing a successful exit is paramount for VC firms (Gompers & Lerner, 2004).

1.2. Venture Capital: Value Adding and Geographic Proximity

The modern venture capital model, as shown through the cycle above, is generally thought to be the best possible means for developing NHTCs. This process involves not only finance and risk tolerance, but also 'active monitoring', and a considerable amount of knowledge, expertise, and strategic positioning (Gompers & Lerner, 2001). The notion of venture capital as an 'active' form of risk capital investment carries with it two related assumptions (De Clercq & Fried, 2005; Elango, Fried, Hisrich & Polonchek, 1995; Gompers, 1995). The first is that venture capital creates value, beyond finance, toward the development of the companies invested in (Manigart et al., 2002). This value added, particularly a venture capital firm's expertise and connections to appropriate factor inputs of knowledge and resources, is seen as fundamental to the venture capital process, playing a significant role in the initial decision to invest and in post-selection monitoring and development (Brander, Amit, & Antweiler, 2002; Fried & Hisrich, 1995).

Second, venture capital's active investment approach and its value adding capacities are supposedly facilitated through geographic proximity between both VC firms and the companies they invest in, between VC firms themselves (i.e. syndication), and to a broader yet geographically concentrated venture capital community. As Florida and Kenny (1988) propose:

> Venture capital investing is dependent upon *tremendous information sharing* between venture capitalists, entrepreneurs, consultants, and a wide range of related actors who operate as networks to locate deals, organise companies, establish investment syndications and so on. Because of the

> intensive nature of this information flow, these venture capital networks tend to be personalized, *informal and local.* (p. 34 emphasis added).

As such, investing in local companies through local investment networks allows VC firms to better manage and evaluate the highly asymmetric and tacit information associated with NHTCs, thus allowing them to more effectively select, monitor, and provide value added toward the development of their portfolio companies. That being said, questions pertaining to how this value is actually created and from where specifically it derives are often relegated to a black box of venture capital behaviour (Busenitz, Moesel, & Fiet, 2004; De Clercq & Manigart, 2007).

Attempts to explain the mechanisms or sources for venture capital's value-adding capacities have focused on the background of individual or teams of venture capitalists (e.g. Bottazi & Da Rin, 2002), on propensities for value adding when investing in early stage companies compared to investing in more established companies (e.g. Sapienza, Manigart, & Vermeir, 1996), and the influence of institutional factors such as the relative importance and regard placed on entrepreneurs within different countries (e.g. Bruton, Fried, & Manigart, 2005). Additionally, a number of studies point to investment syndication as venture capital's primary mechanism for knowledge exchange toward the development of portfolio companies (e.g. De Clercq & Dimov, 2004**;** Lockett & Wright, 2001; Manigart et al., 2006; Wright & Lockett, 2003). However, these studies do not question or explore adequately where this knowledge originates, nor do they question the value of other actors for whom knowledge might be obtained and used for investment purposes (De Clercq & Manigart, 2007).

Similarly, studies that look at venture capital through a network perspective generally see syndication as a mechanism facilitated by close geographic proximity between syndicate VC firms, creating geographically concentrated syndication networks (Bygrave, 1987; Sorenson & Stuart, 2001, 2008). These extended networks are defined, however, as between VC firms and exclude other potential syndicate partners. Furthermore, the network exchange of knowledge and finance between VC firms is increasingly understood as occurring across regions and national boundaries. Again, the network exchange in this case is between

geographically distant VC firms (e.g. Aizenman & Kendall, 2008; Madhaven & Iriyama, 2009) to the exclusion of other actors.

An informative study by Lindsey (2008) argues that VC firms, as intermediaries, facilitate strategic alliances between other venture backed companies, particularly alliances between entrepreneurial firms that share a common venture capital investor. Furthermore, Lindsey demonstrates that alliances are more common between companies within similar industries, that such alliances are associated more with early stage high tech companies, and that they seem to be initiated to accrue R&D complementarities. The importance of Lindsey's study is that it solidifies the notion of alliance building as a value adding activity performed by independent VC firms, with alliances positively correlated to investment exits. However, the study does not specifically examine the processes involved in this alliance building nor identify alliances between companies that do not share a common venture capital investor.

Further questions, therefore, are pertinent, because the assumptions that venture capital provides value added toward the development of NHTCs and, more particularly, that venture capital activity concentrates geographically often inform public policy regarding the promotion and development of venture capital markets.

1.3. Venture Capital and Public Policy

Martin, Sunley, and Turner (2002) propose that the geographic concentration exhibited by venture capital activity has led to two policy approaches.[2] The first embraces venture capital activity as location specific activity that is potentially limited to a small number of regions where sufficient capacities for robust innovative activity are present. Heavily influenced by Porter's cluster concept

[2] In the United States, venture capital investments in NHTCs tend to concentrate in Silicon Valley and the surrounding San Francisco Bay region of California and in the greater Boston region (e.g. Route 128) (Florida & Smith, 1991; PWC, 2008). Venture capital's migration to Western Europe has followed a similar pattern of concentration, but the intensity of concentration varies from country to country (PWC, 2008). In France, for example, venture capital investment is highly concentrated in and around Paris/Ile de France, the recipient of roughly 60% of total venture capital investment in France (Martin, Sunley, & Turner, 2002). In Germany, however, venture capital investment is dispersed somewhat more evenly among four urban agglomerations: Munich, Dusseldorf, Stuttgart, and Hanover (Fritsch & Schilder, 2008). This pattern of either intense concentration (e.g. Stockholm in Sweden) or relative dispersal (e.g. regions of Lombardio, Piemonte, Toscana, and Emilio Ramanga in Italy) is repeated throughout Europe.

(1998, 2000, 2007) and high tech agglomerations such as Silicon Valley, policy aims to increase venture capital activity by more effectively connecting a region's innovation and entrepreneurial capacities: breaking down barriers between entrepreneurs and venture capitalists and thus spurring, in a sense, both venture capital supply and demand. The second view holds that venture capital is already too geographically concentrated, contributing to regional inequality. Related policy aims to develop venture capital markets in regions where such markets are comparably small or absent, with a focus on stimulating venture capital supply (Martin, Sunley, & Turner, 2002).

The effectiveness and rationale for these public programmes, particularly those aimed at greater dispersal (e.g. Regional Venture Capital Funds, administered by Regional Development Agencies [RDAs]) has been questioned. Harding (2002), Mason and Harrison (2003), and others point not to an equity gap but rather a knowledge gap or lack of investment readiness among potential portfolio companies, as well as insufficient institutional support at the regional level. Related critiques suggest region-specific venture capital programs may very well be excluding expertise and "specialized knowledge" that could be gained through linkages with better performing regions, and that, overall, more effective mechanisms for the "capacity building" of portfolio companies should be sought and employed (Nightingale et al., 2009, pp. 26–27).

Such critiques echo earlier assessments levelled at public venture capital programmes (e.g. early iterations of the Small Business Innovation Research Program [SBIR] in the United States) where the decided cause for programme ineffectiveness centred on their failing to function or behave like independent venture capital: they did not employ experienced venture capitalists and, partially as a result, they did not follow appropriate processes of due diligence and selection. They also seemed unable, in many respects, to provide significant post-selection value added toward the development of portfolio companies (Armour & Cummings, 2006; Gilson, 2003; Lerner, 2002).

In the history of public venture capital programmes, the issue of effective capacity building continually resurfaces, reiterating questions as to how, from where, and

from whom independent VC firms actually derive and create value for their portfolio companies toward their successful development.

1.4. Corporate Venture Capital and the Potential for Collaboration

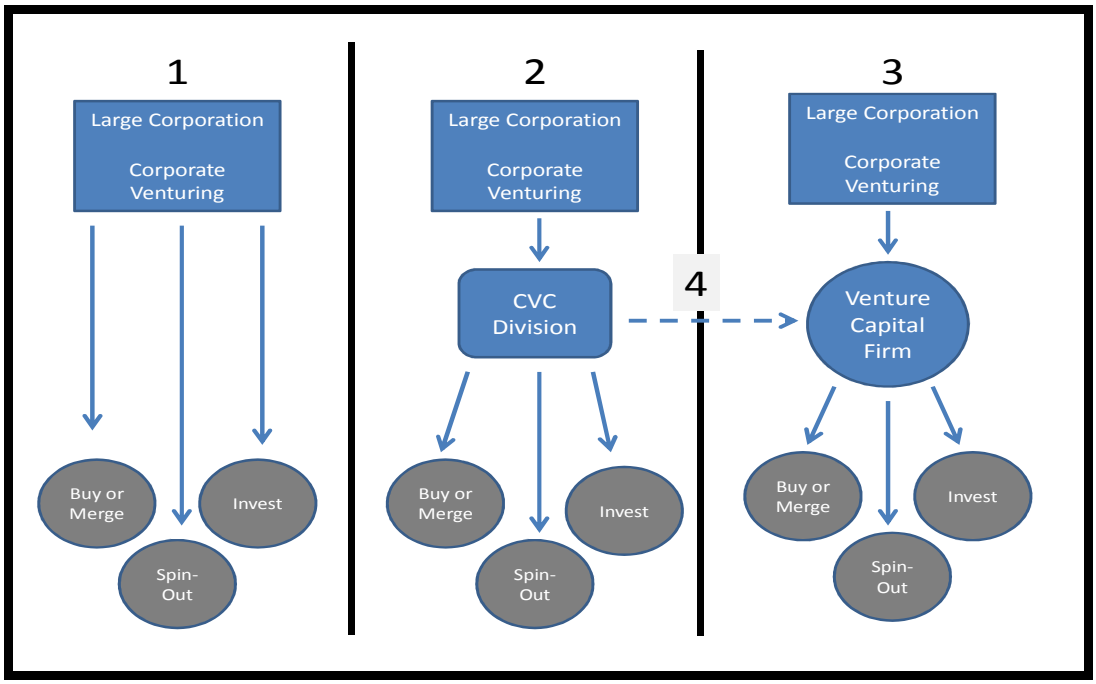
Large corporations have engaged in corporate venture capital and external corporate venturing more generally since at least the 1960s, exhibiting trends that mirror the cyclic pattern displayed by independent venture capital activity (Dushnitsky & Lenox, 2005). *Corporate venture capital* (CVC) can be defined as 'equity or equity linked investments in young, privately held companies, where the investor is a financial intermediary of a non-financial corporation' (Maula, 2007, p. 371). Importantly, CVC can be grouped into a broader category of *external corporate venturing* activities, which Sharma and Chrisman (1999, p. 11) define as 'corporate venturing activities that result in the creation of semi-autonomous or autonomous organisational entities that reside outside the existing organisational domain.' The past several decades have seen major corporations such as Exxon, GE, DuPont, Johnson & Johnson, and more recently Microsoft, Intel, and Apple all engaging in robust corporate venturing and CVC programs (Dushnitsky, 2006; Keil, 2002). Figure 2 portrays the spectrum of corporate venturing activities as proposed by Dushnitsky (2006) and Keil (2002).

These corporate venturing activities include direct investment in and acquisition of entrepreneurial firms, developing corporate spin-offs/outs and activities involving strategic partnerships and alliances with other companies and with the broader venture capital community (Birkenshaw, van Basten Batenburg, & Murray, 2002).

Motivations for engaging in external corporate venturing include financial gain, knowledge and acquisition of new technology (addressing product pipeline needs), access to market knowledge and new market entry, and organisational learning (Benson & Ziedonis, 2009; Kann, 2000; Keil, 2004; McNally, 1997; Siegel, Siegel, & Macmillan, 1988). Again, the common factor among these external corporate venturing activities is that their aims are pursued through investment and partnering platforms external to the firm (Miles & Covin, 2002).

Another common element of these corporate venturing programmes is their linkage to independent venture capital. Keil (2002) shows a number of corporate venture capital programmes that invest in dedicated funds or pooled funds through an independent venture capital firm as an intermediary. A large study by Birkenshaw and colleagues (2002) found that corporate venture capital programmes obtain a substantial number of new investment opportunities (i.e. deal flow) through interaction with independent VC firms. Likewise, a survey study by the European Private Equity and Venture Capital Association (2001) found that one third of corporate venture capital deals in Europe were syndicated, implying that these deals involved co-investing arrangements with independent VC firms.

Figure 2: Corporate Venturing and Corporate Venture Capital Arrangements



Source: Own interpretation based on Dushnitsky (2006) and Keil (2002)

Similarly, a later survey by Birkinshaw and Hill (2005) identified three key factors as important for the success of corporate venture capital programmes: (1) establishing venturing divisions with considerable autonomy from the corporate parent, (2) structuring compensation mechanisms similar to those used by independent VC firms, and (3) establishing robust connections to the broader venture capital community. Another study by Hill, Maula, and Murray (2005) positively links the strategic performance of a corporate venture capital

programme with its overall connectedness to the venture capital community. From these studies the interaction between large corporations and independent VC firms is obvious, yet none captures their frequency nor explains either how these interactions are arranged or the processes involved. Also missing from the literature are studies that approach corporate venturing from the perspective of independent venture capital (see Figure 3).

The potential that such collaboration might offer is suggested in the work of Maula, Autio, and Murray (2005) and Hellmann (2002). These works propose that entrepreneurial firms benefit most when they receive funding from both independent venture capital and corporate venture capital. This survey work suggests that independent venture capital provides entrepreneurial firms with value added benefits in the form of financial and management expertise, whereas corporate venture capital provides entrepreneurial firms with value added associated with commercial and technology expertise. Such investment complementarities (e.g. resources, knowledge, and expertise) would seem to offer sufficient motivation for independent VC firms and the corporate venturing divisions of large corporations to collaborate with one another. A survey study by Keil, Maula, and Wilson (2010) proposes that large corporations and their venturing divisions use their unique resources to gain access and strategically position themselves into what are fairly exclusive venture capital syndication networks.

Again, although suggested anecdotally in the preceding literature, the existence of such collaborative activity and the related organisational structures has yet to be sufficiently verified or understood. For example, the extent to which syndication between VC firms and corporations occurs in the United Kingdom is not known; how might such formal collaborative activity compare to traditional syndication or co-investing arrangements between VC firms? If syndication is viewed as the most formal arrangement, what other forms of collaboration occur, and what are the processes and procedures involved? A claim might be advanced that informal collaborative arrangements precede co-investment and syndication or exist as independent activity.

Furthermore, the motivations for VC firms to collaboratively engage with large corporations have not been substantiated to any significant degree. Is collaboration used to enhance overall portfolio performance through strategic positioning, or is it used to gain complementary knowledge and expertise, perhaps value added that is utilised for developing portfolio companies into successful businesses? Additionally, under what conditions is collaboration between VC firms and large corporations optimal? A study by Ernst, Witt, and Brachtendorf (2005) suggests that corporate venture capital programmes place short-term financial objectives over long-term strategic interests, which may conflict with the 10 year investment timeframes of many independent venture capital investments. How are potentially incompatible interests aligned, and when might complementary assets be exchanged?

Finally, with studies (e.g. Keil, Maula, & Wilson, 2007) suggesting that corporate venture capital programmes pursue engagement and entry into venture capital syndication networks, questions can be raised as to the degree that co-location and geographic proximity are required to facilitate this network entry and collaboration, including syndication, between independent VC firms and large corporations.

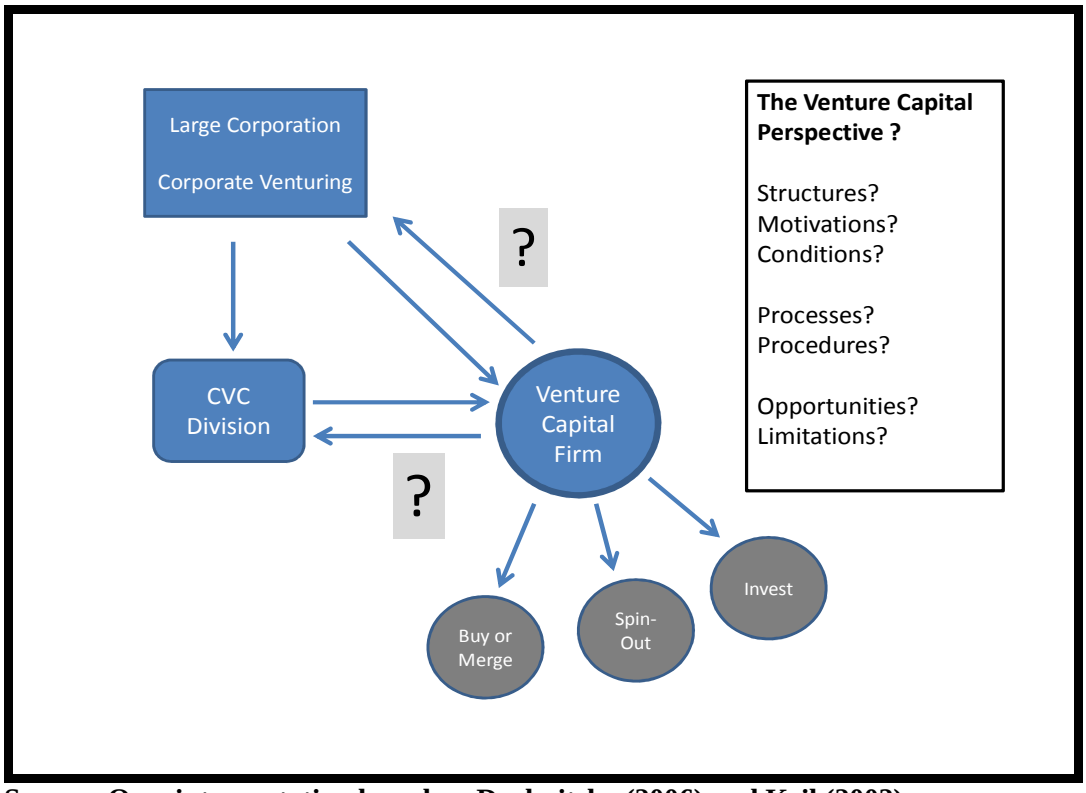
1.5. Primary Research Aims

This research starts from the proposition that large corporations are a potentially complementary collaborative partner for independent VC firms — partners from which venture capital might derive considerable value adding capacity for the development of NHTCs (Maula, Autio, & Murray, 2005). It thus seeks to explore and capture *how, why and under what circumstances do independent venture capital firms collaborate with large corporations and their corporate venturing divisions.* More specifically, it inquires as to the structures employed and the motivations for which this collaborative activity is pursued. In addition, it examines the various opportunities and constraints that may shape collaborative behaviour between these two investment actors (see Figure 3).

Viewing venture capital investment as a location-specific activity concentrated in a select number of high capacity regions, some degree of geographic proximity is

necessary for effective monitoring of investments and appropriate knowledge exchange. The secondary objective of this research, therefore, is to explore the role that *geographic proximity might play in facilitating collaboration between venture capital firms and large corporations.* Furthermore, with many large corporations being multi-national, collaboration with them might act as a primary mechanism through which geographically concentrated venture capital activity connects to global knowledge flows and markets. Understanding this collaboration, therefore, may provide a more dynamic picture of location-specific venture capital behaviour.

Figure 3: CVC and the Venture Capital Perspective?



Source: Own interpretation based on Dushnitsky (2006) and Keil (2002)

Such insights might prove informative to public venture funds — including those operating in less dynamic regions — in identifying replicable mechanisms for entrepreneurial development, particularly greater corporate partnerships and more effective interregional networks.[3]

[3] The London Technology Fund (LTF, 2009), a public venture capital fund financed by the European Regional Development Fund and the London Development Agency, funds young technology firms in London. The LTF runs an annual competition for which potential investee

1.5.1. Building on a Complementary Asset Model of Firm Innovation

The prospects for collaboration between independent VC firms and large corporations — with venture capital as a potential intermediary — bring together two distinct models of firm-based innovation: that produced within the flexible organisations of small entrepreneurial firms (i.e. Schumpeter I) and that produced within the knowledge and resource-rich organisations of large established firms (i.e. Schumpeter II) (Freeman & Soete, 1997). To be clear, although both small firms and large established firms are sources of innovation, there is a prevailing assumption that small entrepreneurial firms are more likely to produce radical innovations, whereas innovation produced by large established firms is generally of an incremental form. At first glance, the bringing together of small firms and large established firms might appear to run counter to notions of entrepreneurship and even venture capital, which is commonly seen engaged in the development and commercialisation of novel technologies that carry the potential for transforming whole industries, often resulting in the demise of established industry players (Bygrave & Timmons, 1986; Schumpeter, 1927). In other words, there is a certain level of implied incompatibility between the aims and competences of venture capitalists and the entrepreneurs they back, and those of large established firms.

In contrast, the research presented here is grounded in the notion that the flexibility and idea-rich environs of the Schumpeter I model and the knowledge and resource capacities of the Schumpeter II model are both necessary for the development and commercialisation of high-tech innovation. Such a perspective is based on a complementary asset model of firm-based innovation first introduced by Teece (1986, 1992) and developed through the related work of Christensen (1995, 1996), Granstrand, Patel, and Pavitt (1997), Patel and Pavitt (1997), Chesbrough (2004),

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firms can compete for and share upwards of £1m in investment through the LTF. Participant companies attend a series of workshops aimed at developing investment readiness (i.e. making one's company attractive and suitable for venture capital investment) and demystifying the venture capital investment process (i.e. investment deal structure and expectations). The day concludes with what is described as a 'corporate speed-dating event' where the participant companies then engage in face-to-face meetings with a number of 'major technology companies.' The purpose of this 'speed-dating' is to facilitate the building of relationships between these technology start-ups and large industry leaders, contributing to investment readiness and initiating potential long-term partnerships.

and Chesbrough, Vanhaverbeke, and West (2008). Much of this work focused on the asset needs of large established firms, with Christensen (2008) proposing that:

> from an innovative asset perspective, large companies will have to look out for external (as well as internal) innovative ideas, technologies, concepts, or IPs [intellectual properties] to align with and integrate into new and improved product architectures. And from an operational asset perspective, large firms will have to look out for external and internal innovations in search of, and sometimes in exchange for, complementary assets. (p. 48)

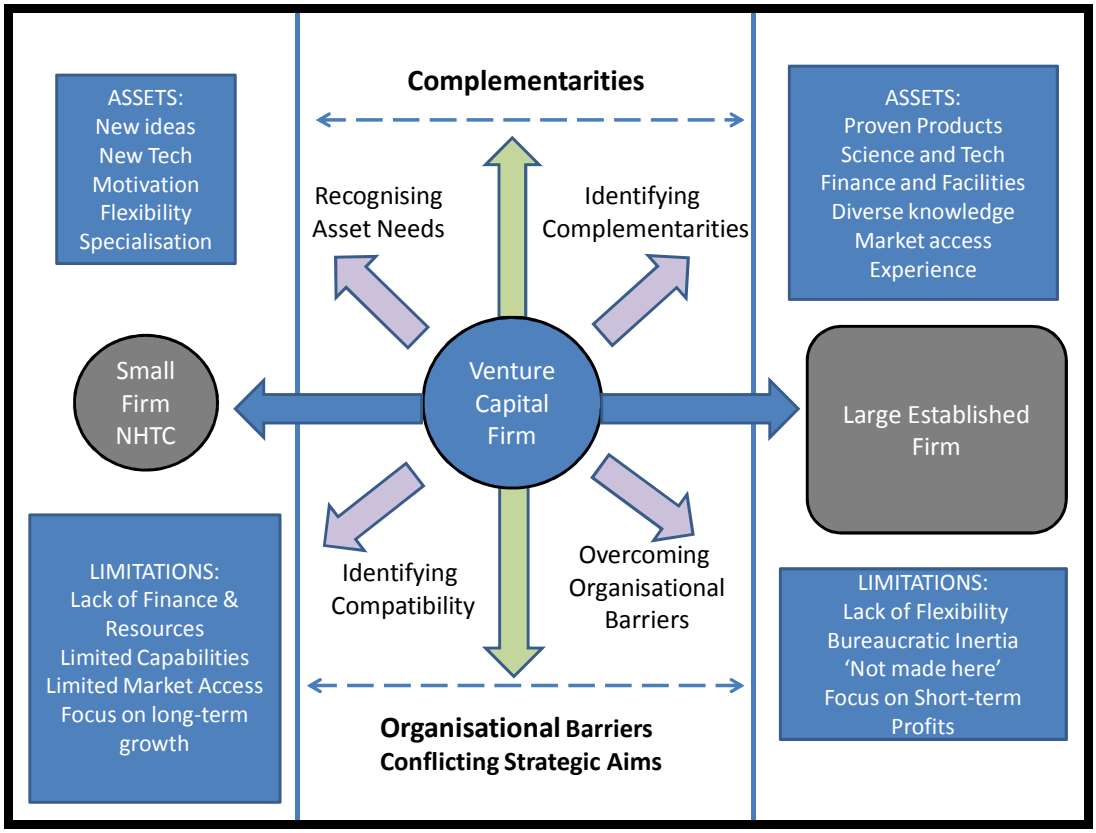
Not surprisingly, this corresponds to works by Rothwell (1994), Rothwell and Dodgson (1991), and Dodgson and Rothwell (1994) and more recent studies (e.g. Narula, 2004; Lee, Park, Yoon, & Park, 2010, van de Vrande et al., 2009) demonstrating that small and medium sized enterprises (SMEs) also regularly engage in external R&D and commercial alliances, so-called open innovation practices, both with each other and with large established firms. There is wide agreement that, as Lee et al. (2010) states:

> while SMEs' flexibility and specificity can be advantages in accelerating innovation, few of them have sufficient capacity to manage the whole innovation process by themselves, and this encourages them to collaborate with other firms. (p. 291)

Empirically captured in the work of Lawton Smith (2004); Lawton Smith, Dickson, and Lloyd Smith (1991); Saxenian (1996); Owen (1999), Rothwell and Dodgson (1991); and others, collaboration between NHTCs and large established firms is common, particularly in the sectors of life science, and information technology, although it is not without challenges and potential drawbacks (Lawton Smith, Dickson, and Lloyd Smith, 1991). Studies point to organisational and cultural barriers, different strategic interests and objectives, competitive tendencies, and differences in collaborative capacities between small and large firms as contributing to less than optimal, possibly detrimental, relationships. Lee and colleagues (2010) argue that choosing the appropriate partner for collaboration can be facilitated through an intermediary actor whose network position and expertise can effectively recognise complementarities and degrees of compatibility between a small firm and a large established firm.

Similar to the work of Lindsey (2008) discussed earlier, which views independent venture capital as an intermediary facilitating alliances between venture capital backed companies, *this research positions independent VC firms as an investment and knowledge intermediary that identifies complementary partnerships for their small portfolio companies through the leveraging of their connections to a relatively small number of large established firms that tend to dominate their respective industries, thus facilitating complimentary partnerships between NHTCs and large corporations* (see Figure 4).

Figure 4: Complementary Asset Model with Venture Capital as Intermediary



Source: Own interpretation based on Rothwell and Dodgson (1994) and Lindsey (2008)

Therefore, this research suggests that that this intermediary role requires independent VC firms to collaborate with large established firms to build and maintain these valuable corporate partnerships.

1.6. A Focus on UK Venture Capital

Venture capital is a global activity. Although its origins and development are rooted in the U.S. experience, sizable venture capital markets have emerged and prospered in most modern capitalistic economies. Global venture capital investment patterns are not uniform, exhibiting wide variation from country to country; this variation is thought to be driven by the varying opportunities for investment exit and entrepreneurial climates exhibited by different countries (Djankov, LaPorta, Lopez-de-Silanes, & Shleifer, 2002; Green, 1991; Wright, Prutti, & Lockett, 2005). Metrick and Yasuda (2010) point to a causal relationship between highly active IPO markets and robust venture capital investment levels, particularly regarding venture capital invested in NHTCs.

Therefore, *this research focuses on venture capital investment in the United Kingdom.* With a traditionally active IPO market and a correspondingly robust high-tech oriented venture capital industry, the venture capital market in the United Kingdom is regularly considered the most robust and dynamic when compared to other European countries, both in terms of investment amount and sector breadth (Jeng & Wells, 2000; Martin, 1989; Metrick & Yasuda, 2010; Sapienza et al., 1996); the United Kingdom has consistently had the highest level of high-tech investment in Europe and is home to almost half of all high-tech European venture capital activity (Djankov et al., 2002; Metrick & Yasuda, 2010; PriceWaterhouseCoopers, 2008). For an overview of venture capital's historical development in the United Kingdom, see Mason and Harrison (1991).[4,5,6] The

[4] As Mason and Harrison (1991, pp. 204–205) explain, the financing of entrepreneurial firms in the United Kingdom prior to the 1980s is 'part of the British financial tradition.' Most of these finance sources, however, with the possible exception of 3i, did not resemble venture capital as it is known today or as it emerged in the United States in the 1960s and 1970s.

[5] The subsequent expansion of 'modern' venture capital in the United Kingdom during the 1980s was a result of numerous factors — attitudinal, policy, and economic (Mason & Harrison, 1991; Murray, 1995). Along with growing recognition of venture capital's supposed effectiveness in the development of the technology driven growth, Prime Minister Margaret Thatcher introduced a number of initiatives and policy changes to support small business and venture capital activity (Mason & Harrison, 1986; Owen, 1999). Such measures included training and advice for entrepreneurs and changes to company law that allowed company founders to repurchase their shares (i.e. gain more ownership), making it more favourable for entrepreneurs to seek out external equity such as venture capital (Burns & Dewhurst, 1986).

[6] The establishment in 1980 of the Unlisted Securities Market, the requirements for which were conducive to small and medium-sized firms, made a profitable exit by IPO an attainable and attractive reality for entrepreneurial firms and VC firms interested in financing them (Shilson,

contributing strengths of the United Kingdom are thought to be its dynamic, market driven entrepreneurial culture (when compared to the more coordinated economies of Western Europe), its strong science base associated with Oxford and Cambridge, a history of corporate innovation, and the London region's considerable global magnetism regarding international finance and knowledge flows (see Smith, 2004; Simmie et al., 2002).

1.6.1. A Focus on Early Stage Technology Oriented Investment

Furthermore, *this research focuses — to as great an extent as possible — on U.K. venture capital investment in the early stage development of NHTCs*, a form of investment generally referred to as classic venture capital (Gompers & Lerner, 2004; Gorman & Sahlman, 1989). Classic venture capital "is oriented towards the financing of companies at their seed, start-up and early growth stages," leading through expansion stages and investment exit, and generally involves companies engaged in technology based endeavours (Mason & Harrison, 2002, p. 430). Of the various forms of venture capital, classic venture capital is the one most associated with the spurring of technological innovation and subsequent economic growth (Bygrave & Timmons, 1986).

In focusing on classic venture capital, this study foregoes what is commonly referred to as *merchant venture capital* or what is more generally called *private equity*. These funds "invest in later stage deals and management buyouts (MBOs) and buy-ins (MBIs), that is, the sale by large companies of noncore subsidiaries and divisions to either incumbent or incoming management teams (Mason & Harrison, 2002, p. 430). Also absent from this study is *informal venture capital*, which flows predominately from wealthy individuals, often called angel investors, who provide start-ups with seed capital that generally precedes any formal venture

1984). Additionally, the promotion of a 'pro-investment' climate in the United Kingdom under Prime Minister Margaret Thatcher proved particularly attractive to foreign investment, including foreign venture capital. This occurred with a resurgent global economy that followed nearly a decade (1970s) of high interest rates, high inflation, and stagnant economic conditions (Owen, 1999).

capital investment (Mason & Harrison, 1996, 2000; Wong, Bhatia, & Freeman, 2009).[7]

The focus on early stage investing is pertinent for both understanding collaborative venture capital activity and for venture capital investment in the United Kingdom more generally. First, given the lack of resources, expertise, and capital held by most young companies and start-ups, it is expected that early stage companies will require a disproportionate number of external inputs (Perez & Soete, 1988; Zook, 2005). Such inputs are likely to involve highly tacit and/or specialised knowledge and resources that are shared through feedback loops and learning processes that extend beyond the boundaries of the firm (Carlile & Rebentisch, 2003; Freeman & Soete, 1997; Hirsch, 1965; Hislop, 2009). Therefore, *it is expected that early stage venture capital investment will necessitate a considerable degree of external collaboration* (Bottazzi & Da Rin, 2002; Sapienza, 1992; Steier & Greenwood, 1995; Zook, 2004).

Second, global venture capital investment levels in early stage companies rise and fall in accordance with global market conditions, comprising nearly 50% of venture capital investments in up times such as the tech boom of the 1990s and declining to roughly 15% during economic downturns such as the tech crash of 2000–2001 and the recession of 2008–2010 (Pierrakis, 2010). Over the past 3 decades trends toward decreasing levels of early stage venture capital investment have led to an ongoing assumption that an early stage venture capital equity gap exists, prompting governments to implement the various public venture capital programmes discussed earlier in this chapter (Lerner, 1999; Mason & Harrison, 2003; Nightingale et al., 2009).

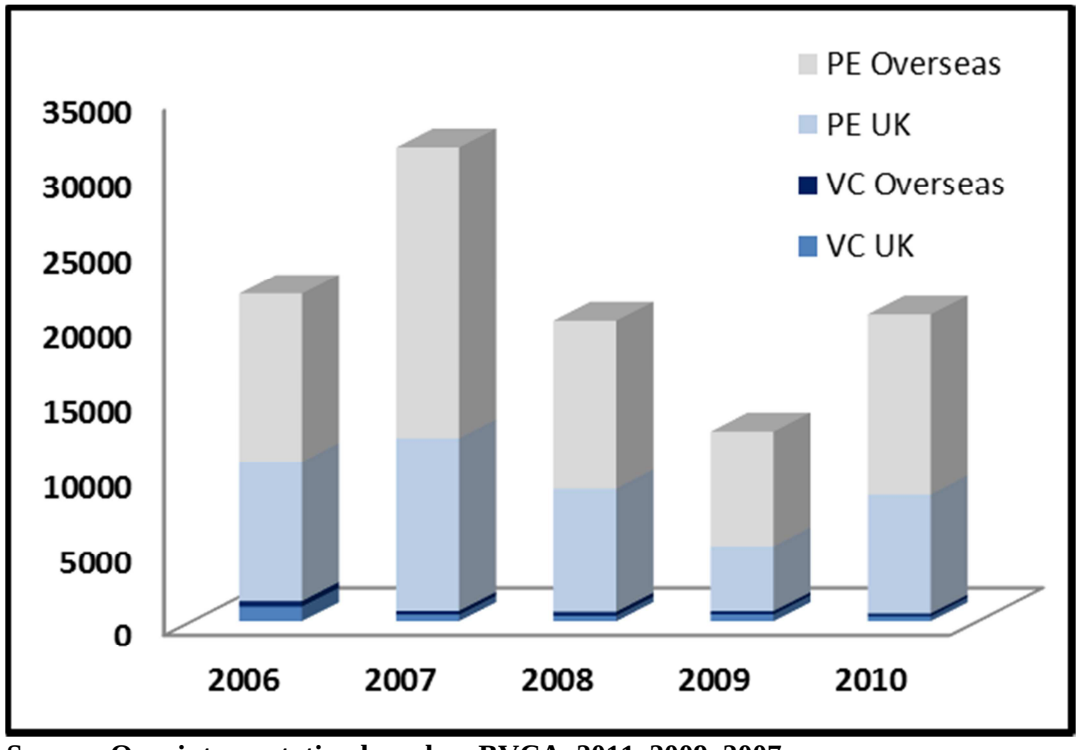
This early stage equity gap is apparent when looking at U.K. venture capital investment over the last half decade. Total venture capital and private equity investment in the United Kingdom — invested by U.K. based venture capital and private equity firms in U.K. based companies — peaked in 2007 at £11,972 billion (up from £10,227 in 2006). This upsurge was due to an increase in private equity investment, much of which rode the global real estate and associated stock market

[7] For an overview of informal venture capital see Smith, Harrison, & Mason (2010).

bubble. As the credit crunch swiftly took hold, this amount fell to £8,556 billion in 2008 and to £4,790 billion in 2009. Figure 5 shows total venture capital and private equity investment by U.K. based venture capital and private equity firms invested in the United Kingdom and abroad, demonstrating both the enormous difference in investment amounts between private equity (total private equity investments peaking at roughly £31 billion in 2007) and actual venture capital investments (total venture capital investments in 2007 were £683 million), as well as the significant amount of U.K. investment that flows abroad.

When private equity investment is removed from the picture, it is clear that *true* venture capital investment in the United Kingdom, a large part of which is invested in early stage technology based companies, has both declined overall and remains a comparatively small segment of the United Kingdom's risk capital market.

Figure 5: Total Global UK VC and Private Equity Investment 2006-10 (£b)



Source: Own interpretation based on BVCA, 2011, 2009, 2007

In 2007 U.K. based VC firms invested roughly £434 million in 502 U.K. based companies, down from roughly £960 million in 2006. Venture capital investment continued to decline to £359 million in 2008. After rebounding slightly in 2009, investment levels dropped again to £313 million in 2010, invested in 397 U.K.

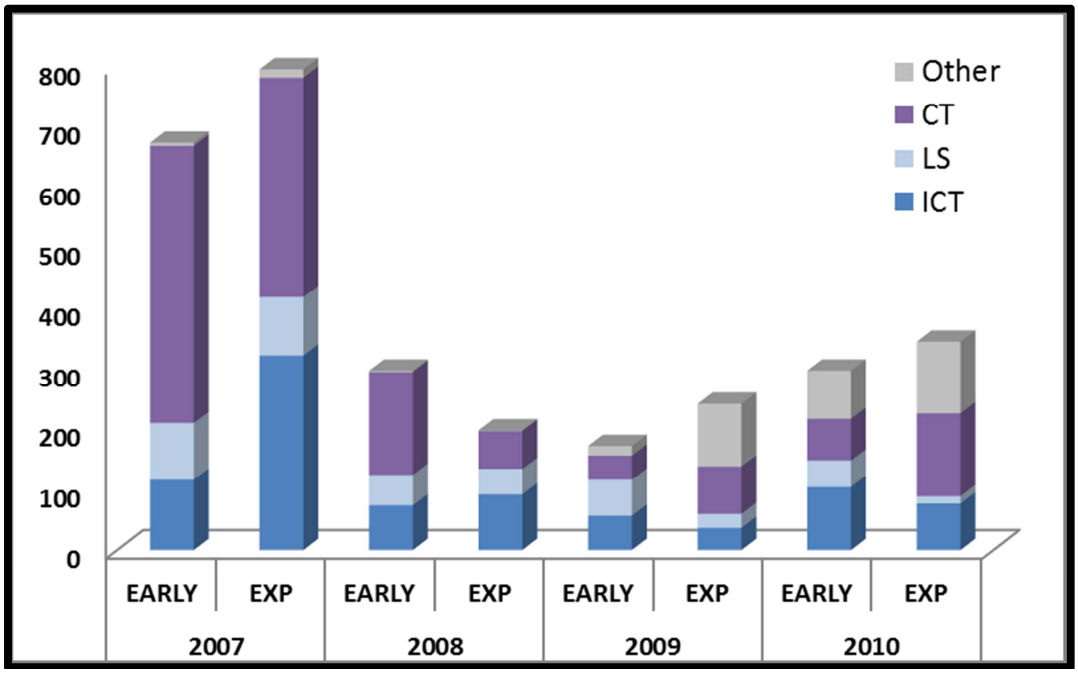
based companies (BVCA, 2011). The available data on investment in U.K. start-up and early stage companies places such investment at £247 million in 2008, £289 million in 2009, and £214 million in 2010 (BVCA, 2011).

1.6.2. A Focus on Investments in Key Technology Sectors

In looking at early stage venture capital investment in the United Kingdom, *this research includes a further focus on such investments in three key technology sectors:(1) information and communication technology (ICT), (2) life science and biotech, and (3) clean tech.* U.K. venture capital and private equity investments in technology based firms, somewhat surprisingly, remained relatively stable or even increased during the most recent recessionary period, going from £1,793 billion in 2007 (£958 million of that going to clean tech companies), dipping to £727 million in 2009, and increasing sharply to £2,229 billion in 2010. Much of this variation can be attributed to continued expansion stage funding and MBOs in pre-existing investments rather than new investments in new companies (BVCA, 2011). Similar to investment patterns of the previous decade, investments in technology based companies during this period were concentrated in companies engaged in ICT, notably software, semiconductors, and the Internet; and companies engaged in life science, particularly medical instruments, pharmaceuticals, and biotech. In contrast to earlier in the decade, companies engaged in the burgeoning clean technology sector also received sizable investment during this period, with clean-tech investments peaking in 2007 at £958 million and levelling off at £518 million in 2010 (BVCA, 2007, 2009, 2011).

Although overall investment amounts in technology based companies remained steady, even increasing in some sectors, the amount of true venture capital investment — much of this early stage funding — in technology based companies, including clean tech, remained volatile and relatively low (posting at £674 million in 2007, £296 million in 2008, and £171 million in 2009) then increased to £296 million in 2010 invested in 417 U.K. based technology companies (BVCA, 2007, 2009, 2011). When looking more closely at funding in key technology sectors during this period, various patterns of resiliency and decline are evident.

Figure 6: UK Venture Capital Investment by Sector and Stage 2007-10 (£ m)



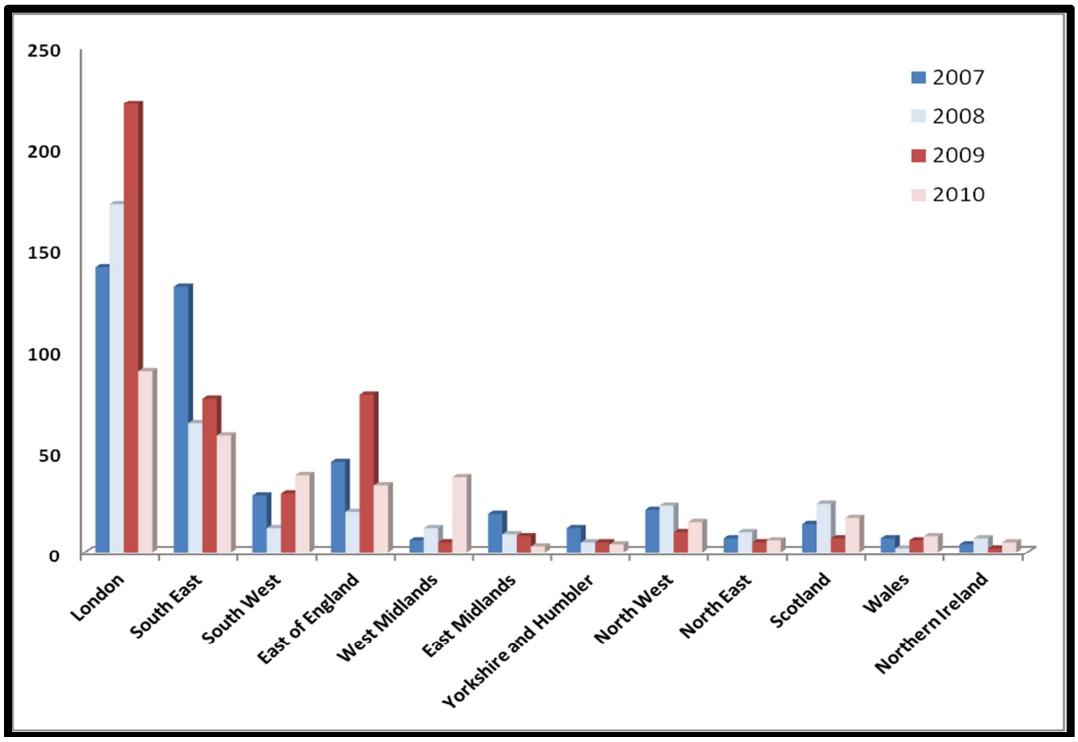
Source: Own interpretation based on BVCA, 2011, 2010, 2008

Figure 6 shows the total amounts of venture capital investment in the United Kingdom, by U.K. based VC firms, invested in ICT, life science, and clean tech companies, by investment stage, from 2007 to 2010, distinguishing between early stage investment and expansion stage investment.

1.6.3. A Focus on Investment Activity in the LMR

Nearly 70% of all U.K. venture capital investment and 68% of all early-stage venture capital investment regularly flows into the LMR. Furthermore, the LMR, including Oxford and Cambridge, is home to roughly 70% of all U.K. based VC firms (BVCA, 2009, 2010, 2011). Therefore, *this research further focuses on early stage venture capital investment in NHTCs located in the LMR, including Oxford and Cambridge.* What Miles and Daniels (2007, p. 4) calls the "Golden Triangle," an area "bounded by Oxford and Cambridge and along the M4 to London," the LMR constitutes the economic engine of the United Kingdom and acts as a global centre for high-tech innovation and related industries, the arts, and finance (Smith & Virah-Sawmy, 2008; Simmie et al., 2002). For a distribution of U.K. venture capital investment by region, see Figure 7.

Figure 7: Total UK venture Capital Investment by region 2007-2010 (£ m)



Source: Own interpretation based on BVCA 2011, 2009, 2008

The geographic concentration of venture capital activity, as in the case of London, corresponds to the perspective that situates venture capital activity within the context of a broader entrepreneurial ecosystem (Zacharakis, Shepherd & Coombs, 2003). According to Metrick and Yasuda (2010), such an ecosystem implies an environment that makes it easier for entrepreneurs to start and grow their businesses. In practice, such ecosystems might include a critical mass of finance and legal professionals that understand the needs of entrepreneurs, regulatory bodies that support business development, easy access to highly skilled and mobile labour (scientists, engineers, managers), a propensity for corporate and university spin-outs, and so forth (Mathews, 1997). The explanation follows that those countries and regions with vibrant entrepreneurial ecosystems exhibit higher levels of entrepreneurial activity and thus higher levels of venture capital investment (Djankov et al., 2002).[8]

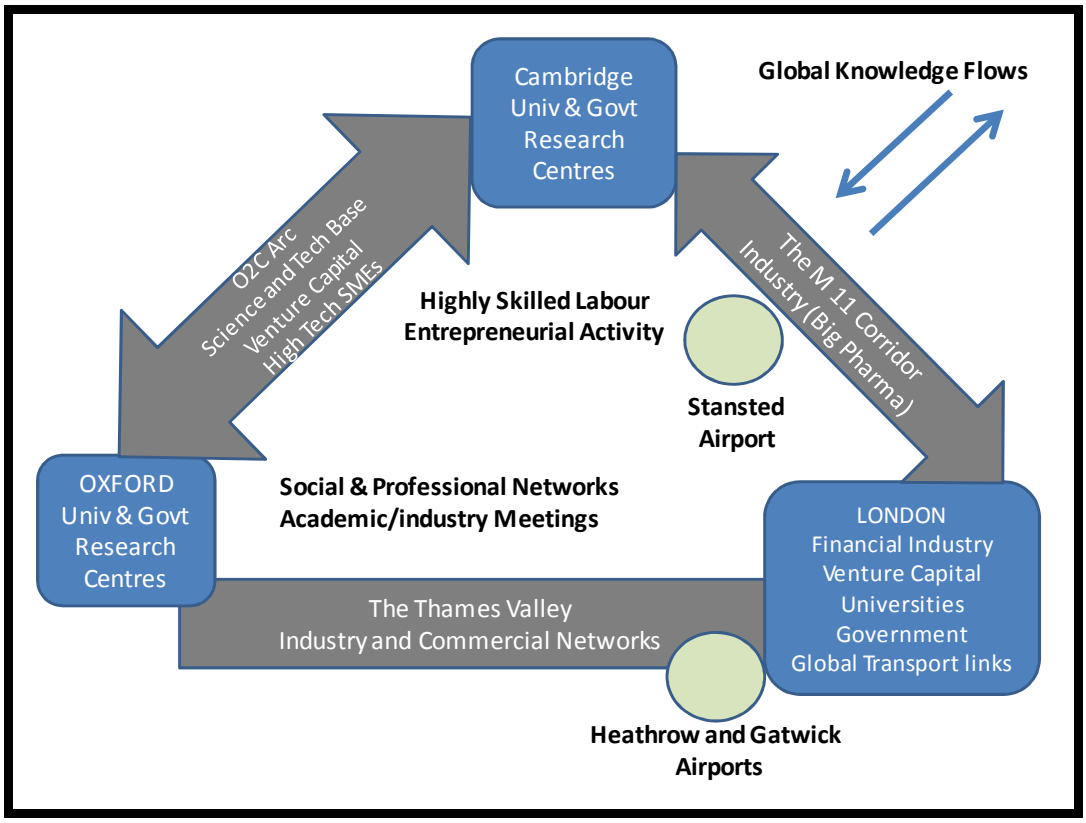
[8] Djankov et al. (2002) considers 85 countries and compares the overall costs of starting a business in each. The costs are measured by comparing the number of regulatory procedures necessary to start a business and calculating the average number of days it takes to start a business in each country. The countries exhibiting the shortest number of days to start a business – between 2 and 4 business days – were Canada, Australia, the United States, and the United Kingdom. In contrast, in

In many ways, such ecosystems are thought to reside within broader regional innovation systems that characterise a select number of high capacity regions (Cooke, 2004). Such systems imply an institutionalisation of innovation capacities and a high degree of regional embeddedness concerning innovative activity, related interactions, and social capital (Cooke, 2004; Miles & Tully, 2007). For understanding innovative activity in large metropolitan regions such as London, the regional innovation systems (RIS) concept is informative. *First*, the RIS concept positions entrepreneurialism and related activity, such as venture capital, as system catalysts: coping with uncertainty, they are the sources for new ideas and experimentation, ideas which, through subsequent interactions with other actors and functions of the RIS, lead to new innovations (Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007). Therefore, entrepreneurial activity is reinforced through positive feedback loops and the absorptive capacity of skilled labour markets, spurring a continual cycle of new idea creation and development (Lawton Smith & Waters, 2011). Furthermore, central to the RIS concept is that entrepreneurial activity occurs through the efforts of both incumbents and new entrants; offering possibilities for collaborative interactions between them.

Second, the geographic boundaries of the RIS concept, although "fuzzy" and difficult to define (Doloreux & Parto, 2005; Markusen, 1999), can be understood as a functional region or territory: a region that extends as far as there are significant, purposeful linkages between actors that go beyond administrative boundaries — encompassing both central nodes of interaction and association (e.g. a major city) and peripheral sub regions (e.g. university research hubs or industrial clusters); or as Nuur, Gustavsson, and Laestadius (2009, p. 127) propose, "in practice, functional regions are normally neighbouring regions or regions connected by communication systems allowing daily commute." The LMR can be understood as such, with London acting as a central node by which the broader region that includes Oxford and Cambridge purposefully interact (see Figure 8).

countries such as France and Germany this study estimates is takes between 40 and 55 days to navigate the regulatory hurdles for starting a new business, almost 10 times as long as in the neighbouring United Kingdom. Such differences might indicate more vibrant entrepreneurial ecosystems.

Figure 8: Miles' "The Golden Triangle": The LMR as a Regional Innovation System



Source: Adapted by the author from Miles & Daniels (2007)

Thirdly, the RIS concept posits that local and intra-regional interactions and knowledge exchange between actors are understood as occurring through networks that change and evolve through repeat interaction and the varying dynamics among dominant network incumbents (i.e. gatekeepers) and new network entrants. More so, the RIS concept emphasises that regions (as similar to innovative firms discussed earlier) must remain open to external knowledge flows to remain dynamic and competitive and thus avoid lock-in (Asheim & Isaksen, 2002). This openness is characterised by interactions between regional and global networks — in many cases linking one RIS to others around the globe — whose network interface, as Iammarino (2005) suggests, occurs at the level of the region. London, as a central node for global interaction and exhibiting robust international transport links, epitomises this concept of global-regional interface. *Therefore, a large portion of the collaborative activity between VC firms and large companies occurring in the United Kingdom is expected to have its interface within London itself.*

1.7. Hypotheses, Assumptions, and Research Approach

This study takes the view that propensities for collaboration between VC firms and large corporations will be premised, in part, on the differing input requirements of portfolio companies, differences that are likely to be sector specific. First, as discussed earlier, theoretical constructs regarding the innovation process place the highest input requirements of science and technology at the early stage of product development (Hirsh, 1965; Markusen, 1985; Perez & Soete, 1988). Such inputs will vary among high tech sectors and industries. This variance corresponds to different sector specific finance requirements and development timeframes, as well as different barriers to market, all of which inform investment decisions, including propensities for collaboration with external partners. From these constructs this study proposes that:

> *(H1) the greater the science and technology inputs required by portfolio companies, the more important and formal collaboration between VC firms and large corporations becomes.*

It follows that higher input requirements will correspond to more substantive value adding activities, with VC firms more readily connecting portfolio companies to critical external sources of specialised knowledge, resources, and commercial capacity. In this way:

> *(H2) the greater the science and technology inputs required by portfolio companies, the more important collaboration between VC firms and large corporations becomes for value adding purposes.*

Therefore, the more value added a portfolio firm requires (i.e. the more inputs toward development needed) the more intense and substantive the monitoring and evaluation of portfolio firms will likely be. Therefore:

> *(H3) the greater the science and technology inputs required by portfolio companies, the more important collaboration between VC firms and large corporations becomes for investment monitoring and evaluation.*

Second, as mentioned previously, VC firms tend to geographically concentrate both themselves and their investments within the environs of high capacity regions; this geographic proximity facilitates their management of highly asymmetric and tacit information and related agency costs associated with developing NHTCs. In this way, geographic proximity allows VC firms to regularly monitor their portfolio companies and regularly access the capacities of local investment networks, including syndicate VC firms and corporate partners. Therefore:

> *(H4) collaboration between VC firms and large corporations will be facilitated through both geographic proximity and the capacities of the LMR.*

With geographic proximity facilitating investment monitoring, and given the connection between investment monitoring and value adding, this study further proposes:

> *(H5) for collaboration between VC firms and large corporations, the importance of geographic proximity will be most prominent during the post-selection monitoring and evaluation of portfolio companies.*

In capturing the existence of organisational constructs, and for understanding the processes and procedures for collaboration, this study employs a mainly qualitative approach based on in-depth, semi-structured interviews with 30 technology oriented VC firms located in the London metropolitan region. Additional interviews were also conducted with corporate venturing divisions operating from offices in London. This represents an important triangulation of sources. For the core interviews questions were split into three sets or themes of inquiry corresponding to the structures, motivations, and conditions for collaboration. A line of inquiry running through these questions regarded the extent to which co-location and the LMR plays a role in the facilitation of this collaboration.

1.8. Dissertation Outline

Chapter 2 proceeds by discussing the process of innovation, examining both the opportunities for profit that innovation offers and the constraints that innovation,

as inherently uncertain, places on firms, demonstrating that firm based innovation generally requires the exchange of complementary assets between firms through various collaborative processes, often facilitated through intermediary actors. Furthermore, this chapter explores the connections between innovation and geography, looking at why geographic proximity and location factors, captured in the regional innovation systems model, may provide a facilitating mechanism by which collaboration between VC firms and large corporations is developed and maintained.

Chapter 3 then examines more extensively the venture capital cycle and how each phase sequentially positions venture capital to effectively engage and manage the complexities of the innovation process as they pertain to the development of NHTCs. This discussion places particular emphasis on how VC firms can create and provide value added toward the development of their portfolio companies. Furthermore, the geographic tendencies of venture capital are explored more thoroughly, looking at how and why VC firms leverage geographic proximity at each phase of the venture capital cycle. This chapter concludes by discussing how the technology and sector focus of potential portfolio companies drives investment decisions regarding funding and external collaboration.

Chapter 4 describes the qualitative methodological approach employed in this study, with an emphasis on the research design, the selection of objects for study, the interview process, and the procedure for analysing the empirical findings.

Chapter 5, the first empirical chapter, presents and explains the findings regarding how VC firms collaborate with large corporations and establishes the existence of organisational structures and arrangements while capturing the mechanisms, processes, and procedures for such collaborative activity. This chapter also looks at how geographic proximity and the capacities of the LMR facilitate collaboration between VC firms and large corporations with an emphasis on face-to-face interaction and potential co-location dynamics. Chapter 6 then presents and explains empirical findings regarding the motivations for VC firms to collaborate with large corporations. Sector based propensities for five possible motivations places emphasis on the extent to which collaboration is used by the venture capital

firm for either enhancing its strategic position or developing and positioning individual portfolio companies.

Chapter 7 presents and discusses the specific findings regarding the conditions under which VC firms collaborate with large corporations, deriving the *when* of collaboration, and the extent to which geographic proximity facilitates collaboration at different phases of the venture capital cycle. Chapter 8 concludes by summarising the empirical findings, clarifying the opportunities and constraints that collaboration between VC firms and large corporations offers toward the development of NHTCs, and the potential drawbacks this collaboration might have relative to innovation.

Overall, the findings demonstrate that collaboration between VC firms and large corporations is increasingly common, but more formal collaborative structures are the exception. Driving this collaboration is the exchange of complementary knowledge for purposes of better investment selection and exit, with access and use of specialised expertise for the development of investee firms (i.e. value adding) being somewhat secondary; VC firms investing in life science and biotech are, however, the exception. In this way, the findings suggest that less formal collaboration provides a more flexible and advantageous arrangement between two risk capital actors and that collaboration is used more often by VC firms at the early and late stages of the investment cycle than during the expansion stage. The findings also point to significant value adding relationships between large corporations and portfolio companies, although these often are established and maintained independently of an intermediary venture capital firm. Furthermore, the findings suggest that this collaboration is facilitated by geographic proximity, as it allows regular face-to-face interaction for the exchange of specialised and tacit information, with the LMR's rich social and professional networks and robust international transport links crucial in this regard.

Importantly, the context of a severe economic downturn and subsequent diminishing IPO opportunities appears to be an additional driver for collaboration, as VC firms increasingly seek out large corporations to facilitate investment exits by corporate acquisition or merger.

Although limitations to this study make definitive conclusions somewhat premature, this research presents a substantial first step by establishing the existence of particular organisational structures and offering answers regarding the processes and procedures employed for collaboration while raising new research questions about collaborative venture capital activity and its regional dynamics. *Its central claims are that (1) collaboration between VC firms and large corporations plays a critical and decisive role in all phases of the venture capital investment process, from the initial decision to invest in an NHTC, to ongoing investment monitoring, through to the positioning of NHTCs for investment exit; and that (2) geographic proximity plays some facilitating role in the development and maintenance of this collaboration and associated networks.* These are findings on which future research can build.

2. Bringing Innovations to Market: Complementary Assets, Network Intermediaries and Regional Innovation Systems

Innovation, understood as the recombination of existing ideas or the generation of new ideas into new processes and products (Freeman & Soete, 1997; Gordon & McCann, 2005; Morroni, 2009) is widely viewed as the main driver of growth in modern capitalistic economies (Rodriguez-Pose & Crescenzi, 2008). Innovation's overarching importance coincides with a recognition that innovation, as it pertains to the modern economy, (a) resides in the context of technological change; (b) is significantly difficult to achieve and manage due to inherent uncertainties, particularly during the early stages of the innovation process; and (c) unleashes often transformative yet disruptive forces on firms, organisations, and the broader economy (Nelson & Winter, 1982). This Schumpeterian notion of innovation as both a "creative" and "destructive" phenomenon (i.e. creative destruction) implies that some firms will successfully innovate or adapt to new innovations and others will fail, leading to their demise – innovation causing repercussions across the wider economy that are felt unequally at the local and regional levels (Fagerberg, 2003; Schumpeter, 1947).

Understanding how firms and organisations effectively manage the innovation process is generally viewed as an organisational and resource dilemma. Firms must reconcile the potential contradictions between considerable organisational flexibility, seen as necessary for the emergence of new ideas, and the allocation and management of significant organisational resource and finance capacities, all requiring some degree of structure and systemisation (Tang, 1998). More important though, the process of bringing new innovations to market is considerably challenging, particularly for small entrepreneurial firms, because these finance and resource capacities must be coupled with cumulative knowledge regarding the commercial viability of new ideas, as well as experience and expertise toward developing these new ideas into new commercial processes and products (Ben Ari & Vonortas, 2007).

For small entrepreneurial firms engaging in high-tech endeavours, *venture capital* is viewed as one possible solution to the finance and resource challenges faced by

these flexible and idea-rich companies that often lack the finance, resources, and expertise for bringing their new ideas to market. Venture capital seems to provide these small firms with not only structured finance, but also knowledge and expertise regarding the managing, commercialisation, and marketing of high-tech innovation, and offers portfolio companies valuable connections to appropriate external partners and resources (i.e. value added) (Gorman & Sahlman, 1989). For large established firms, *corporate venturing* and *corporate venture capital* programmes are viewed as possible solutions to the organisational dilemma faced by these resource-rich companies that often lack the organisational flexibility to effectively use their resources to develop and commercialise new ideas. Corporate venturing and corporate venture capital programmes generally grant special divisions within the company's R&D and investing apparatus greater autonomy coupled with directives to seek out new ideas through mechanisms and sources external to the firm (Keil, 2002).

The previous chapter introduced the roles of venture capital and close geographic proximity in financing and developing NHTCs and the complementary potential that collaboration between venture capital and large corporations holds for NHTCs. For a more comprehensive understanding as to how, why, and under what circumstances VC firms will collaborate with large corporations and their corporate venturing divisions, it is necessary to more fully understand (a) why specially structured forms of finance such as venture capital are deemed important for innovation-led economic growth, (b) why collaboration between the two might offer significant complementary advantages to themselves and the companies they invest in, and (c) why such collaboration might be facilitated through close spatial proximity within the geographic boundaries of high capacity regions.

Viewed primarily through the perspective of NHTCs, this chapter proposes that answers to the above questions are found in the finance and resource challenges associated with bringing new innovations to market (Sect. 2.1, 2.2, & 2.3); many of these challenges are based on the uncertainty inherent to the innovation process. Overcoming uncertainty requires the exchange of complementary assets between firms (Sect. 2.4) through collaboration that emphasises external alliance building and the development of related networks, all of which can be facilitated by

intermediary actors that can combine finance with knowledge and connections to commercial capacities. The connection between innovation and location is then explained (Sect. 2.5) through the combination of profit driven agglomeration theory and the positing of innovative activity within the regional innovation systems of large metropolitan regions.

2.1. Innovation: Uncertainty and Schumpeterian distinctions

To begin with, much of our understanding of innovation comes from the work of Schumpeter (e.g. 1942, 1947, 1927). Observing the economic transformations of the late 19th and early 20th centuries and building on the works of Marshall (1925), Schumpeter was the first to forcefully argue that innovation is the primary mechanism driving economic growth, causing long waves in the economy. In the broadest sense, Schumpeter (1927) describes innovation as

> such changes of the combinations of the factors of production *as **cannot** be effected by infinitesimal steps or variations on the margin*. They consist primarily in changes in methods of production, transportation, or in changes in industrial organisation, or in the production of a new article, or in the opening of new markets or of the new sources of material (p. 295 emphasis added).

Schumpeter's emphasis here on changes not associated with "variations on the margin" points to a concept of innovation that involves considerable change and the unleashing of transformative forces. Thus, innovation, according to Schumpeter and others, is generally associated with the process of technological change, including the diffusion and adoption of new technologies (Ruttan, 2001).

Over the course of his career Schumpeter's views evolved regarding the importance of small entrepreneurial firms (i.e. Schumpeter I) as being the primary engines of innovation-led economic growth. He eventually recognised that large corporations and their R&D activities (i.e. Schumpeter II) are also a major source of innovations in the modern economy (Freeman & Soete, 1997). Distinctions between the two, however, are still relevant and are used here to illustrate both the challenges faced by small entrepreneurial firms in bringing new innovations to market and the complementarities that small and large firms offer one another through collaborative innovation activities.

2.1.1. Innovation and Uncertainty

Innovations, as new ways of doing things, are not homogenous activities for which strict blueprints can be followed (Stoneman, 1983). Recognizing this, Schumpeter understood that innovation is inherently uncertain, requiring individuals and firms to engage in activities for which outcomes cannot be wholly predicted (Schumpeter, 1927). As explained by Knight (1965), *uncertainty* is a situation or event for which the outcome cannot be objectively calculated. This contrasts with the notion of *risk*, which implies that the probable outcome of a situation can be objectively calculated to some degree (Leroy & Singell, 1987). Knight recognised that most situations involve both incalculable and calculable probabilities; when the incalculable probabilities outweigh the calculable, the situation can be described as uncertain or uninsurable from a risk perspective.[9] Of course, individuals and established firms with cumulative experience will have loose blueprints to guide new innovation projects and will employ comprehensive project evaluation measures, thus reducing the number of incalculable probabilities. However, even the most carefully laid project plans are subject to unforeseen events and externalities that can lead to inefficiencies and far less than optimal development trajectories (Arthur, 1994).[10] In other words, the past can inform the present, but the past cannot predict the future.[11]

Uncertainty is particularly rampant in high-tech innovation, where, as discussed later in Chapter 3, costs and incalculable probabilities multiply due to the

[9] Leroy and Singal (1987) write: "For Knight business decisions are uninsurable because there is no way to separate bad luck from bad decision making in order to insure the former. This being the case, it is impossible to insure the outcome of entrepreneurship without adversely affecting the entrepreneur's incentives" (p. 400).

[10] The term *path dependence* is regularly ascribed to innovation. Introduced by David (1988) and Arthur (1994), path dependence is "intended to capture the way how small, historically contingent events can set off self reinforcing mechanisms or processes that lock-in particular structures or pathways of development" (Martin & Sunley, 2006, p. 5-6). As understood here, path dependence does not imply that innovation is a static or rigid process, but rather that the decisions made, particularly early on in the innovation process, can set a path trajectory that can be difficult and costly to deviate from even in the face of alternative paths, making innovation vulnerable to the effects of externalities.

[11] The notion that innovation is *path dependent* is hinted at by Schumpeter (1947) when he writes of innovation as a *creative response*: "First, from the standpoint of the observer who is in full possession of all relevant facts, it [innovation] can be understood *ex post*; but it can practically never be understood *ex ante*; that is to say, it cannot be predicted by applying the ordinary rules of inference from the pre-existing facts. … Secondly, creative response shapes the whole course of subsequent events and their 'long run' outcome" (p. 150).

combination of increasing science and technological complexity, shortening product life cycles and, in some sectors (e.g. life science), increasingly long development timeframes. Affecting the path trajectory of an innovation project are three interrelated uncertainties: technical uncertainty, market uncertainty, and more general business uncertainty (Freeman & Soete, 1997). *Technical uncertainty* refers to the degree by "which the innovation will satisfy a variety of technical criteria without increased cost of development, production or operation" (Freeman & Soete, 1997, p. 243). As such, technology may not work or it may not work as expected, likely increasing project costs and the possibility that customer expectations will not be met. A frequently cited example is computer software that is shipped to customers as "technically sound" but is often later found to be riddled with bugs and technical deficiencies, resulting in high redevelopment costs and erosion in customer trust.

Market uncertainty refers more generally to the degree to which the innovation will satisfy market demand that is predicated on changing consumer preferences and the behaviour of competitors. Even if an innovation is technically sound, it may not meet the demand of the intended (i.e. future) market, particularly following years of product development. A current case in point might be the electric car. After years of development, market demand is far less than expected due to, among other things, the persistence of unexpectedly low petrol prices. Also, years of product development might be superseded by competitors who bring a similar or better innovation to market first. *Business uncertainty* refers to future economic and political events or conditions that may affect factors of production and market receptivity. Examples include changing tax and interest rates, changes to energy and material supplies due to political instability and natural disasters, and cyclic periods of macro growth and recession (Freeman & Soete, 1997).

2.1.2. Uncertainty and Profit

Even in the face of uncertainty, individuals and firms are still compelled to pursue innovation. For those that do, Schumpeter (1927) wrote "there are always great prizes to be won" (p. 28), referring to what Knight (1965) later explained as the connection between uncertainty and *profit*. Knight proposed that situations

containing a high degree of uncertainty hold considerable profit potential (Knight, 1965). According to Knight, profit is the revenue that is residual following the payment of contractual costs. As such, real profits will be higher for individuals and firms engaged in uncertain enterprises due to the uniqueness or customisation of their output, which allows them to charge a relatively high price in relation to production costs, in the absence of any significant competition (Leroy & Singell, 1987). Knight argues that in the pursuit of profit, probabilities or expectations regarding an outcome are regularly made but are heavily subjective; they are observations and subsequent insights that are unique to the observer and not yet publicly verifiable (Langlois & Cosgel, 1993).[12]

For overcoming uncertainty and realising profits, Schumpeter (1927) emphasised the need for a rare "attitude" and "aptitude" associated "with more of character than of intellect" and found only in "certain people," which he repeatedly identified as the "entrepreneur" (p. 28). Echoing Schumpeter, Knight places much weight on the motivation to bear uncertainty. Motivation here implies both openness to information regarding opportunities and a willingness to pursue them. In many ways the importance of motivation corresponds to more recent ideas of *effectuation*, in which opportunities are not just identified and pursued but also created; in pursuing an uncertain enterprise one aims not to predict the probable outcomes but to create them (Read, Song, & Smit, 2009). Also like Schumpeter, Knight positions the entrepreneur or the entrepreneurial firm as having the requisite motivation (insight and determination) and, it is assumed, both the information and the expertise for pursuing and realising such opportunities (Knight, 1965).

The notion of uncertainty, as it is described above, raises important questions as to how entrepreneurs and firms, including large established firms, actually overcome uncertainty and realise its profit potential. In arguing that entrepreneurialism is the key source of innovation, Schumpeter put considerable thought (and scepticism) into how large established firms might overcome bureaucratic inertia through

[12] In explaining the connection between uncertainty and profit, Knight (1965) writes: "The presence of true profit, therefore, depends…on the absence of the requisite organization for combining a sufficient number of instances to secure certainty through consolidation" (p. 284).

entrepreneurial practices of their own. Schumpeter, however, was less reflective when it came to how entrepreneurs, generally lacking their own finance and resources, actually pursue innovation based on motivation and insight alone. Although the importance of finance is raised by Schumpeter, he omits the process by which the entrepreneur obtains it. [13,14] As will be shown later, it is clear that the true uncertainty faced by entrepreneurial firms is whether they can convince others to participate — through necessary investment of finance, knowledge, and resources — in their uncertain enterprises.

2.1.3. Radical and incremental innovation

Important to Schumpeter's thinking on innovation is the distinction he makes between radical and incremental innovation (Freeman & Soete, 1997). *Radical innovation* is generally understood as the introduction and adoption of new products or processes that are complete departures, resulting in entirely new product categories (Feldman, 2000).[15] Two recent examples are Apple's iPod,

[13] During Schumpeter's time, modern venture capital did not yet exist. When Schumpeter mentions entrepreneurial finance, he refers to *credit creation*, the primary mechanisms being "banks" and "capitalists." Schumpeter recognised that entrepreneurial finance is vital to the development of innovations and subtly connects "credit" to the pursuit of profits through uncertain enterprises. Schumpeter (1928) writes: "innovation, being discontinuous and involving considerable change . . . typically involving new firms, requires large expenditure previous to the emergence of any revenue, credit becomes an essential element of the process. And we cannot turn to savings . . . for this would imply the existence of previous profits, without which there would not be anything like the required amount -- even as it is, savings usually lag behind requirements -- and assuming previous profits would mean, in an explanation of principles, circular reasoning [previous profits will diminish the 'motivation' for new profits]" (pp. 380–81).

[14] Like Schumpeter, Knight was equally vague in explaining how entrepreneurs convince others as to the validity and profit potential of their uncertain enterprises. Whereas Schumpeter emphasised the "determination" of the entrepreneur, Knight (1965) suggests that entrepreneurs build "business" support through trust based relationships. As such, entrepreneurs use relations of trust "so as to eliminate or reduce the moral hazard and make possible the application of the insurance principle of consolidation to groups of ventures too broad in scope to be 'swung' by a single enterpriser" (p. 252).

[15] Schumpeter also proposed a now widely acknowledged distinction between *product innovation* and *process innovation* (Schmookler, 1966). *Product innovation* involves the creation of new or better products, which take the form of either new material goods or new services that are more intangible (Edquist, Hommen, & McKelvey, 2001). *Process innovation* involves the application of new technology to the methods of production. Process innovation "is usually associated with firm-level productivity effects that lower productive costs or increase product quality" (Feldman, 2000, p. 374). Process innovation is also typically identified with large established firms with existing production processes that can be improved on. Connections, however, between product and process innovation can be made, because the development of a new product innovation may require or lead to new production processes (e.g. computer electronics applied to manufacturing processes), and a new process innovation may lead to the development of a new product. Also, a firm might develop and then licence or sell a process innovation to other firms to be used within their own production

which radically altered the way consumers purchase and listen to music and other media, and the emergence of 3D printing. Radical innovation might necessitate "new competencies, and render existing ideas, techniques and perhaps companies obsolete" (Feldman, 2000, p. 375). In contrast, *incremental innovation* is viewed as small continuous improvements producing new products and processes similar to those previously existing (e.g. gradual and continuous improvements to the personal computer over a period of 30 years, such as increases in memory, speed, visual resolution, and portability) (Freeman & Soete, 1997). In considering these two forms, Schumpeter (1947) viewed radical innovation as more important for unleashing transformative forces on the economy, leading to clusters of innovations that reshape industries and may create entirely new industries (e.g. the Internet).

Schumpeter's early views positioned small entrepreneurial firms as the most likely producers of radical innovation (Schumpeter, 1947). Schumpeter thought that small firms, unlike large established firms, are driven by the entrepreneurial will to push for new and better ways of doing things. It follows that when large established firms are innovative, such innovation will likely be of the incremental form that is based on the improvement of existing products and modes of production. What Schumpeter downplayed, and what is now widely recognised, is that most innovations are incremental; that incremental innovations can have profound effects on industries and economies (e.g. improvements to the personal computer); and that rarer, radical innovations are more often the accumulation of continuous incremental innovations (Lundvall et al., 1992). Furthermore, large established firms such as Apple can and do produce innovations that are considered radical (iPod), transformative (profoundly changing the music industry), and destructive (causing the indirect demise or decline of many traditional recording companies and neighbourhood record stores). In other words, innovation comes about through the efforts of both small entrepreneurial firms and large established firms, with radical innovation being the more difficult to achieve and with incremental innovation being the more likely outcome.

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processes (e.g. a company the produces and sells manufacturing equipment). In other words, process innovations can be sold as products.

2.1.4. From Invention to Innovation: A R&D Gap

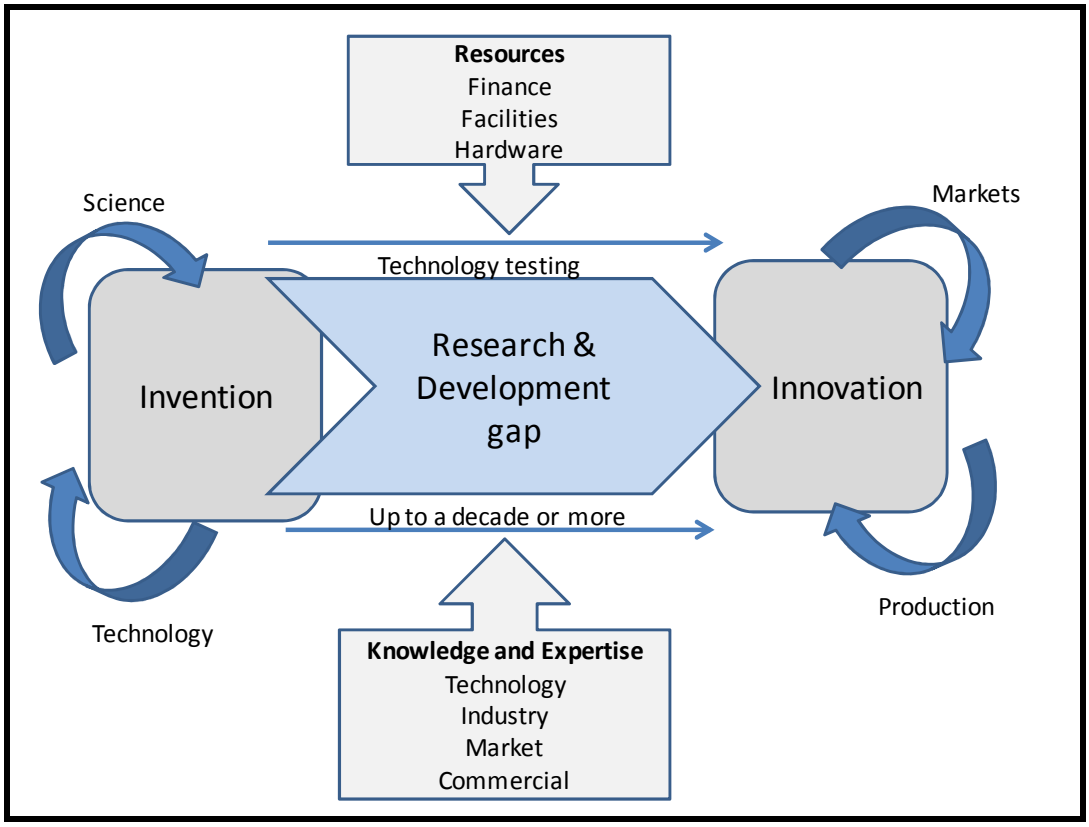
Schumpeter also made the valuable distinction between pure invention and innovation. *Invention* is typically thought of as the initial idea or prototype for a new product or process, whereas *innovation* is viewed as the process by which an idea is successfully used or commercialised as a new and improved product or process (Freeman & Soete, 1997). Schumpeter is known for saying that invention is about producing ideas (the role of the inventor), whereas innovation is about "getting things done" (the role of the entrepreneur). Furthermore, getting things done "is not a distinct process but is a process which produces consequences that are an essential part of capitalistic reality" (Schumpeter, 1947, p. 224). In this way, Schumpeter treats invention and innovation as two different perhaps loosely connected phenomena, placing far more importance on innovation and the entrepreneur and claiming that very few innovations are the result of inventions.

In contrast, later work such as that of Usher (1954) and his "process of cumulative synthesis," Hughes (1978), and Arthur (2007) view invention as an integral recursive component to the process of technological change, proposing also that invention, like innovation, is induced by economic stimuli. Likewise, Ruttan (2001) sees very little value in conceptually separating invention from innovation, arguing that in science intensive industries such as biotech and pharmaceuticals the process of invention is pursued within an R&D framework characterised by recursive interaction between technology and science, with the organisational line between basic research and development increasingly blurred. The distinction, therefore, between invention and innovation is rarely understood along the strict demarcations made by Schumpeter, and it is widely recognised that many inventions eventually lead to innovations (Arthur, 2007).

That being said, Rogers (1995) points out that considerable lag time, the result of a research and development gap, generally exists between an initial invention and related innovation, often involving decades (see Figure 9). Turning inventions into commercial innovations normally requires significant and expensive development and applied research involving the repeated testing and verification of technology and later market testing of a proposed product. Such research efforts generally

need substantial inputs of knowledge and expertise (e.g. technical, industry, commercial, and market), as well as finance, facilities, and access to potential markets and customers (Branscomb & Auerswald, 2002).

Figure 9: From Invention to Innovation: a Research and Development Gap



Source: Own interpretation based Rogers (1994) and Ruttan (2001)

This supposed knowledge and resource gap between invention and commercial innovation places small entrepreneurial firms — generally lacking the respective resources, experience, and prior market position — at a distinct disadvantage relative to their large firm counterparts in successfully making the transition from initial concept to commercially viable product and process innovation (Branscomb & Auerswald, 2002).

2.2. The Innovation Process: A Sequential and Recursive Model

From an organisational perspective, Tang (1998) argues that bringing new innovations to market requires firms to structure the innovation process so that information about opportunities can be effectively communicated to motivated individuals and functions "who also have the necessary knowledge and skills" (pp.

297–298) and resources to act on that information. Therefore, the transition from invention to commercial innovation is better understood by conceptualising innovation as a sequentially staged yet interactive and recursive process. Figure 10 shows the innovation process as interpreted from the works of Lane (1999, 2003), Ruttan (2001), Auerswald and Branscomb (2003), and Lundquist (2003), among others. According to this interpretation the innovation process involves five interrelated stages: (1) a basic research stage, (2) an invention and prototype stage, (3) an early technology development stage, (4) a product development stage, and (5) a final production and marketing stage. These stages are thought to be interconnected through recursive feedback loops that inform decision making and facilitate collective learning.[16, 17, 18]

To begin with, *Stage 1* is where new ideas are first investigated and induced. This idea generation usually occurs through basic research activities at universities, government research laboratories, and some corporate R&D laboratories and is pursued by highly skilled and motivated technologists and scientists, either as individuals or in specialised teams of researchers. Although such research may have commercial objectives — such as ideas explored by individuals with entrepreneurial leanings, sector specific university research centres, and sometimes corporate directed basic research — the ideas generated at this stage will usually

[16] Figure 2 also identifies when during the innovation process the capabilities of small firms and large established firms are generally thought to be more effectively leveraged, and from which stages radical and incremental innovation are more likely to derive. As such — according to this interpretation — radical innovations are more likely to be the result of efforts by technologists and small entrepreneurial firms beginning in Stage 1 and up through Stage 3, whereas incremental innovations are more likely to result from efforts by established firms beginning in the late half of Stage 3 through to Stage 5. Importantly though, for radical innovations to become commercially viable, they must progress through Stages 4 and 5. In other words, all innovations need to be developed to the point at which they match the requirements or demands of a particular market, thus progressing through Stages 4 and 5 of the innovation process.

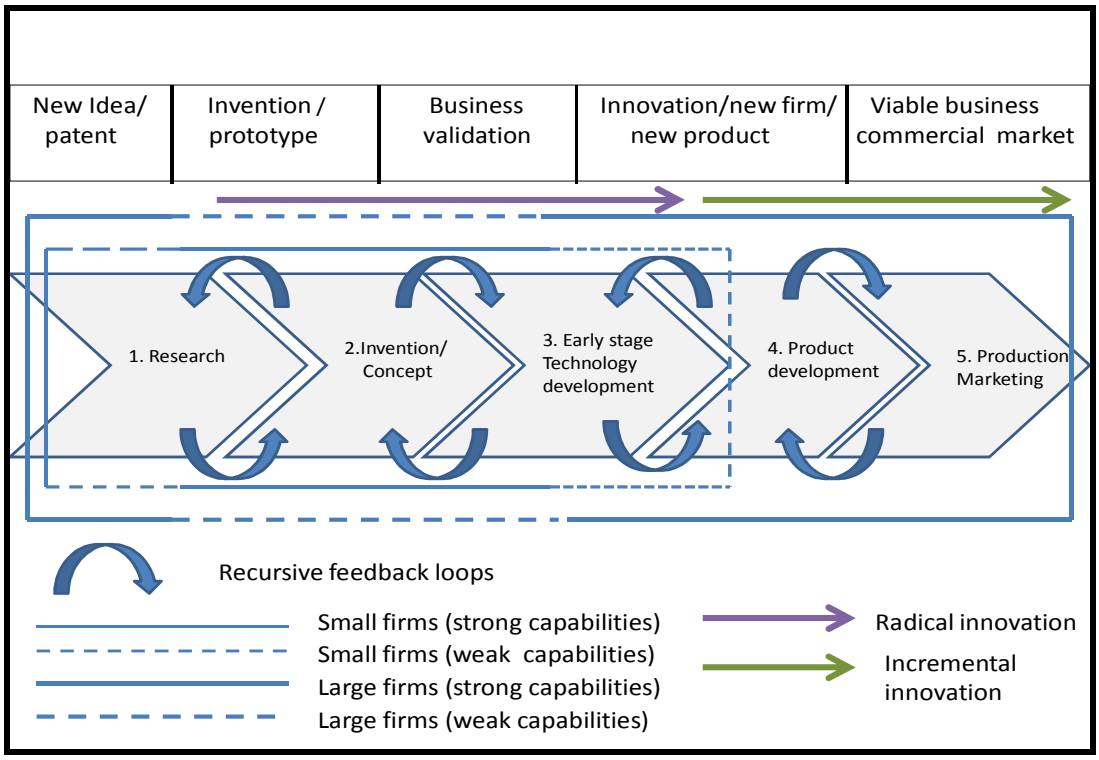
[17] *Feedback loops* allow vital information regarding what works and what does not work as it pertains to the development of a new idea or technology to be relayed recursively to individuals and divisions working within the various stages (Senker, 1995). Although important at all stages of the innovation process, feedback loops are particularly critical in later stages when product development and production activities rely on feedback from market research and testing to refine or redirect their efforts.

[18] Built on the evolutionary interpretation of economic growth and technological change by Nelson and Winter (1982), cumulative learning through repetition and practice produces heterogeneous routines and ways of doing things that firms and organisations apply to the innovation process, becoming part of a firm's organisational memory (Lazonick, 2005).

not yet have any direct commercial application. A common output of this stage is additional ideas and, most notably, patents (Auerswald and Branscomb, 2003).

At *Stage 2* new ideas are developed into working technologies or prototypes. This stage is still the realm of the scientists or technologist, although working in more applied research areas, but it may also be driven by a lead technologist or individual entrepreneur who is emboldened by a vision for the invention's practical or commercial application. At this stage additional patents are a likely outcome (Auerswald and Branscomb, 2003; Ben Ari & Vonortas, 2007).

Figure 10: Sequential Five Stage Model of the Innovation Process



Source: Adapted by the author from Auerswald and Branscomb (2003)

At *Stage 3* an invention or prototype begins the complex and highly uncertain process of transitioning into a commercially viable innovation. Described by Auerswald and Branscomb (2003) as a phase of "early stage technology development,"

> this is the point at which the technology is reduced to industrial practice, a production process is defined from which costs can be estimated, and a market appropriate to the demonstrated performance specifications is identified and quantified. (p. 229)

As such, Stage 3 is characterised by increasing recursive interaction among technologists, production specialist, and marketers (Ruttan, 2001). It is also defined by more extensive technology testing and some limited market testing, likely previewing the technology to influential technologists at leading companies (Moore, 2002). For established companies, priority is placed on matching the technology or prototype with its current product pipeline needs and the related demands of its customers, coordinating its various departments and functions to this end (Auerswald and Branscomb, 2003). For the individual technologist or entrepreneur, this stage will likely coincide with the formation of a new company around the proposed innovation, the priority being to develop a viable business plan, identify partners, and seek out external funding (Ben Ari & Vonortas, 2007).

Stage 4 is an intensification of the activities above, with an emphasis on product development, continued market testing, building the necessary business and commercial capacities, securing finance, and initial outreach to potential customers (Auerswald and Branscomb, 2003; Lane, 2003). At the conclusion of this stage a pilot product line that has strong market potential is produced: what was once an invention is now considered a commercially viable innovation (Ben Ari & Vonortas, 2007). *Stage 5* is focused on further marketing the product and fine-tuning its production, solidifying the business and commercial strategy, raising additional finance, and eliciting customer feedback — leading to ongoing product and marketing improvements (Lane, 2003; Moore, 2002).

2.3. Crossing the Valley of Death: From Innovation to Market

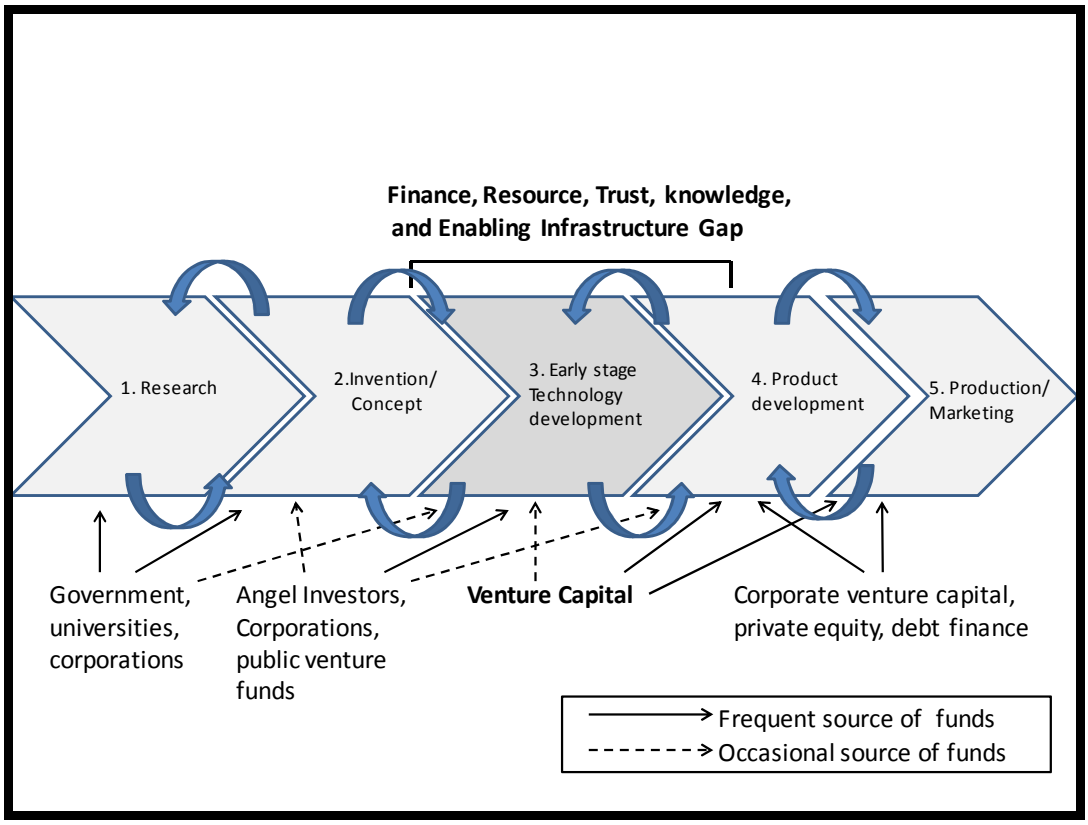
For technologists turned entrepreneurs and the new firms they form, the knowledge and resource challenges of transitioning new innovations into commercially viable products and marketing them to a receptive market are immense. Facing these challenges is often referred to as either “crossing the chasm” (Moore, 2002), bridging “the valley of death” (Markham, 2002), or navigating the “Darwinian Sea” as Auerswald and Branscomb (2003) have called it. As highlighted in Figure 11, it is thought that this valley is first encountered on reaching Stage 3 (early technology development) and into Stage 4 (product

development) of the innovation process (Auerswald & Branscomb, 2003). As described by Ben Ari and Vonortas (2007):

> On the one side of this valley stand the innovators and their innovations. On the other side stand investors and potential customers who possess capital to fund more work and knowledge of what the market requires. (p. 476)

For innovators and the entrepreneurial firms they champion, successfully crossing this transitional valley requires them to reconcile and bridge three interrelated gaps concerning uncertainty and related knowledge and resources (Branscomb & Auerswald, 2001; Auerswald & Branscomb, 2003). These include (1) significant challenges in obtaining the financing necessary to fund expensive and uncertain early stage technology development (a finance gap), (2) related differences in capabilities and motivations between innovators/entrepreneurs and investors (a knowledge and trust gap), and (3) a lack of access to valuable sources of commercial capacity building and potential markets (an enabling infrastructure gap) (Auerswald & Branscomb, 2003).

Figure 11: The Innovation Process and the Valley of Death



Source: Adapted by the author from Auerswald and Branscomb (2003)

As will be shown, filling these gaps and crossing the valley takes specialised intermediaries to provide not only finance, but also to package that finance with appropriate knowledge and connections to complementary assets.

2.3.1. A Finance Gap

Figure 11 identifies the likely sources of finance and resources that support activities at each stage of the innovation process as described by Auerswald & Branscomb (2003). For innovators and entrepreneurs, funds are generally available for doing basic research, testing technology, and developing product prototypes that correspond to Stages 1 and 2 of the innovation process. Such activities are readily funded by government agencies, universities, some corporate research funds, and more often than not through personal savings and assets (Auerswald & Branscomb, 2003). At these early stages, investment amounts for individual research projects are generally small compared to later stage funding, because investments, like the projects themselves, usually have no concrete commercial aim, and expectations are aligned to the likelihood that a large number of research projects will result in little to no outcomes of significance. In other words, uncertainty is high, but investment risk is relatively low (Branscomb & Auerswald, 2001). For Stages 4 and 5, funding and resources are available for entrepreneurs with a tested and commercially viable technology or product, a clear business plan, and often a demonstrated revenue stream. In most cases, a company, headed by the entrepreneur, will have been established around the production and marketing of the technology or product. Funding at these later stages is usually provided by private equity firms and investment banks, venture capital funds focused on investing in more established companies, and corporate venturing and corporate venture capital funds (Ben Ari & Vonortas, 2007).

Between initial funds (Stages 1 and 2) and later funds (Stages 4 and 5), though, entrepreneurial firms often struggle to secure financing to develop market-ready prototypes and build appropriate commercial capacities, both associated with the early technology and product development activities (Moore, 2002). When secured, such financial investment is generally provided by either a small number of individuals or teams of angel investors, government venture funds, or a limited

number of early stage venture capital funds: risk equity financers who recognise and understand the complexities and risks, as well as the profit potential toward developing early stage technology into new products (Hall & Lerner, 2009). That being said, such investment is highly specialised and will generally only be made if the investor is convinced that the proposed technology or product is likely to be commercially viable and, to a lesser extent, is convinced that the entrepreneur is capable of realising the identified commercial potential (see Chapter 3).

Again, the primary reason for this finance gap is the uncertainty concerning the development trajectory of a technology or product (being subject to unknown technical challenges, externalities, and related costs), and its long-term market receptivity: early stage technology development and product development takes significant long-term financial investment that is committed when the technical and, more importantly, commercial viability of a technology or product is still highly uncertain (Hall & Lerner, 2009). Such uncertainty makes investment decision-making extremely difficult, with most investors opting for less risky investment opportunities. Compounding this uncertainty is the lack of tangible assets that many entrepreneurs and their young companies hold. Without facilities and, in many cases, personal savings or property as collateral, entrepreneurs often have difficulty in attracting investment from traditional banks or investment banks who tend to use a company's more tangible assets to value the company and evaluate the investment risk (Ueda, 2004). Therefore, at this stage financing must be provided by sources with a unique ability to effectively value intangible assets. Such sources are limited, severely constraining the finance options for small entrepreneurial companies (Hall, 2002).

2.3.2. A Knowledge and Trust Gap

The gap between invention and commercial innovation is often widened by the different capabilities, expectations, and subsequent mistrust between the technologist/entrepreneur on one side of the valley and the investor and eventual customer on the other side (Auerswald & Branscomb, 2003). On one side, the technologist will have deep technical understanding of the invention or prototype and often a firm belief in what the technology might be used for, but will often

lack the appropriate understanding of the invention's real commercial applications or market. In many cases, the technologist will not have an initial commercial or profit objective for the invention, making it difficult to put forward a credible business plan for attracting investors (Moore, 2003). On the other side, the investor and eventual customer do have a sound, experienced based understanding of how to bring a commercially viable new product to market but generally lack the technical knowledge and entrepreneurial insight necessary to identify the commercial applications of a novel technology (Ueda, 2004).

Different expectations can also lead to a trust gap between entrepreneurs and investors. For example, an entrepreneur's long-term vision may come into conflict with the short-term profit aims of investors (Auerswald & Branscomb, 2003). Such conflicts may centre on contentious issues of company control and ownership: entrepreneurs, as company founders, expect to have considerable control over both the long-term strategy of the company and personnel decisions, and expect to hold the majority of company shares (Gompers and Lerner, 2004). Investors often push or negotiate for both greater control over company decision making and a larger profit share, while trying to limit their overall liability should the company fail (Gompers & Lerner, 2004). Again, bridging this trust gap generally requires the involvement of specialised investors (e.g. angel investors and early-stage focused venture capital) who have or have access to the requisite technical knowledge and entrepreneurial insight to communicate effectively with the entrepreneur, and who practice a long-term investment strategy that is more aligned with the entrepreneur's expectations. This builds credibility for the investor, allowing them to negotiate more control and oversight over a company's business strategy and operations (Ben Ari & Vonortas, 2007).

Much of the knowledge and trust gap discussed above is due to the tacit and asymmetric information that characterises the innovation process, particularly during its early stages. Being new, innovation tends to involve transmission of information that is context specific and generally tacit in form (not yet codified). Such information may be easily misinterpreted or lost when communicated to others (Howels, 2002; Zook, 2004) and often involves the capture of knowledge flows that are highly asymmetric, in that one party or actor generally has more or

better information than the other (Inkpen & Currall, 2004). The prevalence of asymmetric information can lead to agency costs and subsequent distrust between actors. For example, entrepreneurs know more about the technology and their own abilities than others, knowledge they may exploit in their courting of investors, making the investment screening and selection process difficult (see Chapter 3). Likewise, investors know more about the investment process and deal structure than the entrepreneurs they invest in, knowledge they can exploit to gain more favourable ownership, profit, and liquidation rights (see Chapter 3).

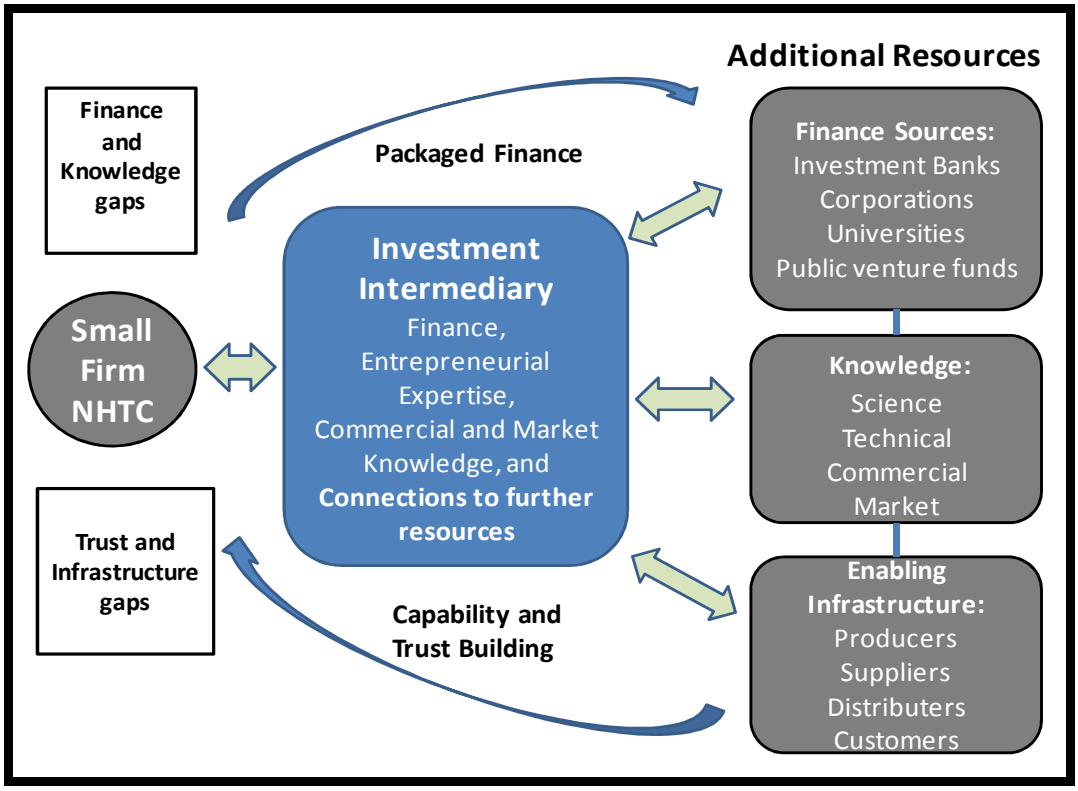
From an investor standpoint, the prevalence of asymmetric information can also lead to situations of agency costs in which entrepreneurs make potentially detrimental decisions that investors are unable to observe initially (e.g. disregarding some early technical deficiencies or making abrupt changes to key personnel) (Block, 2012; Holmstrom,1989). Therefore, providing financing to entrepreneurial firms at the early technology and product development stages requires investors who know how to effectively manage asymmetric information during the initial investment selection process and in the post-selection monitoring of the investment (see Chapter 3).

2.3.3. An Enabling Infrastructure Gap

Technologists and entrepreneurs developing new technologies may lack not only tangible assets and access to necessary infrastructure (e.g. production facilities, laboratories, and critical transport and communication links), but also access to complementary assets such as producers, suppliers, distributers, and customers (strategic partners), which are vital for developing and positioning a new product for a receptive market (Auerswald & Branscomb, 2003). Such partners can provide an entrepreneurial firm with tremendous commercial knowledge and market feedback as well as complementary expertise in technology and hardware (see Howells, 2006 & Zook, 2008). Without prior market positioning, entrepreneurs and the NHTCs they champion face considerable challenges linking to such enabling infrastructure, thus contributing to the knowledge gap. As shown in Figure 12, effectively linking to sources of enabling infrastructure often requires an NHTC to go through an investment intermediary such as an individual or group

of angel investors, a venture capital firm, or a corporate venture capital division that has deep connections to a network of producers, suppliers and distributors, and other sources of complementary assets (Auerswald & Branscomb, 2003).

Figure 12: The Valley of Death and the Role of Investment Intermediaries



Source: Own interpretation based on Auerswald & Branscomb (2003), Lee et al (2010) & Moore (2002).

As explained more fully in Section 2.4.5 and Chapter 3, the effectiveness of such intermediaries is based in large part on their unique position as experienced investors in NHTCs: they are viewed as honest brokers capable of connecting NHTCs to appropriate partners by effectively translating (i.e. matching) the commercial aspirations of the NHTC to the commercial and strategic needs of a potential partner (i.e. bridging the knowledge and trust gap). Key to this facilitation, however, is the intermediary's financial investment itself. The investment validates the NHTC, signalling its commercial potential to would-be partners (Gompers & Lerner, 2004). For NHTCs, therefore, successfully bringing a new innovation to market requires financial investment from an intermediary who can package that finance (filling the finance gap) with appropriate entrepreneurial and commercial expertise (crossing the knowledge and trust gap) while providing

connections to sources of additional enabling assets and capacities (bridging the enabling infrastructure gap).

2.4. The Complementary Assets of Small and Large Firms

So far this chapter has explored and discussed the innovation process in terms of its inherent uncertainty and the associated knowledge and resource challenges faced by small entrepreneurial firms in successfully bringing new innovations to a receptive market. It has also identified the need for investment intermediaries that can provide small entrepreneurial firms with not only finance and knowledge, but also access to external sources of knowledge, resources, and commercial capacity building. In doing so, this discussion has illuminated the different strengths and weaknesses of small entrepreneurial firms and large established firms concerning technological innovation and has hinted at the complementary assets they potentially offer each other in this regard. Figure 13 summarises the differing asset strengths of small entrepreneurial firms and large established firms, indicating where complementarities between the two might be realised.

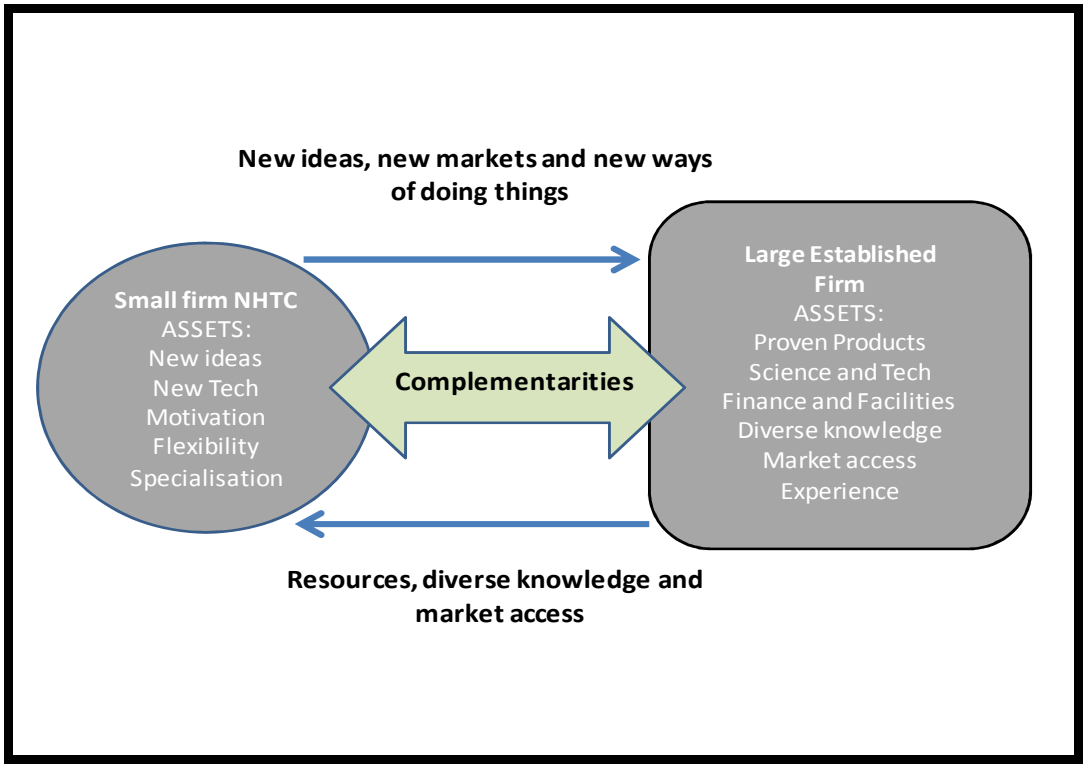
The strengths of the small firm model are found in its effective coupling of entrepreneurial drive (motivation to pursue uncertainty's profit potential) with a high degree of organisational flexibility between the different functions of the firm. This allows for effective communication of information regarding opportunities between motivated and capable individuals and the subsequent ability to quickly act on them (Hewitt-Dundas, 2006; Lewin & Massini, 2003). Additionally, for many small firms the lead managers, executives, or heads of research are the firm's founder(s), that is, the entrepreneurs whose ideas and initiative the firm is established on and from which the firm's objectives are vigorously pursued (Cassen, 1982). Overall, it is thought that this motivation and flexibility promotes an environment that is more conducive to the generation and pursuit of new ideas (Acs & Audretsh, 1990; Arrow, 1983; Cassen, 1982). As previously discussed (see Section 2.3), *the weaknesses of the small firm model* are attributed to its lack of — or lack of access to — appropriate finance, experiential knowledge, existing markets, and resources necessary for undertaking the long and

expensive process of transitioning an invention or prototype into a commercial innovation (Rothwell & Dodgson, 1994).

The strengths of the large firm model, in comparison, are the considerable resource and cumulative knowledge capacities — much of this based on their own proven technology and products — that large firms can employ for pursuing innovation (Freeman & Soete, 1997). As mentioned previously, large firms generally have the appropriate facilities, experienced scientists and technologists, and the capital to pursue large-scale science and technology intensive innovation (Cohen & Klepper, 1992). Basing new innovations on their current or past products also allows large firms to leverage established networks to suppliers, distributors, and customers, facilitating a more efficient and effective production and marketing of new products. The assumed *weaknesses of the large firm model* rest on its perceived lack of motivation and ability to pursue uncertainty-driven profits (i.e. radical innovation). This notion is based on a combination of pre-existing revenue and high organisational barriers between the various functions of the firm, which first discourage and then degrade information flows between potentially motivated individuals (Dougherty, 1992) and raise the likelihood that radical or transformative innovations will neither emerge nor be pursued (Ghemawat & Ricart Costa, 1993; Suarez & Utterback, 1995).

Despite the potential limitations of each model, science and technology-intensive industries are characterised by both small entrepreneurial firms and large established firms that regularly overcome their relative weaknesses to successfully introduce new technological innovations to their respective markets, these often diffusing to other industries and to the wider economy. Doing so generally requires small entrepreneurial firms and large established firms to partner and collaborate with each other through collaborative arrangements, or more broadly defined *strategic alliances,* in the exchange of complementary assets (Parkhe, 1993; Powell, 1990; Von Hippel, 2007). In this context, collaboration with large established firms provides small entrepreneurial firms a potent mechanism for bridging the gaps, particularly gaps in knowledge and enabling infrastructure, associated with bringing new innovations successfully to market.

Figure 13: The Complementary Assets of Small and Large Firms



Source: Own interpretation based on Rothwell and Dodgson (1994)

2.4.1. A Complementary Asset Model of Firm Based Innovation

Indeed, contrary to Schumpeter's early views, it is now widely agreed that the flexibility and idea-rich environs of the Schumpeter I model (small entrepreneurial firm) and the knowledge and resource capacities of the Schumpeter II model (large established firm) are both necessary for the development and commercialisation of high-tech innovation. Such a perspective is found in a complementary asset model first introduced by Teece (1986) and developed through the related work of Christensen (1995, 1996), Granstrand, Patel and Pavitt (1997), and Chesbrough (2003, 2008) that focus on the external alliance practices of large established firms, and the corresponding work of Rothwell (1991), Rothwell and Dodgson (1994), Tether (2002), Lee et al. (2010), and others that capture similar external collaboration among clusters of small firms and between those small firms and large established firms.

The work of Lawton Smith, Dickson, and Lloyd Smith (1991), Saxenian (1996), Owen (1999), and others empirically demonstrates that collaboration is common between NHTCs and large established firms, particularly in the sector of life

science, information and communication technology, and advanced materials. In these sectors a seemingly symbiotic and complementary relationship prevails even among competing firms, with large established firms residing alongside and interacting with small and medium-sized firms, all producing or contributing to the output of innovation (both incremental and radical) in these industries (Owen, 1999). In describing the emergence of such collaboration in the life science sector, for example, Owen (1999) wrote:

> A division of labour began to emerge between the newcomers and the established pharmaceutical companies, with the former concentrating mainly on research and the latter taking responsibility for development, production and marketing. This was not a uniform pattern … But the typical arrangement was for the established pharmaceutical company to form relationships, sometimes involving a shareholding link, with one or more of the biotechnology firms and to use them as a source of new products. At the same time the pharmaceutical companies took steps to acquire the new biotechnology skills. They did so through a combination of in-house research, close links with academic science and co-operation with the biotechnology entrepreneurs. (pp. 380-381)

As will be discussed later, this seemingly complementary relationship manifests itself in certain locational tendencies, with large established firms acting as anchors to geographically proximate clusters of small and medium-sized firms, all generally concentrated in a small number of high-capacity regions (Lawton Smith, 2004; Lawton Smith, Dickson, & Lloyd Smith 1991).

Inter-organisational relationships between small entrepreneurial firms and large established firms discussed above can be described as *externally oriented*, in that both firms recognise that achieving set goals cannot occur alone through existing in-house capabilities but rather must be sought through external sources. It can also be described as *collaborative* because both firms desire similar or complementary goals and believe that each has something to gain and share through their interaction (Powell, 1996). Although collaboration between firms has long been recognised as a component of most firms' innovation strategy, it is only more recently that collaboration between firms has been identified by some as the *key, necessary driver of innovation* in science and technology intensive industries. Studies by Dodgson, Gann, and Salter (2006), Laursen and Salter (2006), Lee et al. (2010), and others characterise external collaboration in these industries as (a)

focused on both enhancing existing capabilities and obtaining new ideas, (b) complex and often challenging to execute, (c) based on a mix of informal and formal *network interactions* between partner(s), and (d) often facilitated by intermediaries.

2.4.2. Inter-firm Relationships: Arrangements and Motivations

The works of Rothwell and Dodgson (1991), Rothwell (1994), Tether (2002), Chesbrough and Crowther (2006), Lichtenthaler (2008), Lee et al. (2010), and Vrande et al. (2009) identify a variety of relationships between small entrepreneurial firms and larger more-established firms. Although not an exhaustive list, Table 1 groups these relationships into three types, ranging in complexity from (1) fairly straightforward subcontracting and outsourcing relationships to (2) a variety of spin-out arrangements and (3) more complex joint venturing. Any number of these relationships could lead to long-term strategic partnerships between small and large firms or the acquisition of the small firm by the large firm partner.

These practices are often broadly characterised as being forms of knowledge and technology exploitation, i.e. “innovation activities to leverage existing technological capabilities outside the boundaries of the organization” or knowledge and technology exploration, i.e. “innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments” (Vrande et al. 2009, p. 424). Although there is much overlap between the two, the former is usually associated with relationship Types 1 and 2 for improving existing capabilities and products, with the latter more aligned with relationship Type 3 (in some cases Type 2) aimed at developing new capabilities and products and entering new markets (Chesbrough & Crowther, 2006).

What is common among these inter-firm relationships is that that they are based in part on transaction cost considerations and that they lead (in varying degrees) to knowledge or technology transfer between the two parties, resulting in some degree of organisational learning (Rothwell, 1991). Furthermore, they can solidify long-term relationships between the two parties, as well as open firms to relationship opportunities with other complementary firms by building capacities

for collaboration and raising one's position or reputation within an industry network, thus improving the ability to hire new talent and absorb new ideas (Levinthal & March, 1993). In this way, organisational learning, long-term strategic positioning, and expanding collaborative opportunities, what might be described as the *value added* outcomes of collaboration, are often primary motivations for firms to initially engage in an inter-firm relationship.

Table 1: Modes of Substantive Collaboration between Small and Large Firms

(1) Outsourcing Relationships:

- **Producer-customer Partnerships: S**mall firms produce products for large firms to use or sell. Some technical and market knowledge is exchanged (e.g. a small automobile parts manufacturer producing engine parts for a large automobile company).
- **Contract-out R&D:** Large firms fund R&D projects in small niche firms that have been identified as complementary to their existing capabilities, resulting in considerable science and technology exchange (e.g. a large pharmaceutical company funding targeted R&D in a small life science firm).

(2) Spin-off/out Relationships:

- **Sponsored spin-off:** A large firm supports the creation of a new company headed by some of its former employees to develop a promising in-house technology externally. The parent company provides financial, technical, and commercial support and often serves as the primary customer, perhaps acquiring the spin-off company outright.
- **Spin-out Support:** A large firm provides technical and commercial support to a complementary firm established by former employees of another company, possibly resulting in a long-term partnership or acquisition of the spin-out by the large firm.

(3) Joint Ventures:

- **Development Collaborations:** A large and a small firm collaborate in the development and commercialisation of a new product based on the large firm's existing technology or product line for the large company. The relationship involves considerable knowledge and technology exchange (e.g. small software developers collaborating with large IT companies).
- **Large–Small Firm Joint Ventures:** A large and a small firm collaborate in the development and commercialisation of a new product based on technology that is new to the large firm. Significant technological and market knowledge is exchanged; the large firm provides finance, production, and commercial support, and the small firm provides specialised technological expertise, creative insight, and entrepreneurial drive (e.g. a small life science firm and a large pharmaceutical company collaborating on the early research stages of a new drug).

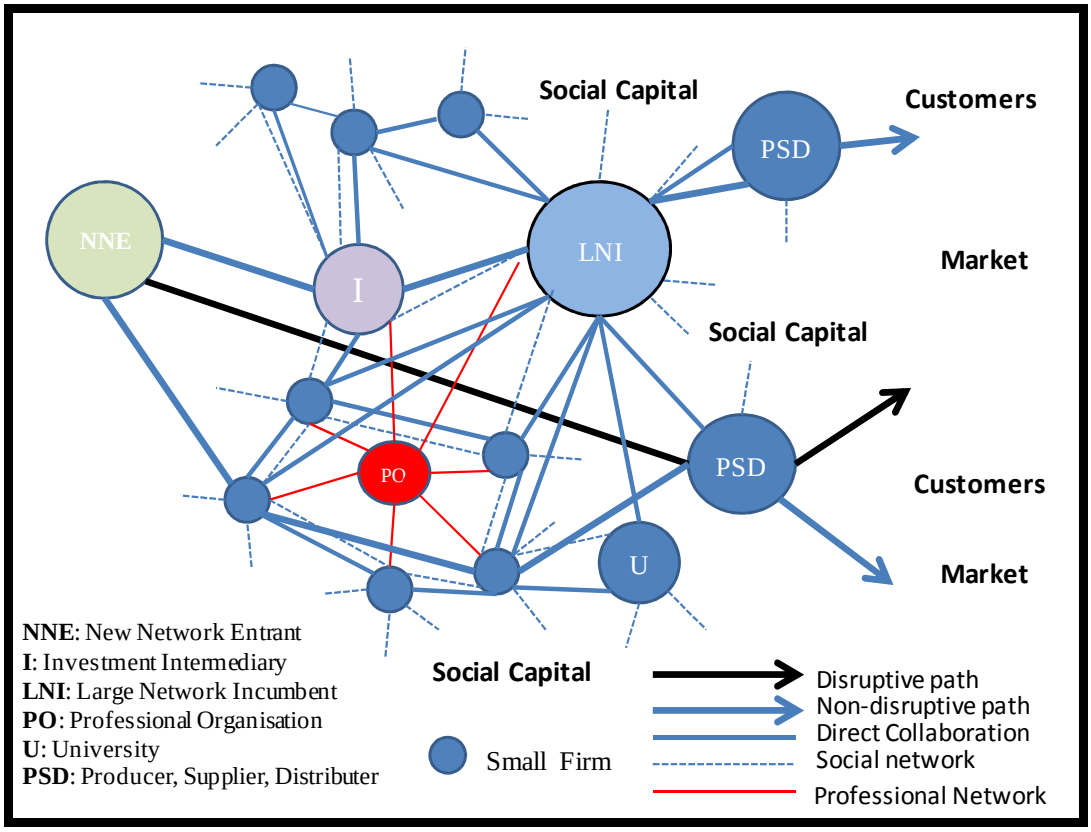
Source: Adapted by the author from Rothwell (1991, p. 109)

2.4.3. Network Based Collaboration

The notion that initial collaboration can lead to further engagement with multiple firms corresponds to the view that by entering into an interfirm relationship, a firm also enters into a wider network of individuals, firms, and organisations that constitute and connect a broader industry (Knoke & Kuklinski, 1983; Lee et al., 2010; Powell, Koput & Smith-Doerr, 1996). Such network based collaboration is thought to be particularly prevalent and necessary in science- and technology-intensive industries. In such industries innovation is based on a diverse set of capabilities and new commercial ideas emerge quickly and often unexpectedly, through formal and informal interactions between actors (e.g. individual scientists, firms, universities and government agencies) whose competencies are as disparate as they are complementary (e.g. industrial design and biological systems) (Bougrain & Haudeville, 2002). Participating in a network not only increases opportunities for collaboration, but it also positions firms to better absorb ideas and information that are created through the collaborative activity of other firms within the network (Argote & Ingram, 2000) and opens a firm to more collective industry knowledge regarding market trends, sources of finance, and changing standards and regulations (Gulati, 1998; Inkpen & Tsang, 2005; Zaheer, Gulati & Nohria).

As depicted in Figure 14, it is thought that networks of inter-firm collaboration produce a web of embedded formal *business and professional networks* and *informal social networks*, which in turn reinforce and facilitate collaboration and shape network development by contributing to the production of social capital from which the network derives new ideas and synergies (Gronum, Verreynne & Kastelle, 2012). Such networks foster substantive interactions (idea and resource exchange) between professionally related individuals that occur outside of or between the actual boundaries of the firm (Pittaway, 2004). *Professional networks* might be quite formal, holding regular meetings (e.g. industry conferences) and based on restrictive membership criteria and dues, whereas *social networks* are highly informal, with interaction taking place in a variety of private and public spaces (e.g. a private home, a restaurant, or online) (Smith, Romeo & Virahsawmy, 2012; Waters & Smith, 2008).

Figure 14: Pathways to Network Entry and Positioning



Source: Own interpretation

These interpersonal interactions where, for example, two technologists from two competing firms might discuss a new product recently launched from a rival firm, lead to further discussions on how to counter or improve on this new product. Such discussions might result in more direct talks between the competing firms about partnering on the development of a new product. Another possibility might be that the two technologists, after further discussions, decide to strike out on their own and form their own company.

As shown in Figure 14, a firm's position within the network matters. Peripheral firms or new network entrants are likely to have initially weaker and fewer collaborative ties than a large incumbent firm occupying a more central network position, i.e. an anchor firm whose network dominance may allow it to control access to not only customers but also to important network members such as key producers, suppliers, and distributors (see Feldman, 2005; Nosi & Zhegu, 2010). This incentivises most new entrants to work toward substantive interaction with the large incumbent, likely through relationships with other firms or intermediaries

that have existing network ties to the central incumbent (i.e. non-disruptive network entry and positioning) (see Freeman, Edwards & Schroder, 2006; Graf, 2011). An alternative yet less common approach would be to take a more disruptive path: bypassing the central incumbent in forging direct relationships with key network members and potential customers. The former is more common, associated with niche type firms, whereas the latter is rare, associated with firms looking to introduce more radical innovations.

As previously mentioned, studies indicate that rates of collaboration in science and technology intensive industries are high and collectively encouraged, with relative network openness allowing for new ideas to emerge, helping a network to avoid certain lock-in tendencies (see Gertler & Levitte, 2005; Owen-Smith & Powell, 2004). However, the knowledge and resource requirements for new firms to successfully enter these networks are extremely high and present significant barriers to new network entrants (see Chapter 3).

2.4.4. External Collaboration: Organisational Challenges and Costs

Despite their perceived benefits, however, inter-firm relationships and network based strategic alliances are not without challenges, costs, and potential drawbacks (Elmuti & Kathawala, 2001). External collaboration of this kind, like all collaboration, involves the opening up and sharing of one's organisation and knowledge (i.e. giving up some degree of control) and therefore *relies on some level of trust between parties* (Sabel, 1993). Trust, as Arrow (1974) and others have explained, is built through repeat interaction. Creating obstacles to trust building and subsequent collaboration between firms, studies point to a variety of *organisational and cultural barriers* centred on conflicting cultures and strategic interests, and *potential costs* involving resource and asset loss, as well as competitive tendencies that may result in the degradation of a firm's reputation and subsequent industry or market position (Das & Teng, 2001). All of these factors may contribute to less than optimal, possibly detrimental, relationships between the two **(**Powell, 1990; Sabel, 1993).

First, different organisational cultures can act as barriers toward collaboration (Rivera-Vazquez & Ortiz-Fournier, 2009). A firm's culture can be loosely defined

as the way in which the firm goes about doing things, from the speed of its decision making, the amount of risk it is willing to assume, the mobility of its employees, and its attentiveness to customers, to its openness to new ideas. As such, a firm's culture is often closely tied to its organisational capabilities and is more often attributable to firm size. For example, collaboration between a small firm and a large firm may uncover difficulties in that small firms are accustomed to building consensus and making decisions quickly, perhaps on limited information, whereas the large firm takes a more deliberative and conservative approach, particularly in decisions involving substantial risk (Prashant & Harbir, 2009). Also, both small and large firms might be sceptical of each other's technical or business capabilities. For example, an entrepreneur might doubt the advice of a large firm marketing director, causing problems in settling on an agreed to strategy; or a large firm's R&D division may have a "not made here" mentality, making the integration of an external technology or product through collaboration difficult (see Rivera-Vazquez & Ortiz-Fournier, 2009).

Second, different organisational interests and objectives can act as barriers to collaboration. Often closely aligned with a firm's size and market position, a firm's strategic interests or objectives may differ widely from those of potential collaborative partners, even those with significant complementary assets (Todeva & Knoke, 2005). For example, in approaching joint ventures, small firms are likely to be focused on long-term profits, this due to expected development lag-times in bringing new or radical product innovations to market, whereas large established firms often have more short-term profit goals associated with less complex, incremental improvements to existing products. This may result in pressure to assume a less risky development approach, leading to less radical outcomes. Also, small entrepreneurial firms may enter into collaboration with the aim to become a long-term strategic partner of a large established firm (the small firm holding on to its operational independence and control of its IP), whereas the large established firm may be more interested or inclined to acquire the small firm outright as an outcome of the collaboration. Either of these aims may involve conflicting strategies.

Finally, collaboration carries with it potential costs regarding time, knowledge, and reputation. Engaging in repeat interaction for building collaborative partnerships necessitates that individuals and firms invest time and capital in the process itself, at the expense of other functions and activities. This can prove costly because some collaboration, even after extended periods of interaction, may lack benefits for either one or both parties involved (Pisano, 1989). Collaboration can also become a channel through which firms lose specific knowledge and know-how; for example, a firm might use collaboration to recruit talent from a partner firm, or knowledge might diffuse to competitors through employee mobility or a firm's other interactions and collaborative partnerships. Pursuing collaboration with multiple parties may also create *competitive confusion* among the firms involved in a particular partnership as to who is a credible partner, in that one partner firm might believe that another partner firm is getting preferential treatment from or access to the lead partner, causing a breakdown in trust between partners, hampering collaborative efforts, and damaging reputations (Parkhe, 1993; Pisano, 1989).

2.4.5. The Role of Intermediaries in Network Based Collaboration

Lee et al. (2010), Davenport, Davies & Grimes (1999), and Luukkonen (2005) propose that overcoming some of the challenges associated with entering into collaborative networks and for choosing the appropriate partner for collaboration can be facilitated through an intermediary actor whose network position and expertise can effectively recognise complementarities and degrees of compatibility between a small firm and a large established firm. In high tech networks such an intermediary role might be played by universities, particularly their technology transfer offices; professional network organisations; chambers of commerce; groups of angel investors; public venture funds; corporate venture capital divisions; and most prominently, independent venture capital firms. The extent to which intermediaries such as venture capital are effective will vary, as will the degree of direct facilitation. Lee et al. (2010) suggests that intermediaries need to perform three interrelated functions regarding collaboration in networks.

First, intermediaries function as *information collectors or databases* for their respective networks. In this role, intermediaries collect information on firms, activities, and trends within the network and outside of it. Such information might include emerging technologies, new products, new markets, and the firms involved (Bougrain &d Haudeville, 2002). This information can then be processed and shared with firms within the network, as well as those attempting to enter the network, who are looking for appropriate partner firms to collaborate with (Fontana et al., 2006). The intermediary's role here, however, is not just about collecting and sharing that information but also about packaging the information so as to identify and match firms with complementary partners. As such, the intermediary itself will need to employ considerable resources for research and data collection, hold substantive industry and commercial experience for interpreting and utilising that information, and have extensive connections to other firms and sources of information within and external to the network (Fontana et al., 2006).

Secondly, an intermediary can expand on its information collection role by actively identifying complementary firms and then introducing them to one another for collaboration purposes, directly contributing to the *construction or development of a network* (Kogut et al., 1992). By bringing specific firms together, the intermediary acts as an important network selection mechanism, both in determining, to some degree, which firms can enter and maintain a position in the network and, in doing so, facilitating the technological transfer and diffusion of certain technologies within the network over alternative technologies (Rosenfeld, 1996). In this construction role the intermediary can also contribute to the collaborative culture and structural characteristics of the network (Rosenfeld, 1996), encouraging certain network norms such as the frequency of collaboration between firms, the degree of formality normally involved in collaboration, and the types of arrangements or structures used for collaboration. Additionally, an intermediary can encourage and reinforce the degree of geographic concentration of a network by bringing together firms that reside in the same geographic location or pulling peripheral firms into a geographically concentrated cluster of firms (Simard & West, 2006).

Finally, once a collaborative relationship between firms is established, intermediaries can then help *manage and develop* that relationship, *facilitating the collaboration process* (Davenport, Davies & Grimes, 1999; Luukkonen, 2005). They may do this by recognising the changing collaborative needs of the parties and facilitating both parties in identifying and meeting those respective needs, thus furthering the development of the relationship. In doing so, the intermediary may become both the point of contact and venue for initiating and conducting meetings between the respective parties as collaboration becomes more direct and/or complex (Luukkonen, 2005). In this context the role of the intermediary becomes particularly critical when additional collaborative partners are deemed necessary for a specific collaborative project; the intermediary is then tasked with identifying and delicately integrating these new partners into the already established collaborative framework. In doing this effectively, the intermediary needs a central position of trust within the network and an understanding of how collaboration works along with the ability to identify and bring together the appropriate capabilities and partners.

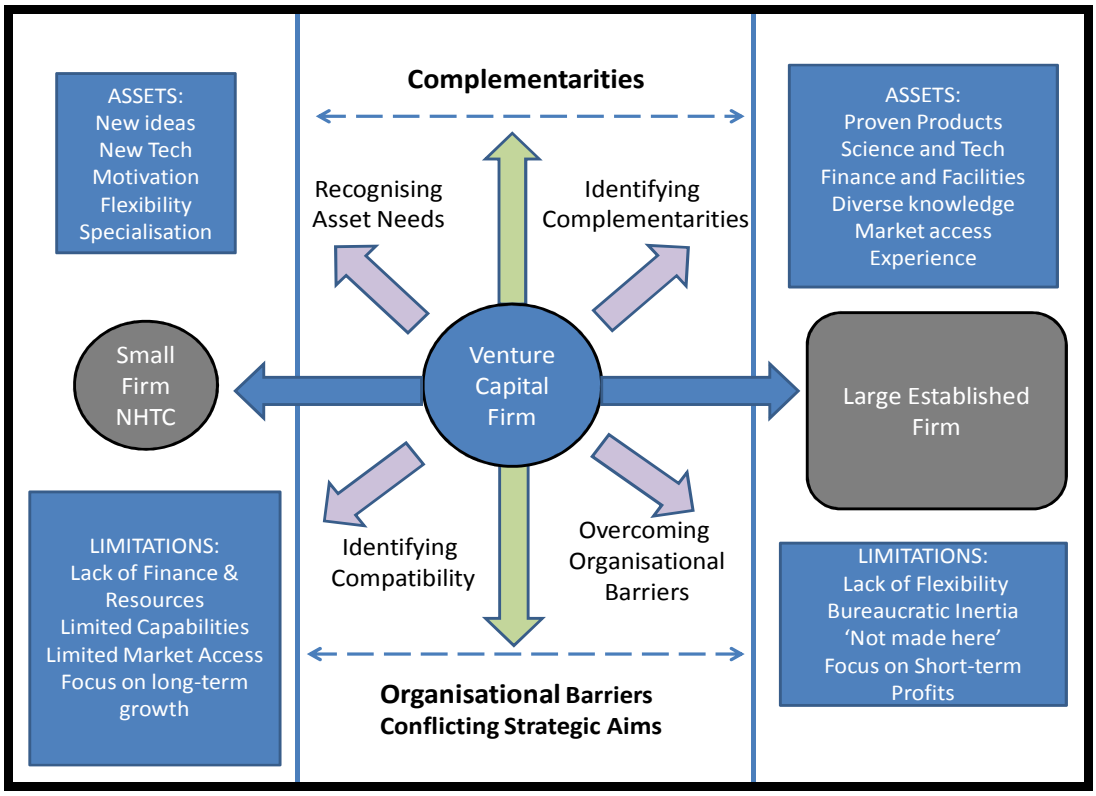
2.4.6. Venture Capital as a Network Based Intermediary

This understanding of the network role that effective intermediaries play in information collection, network construction, and facilitation of relationship building corresponds with the view, discussed in Section 2.3, of independent venture capital firms as investment intermediaries with the capability to help NHTCs successfully bring innovations to market (i.e. crossing the valley of death) by connecting NHTCs with a network of capacity-building sources and enabling infrastructure, particularly with large established firms that hold central network positions (Gulati, Lavie & Singh, 2009). Figure 15 shows venture capital as an intermediary in facilitating collaboration between NHTCs and large established companies.

From a network perspective, VC firms are viewed as capable, through a combination of their experience, information gathering, and network position, of recognising the asset needs of both new network entrants (e.g. NHTCs) and network incumbents (e.g. large established companies) and of identifying

complementarities and facilitating relationships between them. In this context, VC firms are also viewed as capable of recognising potential organisational barriers toward collaboration between the NHTCs they invest in and their corporate connections, providing possible assistance (e.g. managerial insight and trust building measures) in overcoming such barriers. In this way, venture capital can be seen as shaping the technological and commercial pathways of new innovations, pathways that might be considered less disruptive in that they often tend to involve the inputs of established network incumbents (see Cumming & MacIntosh, 2008). As discussed more fully in Chapter 3, it is assumed that this intermediary role requires independent VC firms to collaborate with large established companies within these industry networks to build and maintain these valuable corporate relationships, which they then use for investing in NHTCs.

Figure 15: Complementary Asset Model with Venture Capital as Intermediary



Source: Own interpretation based on Rothwell and Dodgson (1994), and Lindsey (2008)

2.5. Innovation and Location

The preceding sections of this chapter have presented innovation as a process by which individuals and firms, driven by the profit potential of uncertain enterprises, overcome significant gaps in knowledge and resources, often through network based collaboration with complementary firms and partners. This collaboration is facilitated by well-positioned intermediaries such as venture capital, which can bring complementary firms and assets together to bring new innovations successfully to market. Hinted at periodically in this discussion has been the connection between innovation and geographic proximity. In short, it is widely agreed that the highly tacit (i.e. not yet codified) and asymmetric knowledge that characterises necessary information sharing during the early stages of the innovation process is difficult to communicate clearly and in a well-timed way, especially across distances (Audretsch, 1998). Effective communication of this knowledge, what Von Hippel (1994) calls "sticky information," generally requires regular face-to-face interaction between individuals and functions, both within firms and between firms (Audretsch, 1998). It follows that the high costs associated with such interaction are reduced through geographic proximity, that is, collocation between actors, resulting in the geographic concentration of innovative activity (Storper, 1993, 1997).

In looking at high-tech innovation, the question is not so much why innovation agglomerates, but rather why this agglomeration tends to occur in a select number of large metropolitan regions. In other words, why does innovation tend to consistently concentrate in some locations, while failing to take hold or flourish in others? Answering this question has preoccupied innovation studies and economic geography for the better part of three decades, if not longer, with a number of interrelated explanations and concepts proposed (see Simmie, 2005). Common among these concepts are the notions that large metropolitan regions such as London offers individuals and firms much greater opportunities for profitable interactions and knowledge exchange, leading to the creation/reinforcement of specific interdependencies within the region (see Gordon & McCann, 2000; Morgan, 2007). Accounts differ, however, in relation to the importance attached to processes through which interactions between actors are developed, and to the role

of institutions in structuring them in a systematic way (Boschma, 2005). In particular, explanations of how the interaction potential of large metropolitan regions (such as London's) facilitates innovation have been offered in terms of: (1) a purely opportunity driven agglomeration model; (2) a more coordinated network-based clustering concept; or (3) an institutionally structured regional innovation systems approach. These perspectives are not mutually exclusive, however, and in practice some combination of all three is likely to offer the most powerful explanation of how processes operate in particular settings.

2.5.1. Opportunity Driven Agglomeration

Notions that firms will agglomerate and collocate in specific areas harkens back to the work of Marshall (1925) – writing in the context of pre-Fordist manufacturing – who argued that in addition to the internal economies of scale accruing to individual firms, agglomeration allows firms to benefit from external economies, particularly shared labour pools, specialised suppliers and knowledge spillovers (Krugman, 1998). According to Marshall, and later Hoover (1937), the larger these locational advantages, the greater the degree of industrial specialisation -- lowering factor costs and increasing overall productivity. Hoover (1948) expanded this notion by arguing that agglomeration also offers 'urbanisation' advantages that are not industry-specific, but involve overall density effects, with external economies spreading across the range of local industries, leading to greater opportunities for profits for all firms. More specifically, Perroux (1950) argued that innovative industries, due both to their rapid growth and backward/forward linkage, would generate and capitalise on expanded external economies in ways that reinforced agglomeration.

Building off the product life cycle concept, Hirsch (1965), Vernon (1966, 1979), and later Markusen (1985) argue that agglomeration allows firms in technology based industries to more quickly access both information and external economies, particularly pools of skilled labour adept at producing specialised technical and customised products, and this access is seen as vital to (small) firms in rapidly changing industries. In this way, agglomeration not only facilitates a firm’s production capacities but also its capacities for learning. As Markusen (1985,

1987) argued, agglomerations of such firms and specialist suppliers offered the support which was necessary for individuals and firms to participate in the "superprofit" opportunities offered by markets for new and still-customised products. This corresponds directly with the understanding that uncertainty offers the potential for extraordinary gain or profit, for those participants appropriately informed and capable (e.g. Knight, 1968).

For the agglomeration model, overall size and density matter: the larger the agglomeration, the greater the range of factor inputs on offer, and the higher potential there is for multiple opportunities for profitable interaction among firms (Gordon & McCann, 2000). Large, diverse metropolitan regions such as London, therefore, are viewed as particularly advantageous for innovative activity because they offer firms more chance to access different combinations of factor inputs, markets and collaborators (Simmie, Sennett, Wood & Hart, 2002). In this way, large agglomerations may have the critical mass necessary for firms to carry out early stage innovation without any more coordinated forms of collaboration (Gordon & McCann, 2000). Furthermore, activities (e.g. substantive interactions between firms) and factor inputs occurring in the agglomeration, particularly those associated with innovative activity, should not be viewed as permanent or long-lasting, but as activities and events that change over time (Gordon & McCann, 2000).

According to the pure agglomeration model, the externalities offered by an agglomeration are available to any firm paying the price to occupy space there (Boschma, 2005), and this is an important aspect of the economic success of the largest and most diverse metropolitan regions, such as London. But, as Boschma (2005) suggests, it cannot be wholly true of interactions between actors involved in the most highly specialised and uncertain fields. These are likely to require specific competencies and absorptive capacity that are not widely held, what Boschma (2005, 2004) and others (e.g. Antonelli, 2000) refer to as cognitive and organisational proximities. In other words, access to some externalities is unlikely to be freely available to all local firms, but require some infrastructure of coordination including recognition of shared or complementary competencies.

2.5.2. Network Based Clusters

The notion that substantive interaction between individuals and firms is based on the sharing of similar or complementary capabilities and strategies speaks to an interaction that is coordinated through *networks* (see Powell, Koput & Smith-Doerr, 1996). It is thought that networks help decrease uncertainty and facilitate information and knowledge exchange by linking complementary actors and organisational functions -- to the exclusion of others -- in a way that both promotes idea generation and the production and diffusion of new innovations while simultaneously creating norms of network interaction and behaviour (Blomquist & Levy, 2006). In other words, networks provide a degree of stability in the face of particularly uncertain markets. While networks by no means have to be geographically bound, it is understood that geographic proximity can facilitate information exchange through networks by making it easier to both communicate specialised and often tacit information and to build trust between network actors -- leading to more substantive interaction (Boschma, 2005). Examples of such localised networks are venture capital syndication networks that concentrate in locations such as London, Silicon Valley and other innovative regions, and local business and professional networks such as those that help coordinate interactions between firms, university research centres and government agencies in and around Oxford and Cambridge (see Lawton Smith, Romeo & Virahsawmy, 2012).

The notion that networks play an important role in local activities of innovation and production was popularised by the work of Becatinni (1990) and his *new industrial district* concept (Simmie, 2005). Derived from the work of Marshall (1925) on early (pre-Fordist) English industrialisation, his model was based on the ideas of vertical disintegration in the contemporary economy, and the strategy of flexible specialisation described by Piore and Sabel (1984), who argue that due to growing demand for customised goods in certain sectors, firms break up production processes into smaller and more flexible units. This vertical disintegration and the external division of labour results in agglomeration because firms will use close spatial proximity between separate production functions and complementary actors (i.e. specialised producers) to reduce information degradation and transaction costs. Inspired by the revitalised textile and craft

industries of the “Third Italy” described by Becatinni (1990), this network based agglomeration results in flexibly connected communities of production, generally comprised of small and medium-sized firms, which allows regionally based conglomerates to more effectively manage the uncertainties associated with customisation, thus facilitating innovation (Grabher, 1993; Simmie, 2005). Limitations of the model, however, include an emphasis on intra-regional self-sufficiency that is not generally found (Simmie, 2005). But the concept of social networks as key to productive interactions seems to have much more general application in relation to clusters of innovative firms (Gordon & McCann, 2000, 2005).

Two concepts that expanded on the industrial district were the *innovative milieu* and the related concept of *the learning region*. These concepts are derived from the work of Aydalot and Keeble (1988), Camagni (1991), Florida (1995), Simmie (1997), and Hassink (2005), respectively. Unlike the Marshallian examples, these focused on the agglomerative tendencies of high-tech industries (Simmie, 2005). But they also emphasised the use of formal and informal trust based networks to exchange highly tacit information to reduce uncertainty by connecting complementary actors within geographic proximity (Simmie, 2005). The innovative milieu concept enhances the network idea, however, by proposing that these networks create and facilitate collective synergies and embedded processes, particularly those associated with collective learning and decision making within and between networked firms (Lawson & Lorenz, 1999). This network concept, therefore, stresses collaboration and cooperation between firms as a means to exchange often tacit information and reduce uncertainty in rapidly changing industries (Hassink, 2005). In this vein, the networks between firms are highly flexible, allowing the mobility of management, skilled labour, and ideas and thus facilitating the regions’ collective learning and absorptive capacity (Florida, 1995).

The *learning region* concept expands on this, arguing that these collective and embedded learning processes create norms of interaction and a *culture of collaboration* and cooperation between complementary firms and across sectors (Morgan, 2007; Simmie, 2005), and suggesting that these network interactions create a regional atmosphere or buzz consisting of traded and untraded

interdependencies and related social capital which individuals and firms can draw upon for the creation new ideas and the pursuit of innovations (Storper 1995, 1997). The notion that network interaction creates and then reinforces, over time, an embedded culture of expectations and norms regarding collaboration suggest that substantive interaction toward the development of new ideas and innovations takes not only a degree of network coordination, but also a certain amount of institutional structuring, governance, and support (Morgan, 2007).

2.5.3. Regional Innovation Systems

A local institutional perspective informs a *regional innovation system* (RIS) concept proposed by Braczyk, Cooke, & Heidenreich (1998), Cooke, Gomez Uranga, & Etxebarria (1997), and Asheim & Gertler (2005), among others. According to the RIS concept, geographically concentrated innovative activity is induced and sustained, in large part, by the local presence and governance activities of robust institutional actors. These include institutions of higher learning, government research centres and agencies, industry associations, and financial institutions such as investment banks and venture capital, as well as prominent companies (e.g. MNEs) and their networks of suppliers and small firm partners (Cooke, 2001). All of these interact through complex webs of inter-organisational relationships, user-producer linkages, formal business networks, and informal social relations in the support and carrying out of innovation (Carlsson et al., 2002; Cooke, 2005; Kuhlmann, 2001; Lawton Smith and Waters, 2011). Such concentrated institutional capacities, coupled with large pools of highly skilled and well-trained labour (Lawton Smith & Waters, 2011), usually are found only in a select number of large metropolitan regions; examples include San Francisco and Silicon Valley, Paris and Ile-de-France, New York City, Bangalore, Los Angeles/San Diego, Boston and Route 128, and the greater London metropolitan region (Asheim & Gertler, 2005; Saxenian, 1990).

While emphasising a region's institutional capacities, the RIS concept is grounded in (Schumpeterian) evolutionary theory which implies change and adaptation over time (Cooke, 2005). Central to this change are the interactions, tensions, and convergence between established actors and incumbent technologies and the

emerging ideas and technologies often forwarded by new system entrants. As such, Hekkert, et al. (2007) and others propose that entrepreneurial activity is an innovation system's primary source of new ideas and experimentation leading to new innovations and technological trajectories; thus avoiding tendencies toward technological or regional lock-in. In this way, a RIS needs to be structured so as to encourage and support entrepreneurial activity even when considered potentially disruptive from an institutional or incumbent perspective (Hekkert, et al., 2007). Therefore, knowledge brokers (i.e. intermediaries) such as *venture capital* can be viewed as critical actors in *bridging* the potential tensions between entrepreneurs and system incumbents, developing and positioning new technologies as complementary to incumbent technologies and systems (Amin & Thrift, 1992; Zook, 2004). In this context, venture capital also functions within a regional innovation system as an important technology selection mechanism (Hekkert, et al., 2007).

For the RIS, another important institutional actor participating in this interplay between entrants and incumbents is the large corporation, viewed as anchoring and linking geographically concentrated industry networks (see Feldman, 2005). It is suggested that these large incumbents, many of them MNEs, will locate their corporate and R&D headquarters, including corporate venture capital divisions, in core metropolitan regions to scan, and in some instances invest in or acquire, emerging technologies arising from other successful firms, the local entrepreneurial community, and university research centres -- such locations offering a number of competitive advantages (see Porter, 1990). Large corporations will also use their incumbent positions to pursue innovation related activities by both leveraging a region's skilled labour (e.g. scientists and technologists) and its institutional capacities, particularly legal (regulation and patenting) and financial (investment banking), as well as engage in inter-firm relationships and strategic partnering within local industry networks (see Chesbrough, Vanhaverbeke, & West, 2008; Simmie, 2005). In this way, large corporations both contribute to the innovation capacities of the region (e.g. reinforcing both skilled labour pools and R&D infrastructure, and producing knowledge spillovers) and influence, as a system selection mechanism, the

emergence, trajectories and diffusion of new technologies within the system (see Cooke, 2005).

Therefore, the behaviour and strategies employed by large corporations are likely to have consequences for both local entrepreneurial activity and innovation within the region. For maintaining competitive advantage, large corporations may adopt an innovation strategy that sees them couple internal R&D initiatives with external investment in and partnering with other local firms and entrepreneurs (see Chesborough, 2004; Cooke, 2005); thus participating in and contributing to new waves of innovation within the region. On the other hand, large corporations may engage in more oligopolistic behaviour, deciding instead to employ "market policing activities" such as price setting, buying out competitors and "squeezing out entrepreneurs (Markusen, 1987: p. 98)"; actions which can stifle the emergence and commercialisation of new ideas and technologies and lead to monopolistic conditions, regional inertia and potential lock-in. Similarly, large corporations can also partake in consolidation and merger activities with other large companies, decreasing the potential paths to market for new entrants (see Chapter 3). Limiting such tendencies requires RISs to be structured in a way that not only supports entrepreneurial activity, but that it also remain receptive to new ideas from outside the system (Asheim & Isaksen, 2002).

With most RISs recognised as centres of international knowledge exchange, studies place considerable importance on the interactions between regional networks, associated knowledge flows, and global network linkages as sources of new knowledge. Receptivity to global knowledge flows allows large metropolitan regions to absorb best practices and labour from other innovative regions and, over the long-term, be more adaptable to technological and market change (Asheim & Isaksen, 2002; Pred, 1966; Simmie & Sennett, 1999). As advanced by Maskall, Bathelt, and Malmberg (2006),

> Firms therefore develop *global pipelines* not only to exchange products or services, but also in order to benefit from outside knowledge inputs and growth impulse. Such findings imply that, in a globalizing knowledge-based economy, each cluster's economic prospects depend not only on its internal interactions, but also on its ability to identify and *access external knowledge sources far away*. (p. 998; emphasis added)

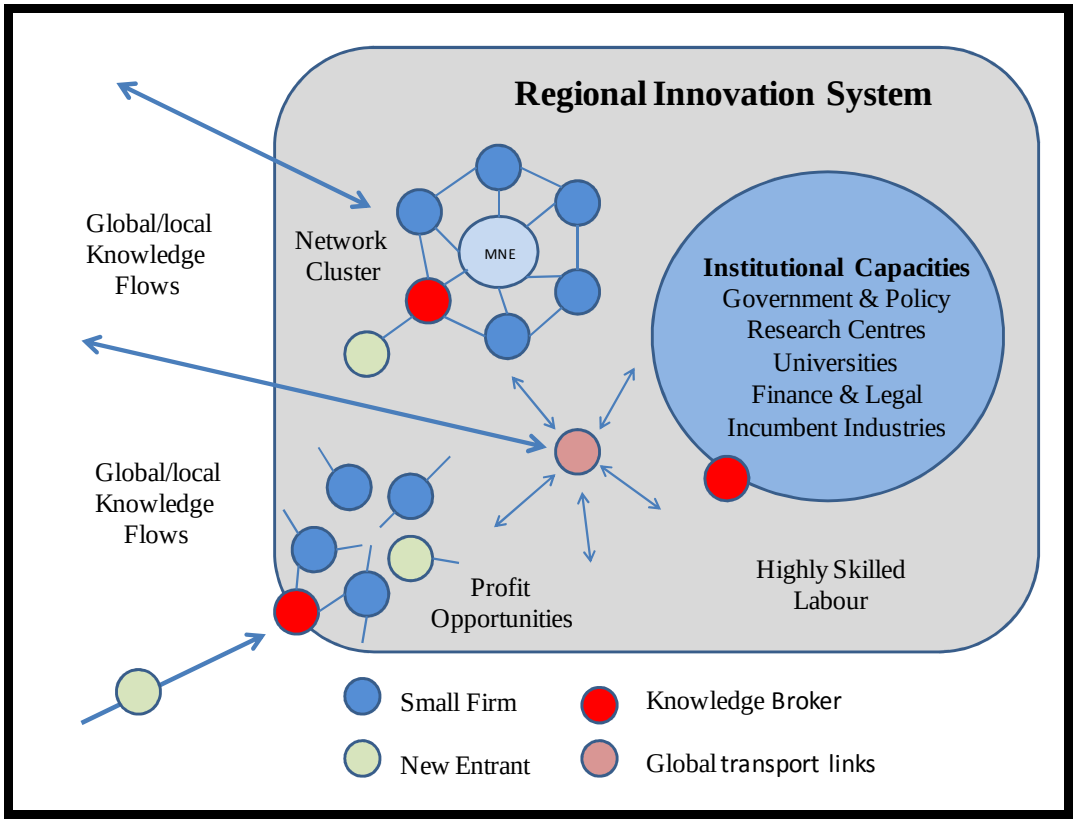
Rychen and Zimmermann (2007) suggest that certain actors, due to their prominent position in a particular regional network, may act as key entry nodes or intermediaries through which both extra-regional knowledge and actors may flow into and gain access to more formal regional innovation networks, many of these networks being industry or sector specific. Again, actors such as VC firms, MNEs, investment banks, industry associations, and universities might be viewed as intermediaries or *knowledge brokers*, part of what Amin & Thrift (1992) describe as *knowledge communities* that collect and analyse extra-regional knowledge and match it with complementary knowledge and assets that are more regionally bound (Amin & Thrift, 1992; Zook, 2008). It is thought that this knowledge brokering facilitates a region's absorption of new ideas and thus helps reinforce and renew innovation within a particular region.

In addition to the presence of such knowledge brokers, large metropolitan regions such as London are at a distinct advantage over less globally connected regions as crossroads for international knowledge exchanges in that they are endowed with rich international transport links (e.g. Heathrow Airport, St. Pancras International) and cosmopolitan business communities (Simmie, 2005). Not only do such transport links facilitate face-to-face interaction, but they also further reinforce the region as a destination, through meetings and international conferences, for the exchange of knowledge and commerce toward the development of new ideas and technologies (Simmie, 2005).

In sum, a number of ideas and concepts can explain how large metropolitan regions such as London flourish as centres of innovation. From these, an explanation emerges proposing that a select number of metropolitan city regions offer individuals and firms a seemingly unlimited number of opportunities for profitable knowledge exchange. These exchanges, often between regional incumbents and new entrants, are coordinated through selective networks which promote norms of interaction and subsequent cultures of collaboration. In this way, these networks build and reinforce regional institutional capacities which in turn structure, support, and govern (i.e. systemise) the continuous development and diffusion of new ideas and technologies in the region. This process is facilitated and sustained by a region's openness and access to global knowledge flows and

the presence of knowledge brokers who can capture and match new, sometimes external ideas with regional competencies and needs (see Figure 16).

Figure 16: Regional Innovation System



Source: Own interpretation based on Cooke (2005)

In looking at collaboration between VC firms and large corporations in the LMR, the research presented here views the LMR as a regional innovation system. In doing so, this research aims to better understand the intermediary mechanisms and processes associated with interactions between new and incumbent system actors in the selection and development of innovations. From a geography perspective, the research looks to understand the role that geographic proximity and the capacities of the LMR play in facilitating collaboration between VC firms and large corporations. In broader terms, this research seeks to characterise substantive processes of interaction within the LMR which might inform similar processes in other innovative regions and in those regions that are less so.

2.6. Conclusion

In considering the innovation process in its entirety, collaboration (within an open competitive environment) can be understood as the primary agent by which innovation is induced and facilitated. Through collaboration, specialised and tacit information is communicated, complementary knowledge and resources are exchanged, feedback loops are formed and coordinated, and collective learning occurs, from which routines and conventions then develop. Collaboration, in other words, acts as a binding mechanism, a necessary channel through which individuals, firms, and institutions (collectively bound by uncertainty) participate in and contribute to the problem-solving and absorptive capacity of firms, communities, and regions (Morgan, 2007). In this context, purposeful collaboration toward innovation requires a degree of geographic proximity, coordination through networks, and institutional structuring and related actors that support the emergence and development of new ideas and their convergence with incumbent technologies and practices.

Integral to the innovation process and the systems that support it, therefore, are entrepreneurs and the NHTCs they champion. This chapter has shown, however, that for NHTCs, lacking the experience and resources of their large firm counterparts, the process of bringing new ideas and technologies successfully to market can be particularly challenging. In pursuing uncertain endeavours, most NHTCs need to connect and partner with external sources of finance, knowledge, and enabling infrastructure, particularly the knowledge, resources, and commercial inputs of large corporations that tend to dominate the research, production, and supply networks of certain high tech industries. NHTCs, however, face substantial barriers to attracting and then developing these necessary industry connections and corporate partnerships. Overcoming them generally requires investment intermediaries such as VC firms that, in addition to providing critical early stage funding and knowledge, can match NHTCs with local complementary capacities and partners, facilitating collaboration and the subsequent development of new ideas and technologies.

As such, VC firms can be viewed as important network intermediaries and knowledge brokers in that they collect information regarding network participants and external knowledge flows, they facilitate network construction and behaviour, and they coordinate interactions between network participants. Having identified venture capital in this way, the proceeding chapter looks more closely at how VC firms leverage their local investment and industry networks to overcome innovation's inherent uncertainty and help develop the NHTCs they invest in. In doing so, the following discussion will further build the argument that local collaboration between VC firms and large corporations likely plays an essential role in the selection and development of venture backed NHTCs. From this discussion, research hypotheses are then proposed regarding the structures, motivations, and circumstances for collaboration between VC firms and large corporations, as well as the role of geographic proximity in facilitating this collaboration.

3. The Venture Capital Cycle: Leveraging External Resources Through Geographic Proximity

As shown in the previous chapter, innovation often comes about through the complementary exchange of new ideas and specialised resources between NHTCs and large established firms, often facilitated by investment intermediaries, the most prominently being venture capital firms. Venture capital's role as an investor *and* intermediary is largely based on its ability to identify the commercial potential of new ideas and match those ideas with appropriate resources to bring them successfully to market (Gompers & Lerner, 2001). In doing so, venture capital firms leverage entrepreneurial insight, industry knowledge, and management practice to capture and act on heavily tacit information within knowledge flows that are highly asymmetric in that entrepreneurs will initially know much more about their companies than investors. In characterising venture capital firms Zook (2004) explains:

> Venture capitalists are best understood as tacit information brokers who acquire and create tacit knowledge about industries, market conditions, entrepreneurs and companies through a constant process of Marshallian interaction and observation. This knowledge is then used to select companies … with the highest potential returns and assist them in their expansion. (p. 628)

More specifically, venture capital firms employ the insight and expertise of their venture capitalists (VCs), many of whom have considerable entrepreneurial experience as well as deep industry and sector specific knowledge; many VCs have held previous positions as corporate research scientists and technologists, corporate CEOs, and heads of R&D and marketing (Bottazzi, Rin, & Hellmann, 2008). This experience is coupled with a venture capital firm's related network based connections to other venture capital firms, investment banks, universities and, most notably, large corporations and their networks of producers and suppliers (Brander, Amit, & Antweiler, 2002). From these networks venture capital firms gain

> a combination of know-how on emerging technologies and business plans, connections to people in the midst of these changes and who are best equipped to evaluate risk and benefits, and direct observation of the variation in companies funded by other investors. (Zook, 2004, p. 628)

These network connections inform the venture capital investment selection process and are then leveraged for effectively monitoring portfolio companies during the post-selection investment phase, leading through to investment exit.

This access and utilisation of what are essentially nonfinancial inputs allows venture capital firms to provide value added to their portfolio companies in the form of market, commercial, and technical advice; guidance in management and personnel; and valuable connections to customers, producers, suppliers, and other strategic partners, all of which can prove critical in the development of the portfolio firm and its success on investment exit (Gompers & Lerner, 2004). Access to such inputs, however, and the quality of those inputs — much of which are based on highly tacit information — will likely be determined by both the quality and accessibility of the networks involved, both of which will be greatly enhanced and facilitated through close geographic proximity (Zook, 2004, 2005). For this reason venture capital firms will more often than not invest in local companies and partner with other venture capital firms for which they share the same local investment network.

As mentioned here and previously, a likely source of value added inputs for venture capital firms in their selection and monitoring of portfolio companies are large corporations that tend to dominate industry specific networks. These relationships however, have not been sufficiently established empirically, with questions remaining as to the involved mechanisms, processes, and motivations and whether geographic proximity plays any facilitating role.

To understand how and why venture capital firms may leverage local networks to connect to large corporations, it is first necessary to examine in detail how venture capital firms effectively manage tacit and asymmetric information at each phase of the venture capital cycle. This chapter begins by explaining the pre-investment selection process (3.1), the post-selection monitoring of investments (3.2), and the process of investment exit (3.3), focusing on the knowledge required at each phase, where this knowledge is obtained, and the role that close geographic proximity and location play. A discussion then follows of how a venture capital firm's selection decisions, monitoring activities, and propensities for their

collaboration with corporate partners are premised on the investment requirements of different high tech sectors (3.4). From this discussion, assumptions and hypotheses regarding collaboration between venture capital firms and large corporations are drawn (3.5), informing the research approach to be discussed in the following chapter.

3.1. The Pre-investment Selection Process

The initial selection of investee companies is probably the most important as well as the most challenging part of the venture capital cycle, requiring venture capital firms to navigate tremendous uncertainty and highly tacit and asymmetric information (Gladstone & Gladstone, 2004). For this screening and due diligence process, venture capital firms supposedly use deep industry-specific knowledge and entrepreneurial insight to identify the commercial potential of emerging ideas and technologies and the qualities (e.g. degree of leadership, expertise, and business acumen) of the entrepreneurs involved (Camp, 2002). From a large number of initial proposals, a very small number of companies are selected for investment, and the degree of initial venture capital firm involvement in the management and oversight of the investee company is decided (Gompers & Lerner, 2004). As shown in Figure 17, the pre-investment selection process involves a number of interrelated and crucial steps.

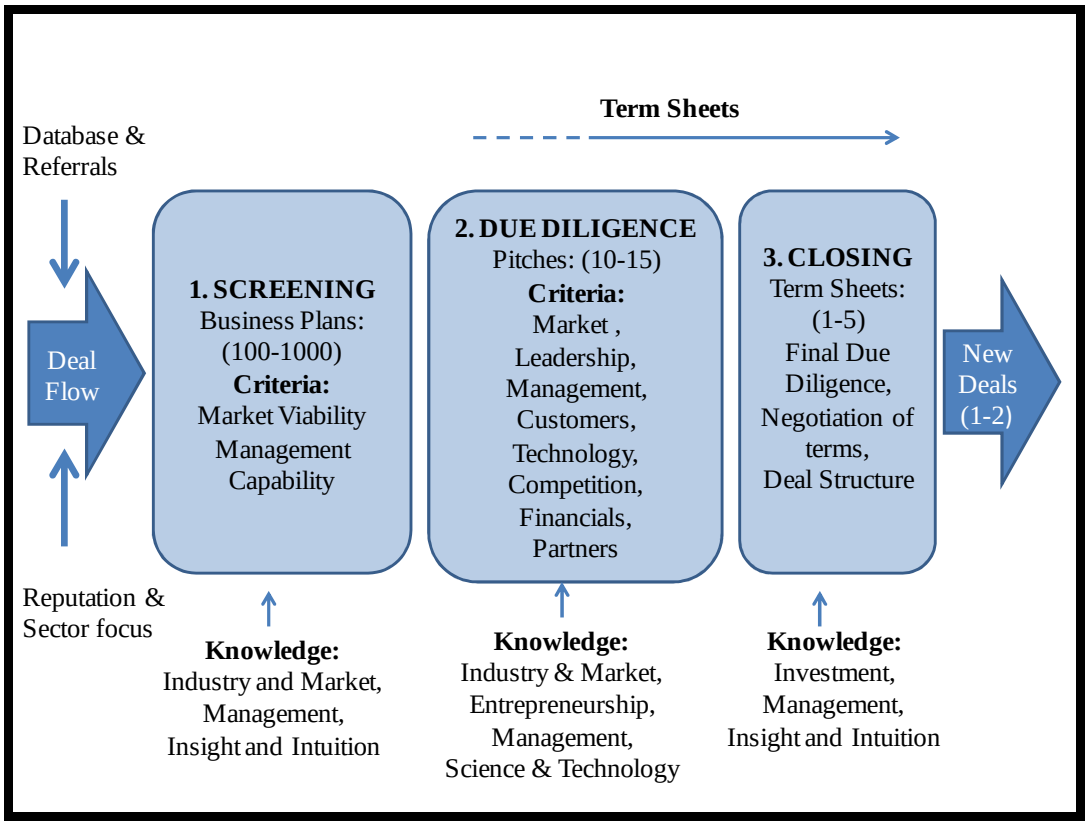
These selection steps include (1) the initial screening of a large number of proposed business plans, (2) an intense phase of due diligence on the most promising new companies, including formal presentations or pitches by those companies, and (3) a final closing phase involving additional due diligence, final investment selection, and settling the terms of the deal, thus establishing the structure and tone of the investment relationship going forward (Gladstone & Gladstone, 2004).

3.1.1. Deal Flow and Investment Screening

The investment selection process begins with the screening of potential firms for investment. The screening or “sourcing” process typically involves the time-consuming evaluation of hundreds of potential firms annually. The amount of new

potential investments for screening is referred to as *deal flow* (Manigart et al., 2006). The quality of the deal flow is generally determined by a venture capital firm's reputation, with the more well-known and reputable venture capital firms attracting business pitches and plans from successful repeat entrepreneurs or direct referrals from industry contacts (e.g. other venture capital firms) (Metrick & Yasuda, 2010). Reputable venture capital firms will likely also derive quality, often proprietary deal flow from their amassed databases of small firm and industry contacts (Zook, 2004), including past portfolio firms, angel investors, venture capital syndicate partners, university tech transfer offices, and corporate partners (i.e. venture capital as an *intermediary*) (Harrison & Mason, 2000). In other words, a venture capital firm's reputation and subsequent position within appropriate investment and industry networks largely determine the quality of its deal flow.

Figure 17: Pre-investment Selection Process



Source: Own interpretation based on Metrick and Yasuda (2011)

The initial screening process generally involves the evaluation of *business plans* provided by entrepreneurs.[19, 20] A number of studies have looked at the criteria used by venture capital firms for evaluating business plans at the initial screening phase, with no one set of universal criteria identified. Early studies by Tyebjee and Bruno (1984) and MacMillan, Siegel, and Narasimha (1986) that involved post-hoc interviews with VCs suggest that venture capital firms considered a company's *market potential*, *management quality*, *competition*, and *product viability*, with the greatest emphasis placed on the quality of the management team and the professional attributes of the entrepreneur. In contrast, later studies by Sandberg et al. (1988), Hall and Hofer (1993), and Zacharakis and Meyer (1995), which employed verbal protocol methods (real-time experiments), found that VCs paid more attention and considered more important the proposed company's potential market and the potential and quality of the proposed product, concluding that VCs may not be all that accurate in their own reflections regarding the initial screening process (Zacharakis and Meyer, 1998; Zacharakis, McMullen, & Shepherd, 2007). That being said, from these studies two overriding criteria tend to emerge for initial screening purposes, what Metrick and Yasuda (2011) refer to as *the market test* and *the management test* (see Mason & Stark, 2004).

The market test refers to whether a large market exists for the company's proposed technology or product and whether such a market is accessible to the company. For VCs a large market generally corresponds to a highly profitable investment exit through a large IPO (e.g. Google) (Metrick & Yasuda, 2011). However, large IPOs are generally the exception, in part because potentially large markets are often more collectively apparent, with advantages going toward established market

[19] A business plan includes a detailed overview of the proposed company's capabilities and strategic objectives, current and potential competitors, and the professional background of the entrepreneur(s) and/or proposed management team, as well as financial projections. Metrick and Yasuda (2011, p. 137) noted that "for early stage companies, the projections usually focus on the uses of funds; for later-stage companies, the projections should be more complete financial statements."

[20] Those assigned to do the actual screening vary and may depend on the venture capital firm's size and investment focus. For example, large venture capital firms with broad technology investments and/or those focused on more concrete later stage companies (for which information is more quantitatively verifiable) will likely employ a number of junior associates to do the initial screening, with full partners participating only later in the pitch and due diligence phases. With smaller venture capital firms, many of them focused on less certain early stage companies in a particular sector, the initial screening of business plans often involves the participation of more experienced firm partners (Metrick & Yasuda, 2010).

incumbents who either fill the market gap first or thwart new market entrants from doing so (e.g. Microsoft). As such, most venture capital firms will look for a company's viable market potential; where a company's proposed technology or product is identified as addressing a complementary market need (i.e. opportunities for which the market will be more receptive to a new entrant) (Gladstone & Gladstone, 2004). For venture capital firms, particularly those investing in early stage companies, effectively identifying the market potential of a proposed technology or product is challenging, even for the most experienced VCs, requiring them to hold or have access to considerable industry and market specific knowledge (Mason & Stark, 2004).

The management test determines whether the entrepreneurs and proposed management team are capable of handling the unique demands of an entrepreneurial environment and of carrying the company's strategic vision forward (Gompers & Lerner, 2001). The management test is highly subjective, requiring VCs to merge the qualitative information provided in the business plan with their own insight and intuition. In evaluating the company's leadership, VCs look favourably on a proposal headed by a successful repeat or serial entrepreneur, as well as entrepreneurs that have significant industry experience (e.g. a spin-out) and/or a degree of technical intimacy with their proposed technology or product (i.e. the entrepreneur as technologist or inventor) (see Zacharakis, McMullen, & Shepherd, 2007). In looking at the proposed management team, VCs pay particular attention to the experiences and skill-sets the team offers, looking for dynamic complementarities. In doing this, venture capital firms consult with referral sources (e.g. other VCs) and check references provided by the entrepreneur, possibly through face-to-face meetings with them (Zook, 2005). From this, VCs begin envisioning how the team meets the functional requirements of a working start-up, including R&D, marketing, and finance, and where gaps in expertise will need to be filled (e.g. bringing in an experienced CFO to work with the lead entrepreneur/CEO) (Metrick & Yasuda, 2011).

3.1.2. Due Diligence and Deal Closing

Based on the initial screening of business plans, venture capital firms invite a small number of entrepreneurs to personally present their proposals (i.e. the infamous pitch meeting). This meeting gives VCs added insight into the management capabilities of the team, and the pose, temperament, and communication skills of the lead entrepreneur, which answers some questions as to whether the venture capital firm can work with the entrepreneur and whether the entrepreneur, as CEO, has the personality and gravitas to articulate the company's strategic vision (Camp, 2002). Companies that pass the pitch meeting are then subjected to an intense process of due diligence, a large part of which is focused on further vetting the management team through extensive background checks on professional and even personal history and scrutinising the company's finances and projections. The main emphasis here, however, is on firmly establishing the company's market potential and the quality of the proposed technology or product (Hall & Hofer, 1993; Mason & Stark, 2004).

As shown in Table 2, this requires intensive scrutiny of, among other things, a company's *potential customers* and *competition*, the *quality and technical viability of the proposed product*, and any *strategic partnerships* that the entrepreneur has either identified or already established, all requiring some degree of consultation with experts and trusted network contacts (Metrick & Yasuda, 2011).

It is common during this due diligence phase for the venture capital firm to offer a preliminary term sheet, to be finalised at closing, giving the venture capital firm exclusive negotiating rights with the company. During this phase the venture capital firm also looks particularly hard at how much financing the company will need to progress from initial investment to exit, thus informing the amount of money expected at each investment round, the number of rounds needed, and the length of time between rounds (Gladstone & Gladstone, 2004).

Table 2: Venture Capital Due Diligence: Criteria and Verification

Potential customers: Venture capital firms need to determine who the actual customers are for a proposed technology or product, considering whether the customer base includes a broad range of individual consumers, as for a new mobile phone or related application, or if the customer base is narrower, as for a new drug to combat a rare disease or condition. It is very possible that the target customers will be other companies or organisations (e.g. a marketing analytic tool); if so, how many of these customers are there, and what is the level of their demand or interest? During this process VCs consult a number of industry and corporate contacts, meet with potential customers, and pay particular attention to a company's sales and marketing capabilities, possibly attending sales pitches and focus groups.
Potential competition: Venture capital firms need to determine who the potential competition is for a company's proposed product. Questions are asked regarding the strengths and weaknesses of the competition and whether a company has or can gain a competitive advantage over them. In asking these questions, VCs consult with their industry contacts and partners and other venture capital firms.
Product quality: Venture capital firms need to determine the quality of the proposed product: how well does the product work, from a technical and functional perspective, and how receptive are potential customers to it — does the product meet or exceed customer expectations? In asking these questions, VCs may try out the product or allow preferred industry contacts to do so and provide feedback; may speak with potential customers; and possibly will initiate focus groups.
Technology: Venture capital firms need to determine the technical viability of the proposed product. Questions are asked regarding the quality and function of the technology and the complexity and cost involved in developing the technology. In asking these questions, VCs will likely consult with university scientists and corporate technologists, and heads of R&D, with some venture capital firms having their own scientific advisory boards. VCs also verify whether the technology is patented by the company or needs to be patented, or whether similar patents for similar technology are already held by others, which requires additional due diligence and legal services rendered by patent attorneys.
Strategic partners: Venture capital firms need to verify the strength and quality of a company's partners and/or determine which strategic partners the company needs (e.g. producers, suppliers, R&D partners, primary customers). For venture capital firms the existence and quality of strategic partners is important, because they can validate the potential of a company for investment selection purposes and they play a crucial role in the development of the portfolio company and in the investment exit process. Strategic partners help position a portfolio company within an industry network and provide credibility for attracting additional partners and resources.

Source: Adapted by the author from Metrick and Yasuda (2011)

The overall funding amount will probably be determined by the expected development costs, which will vary depending on the sector and product focus of the company (e.g. developing a new drug will take far longer and cost far more than developing a new Internet search engine). In addition, the venture capital firm will probably decide, based on a company's market potential, on the exit strategy for the investment: a potentially large market requires strategising for an eventual IPO, whereas a more modest market might focus planning on an eventual exit by acquisition or merger, a strategy that might emphasise partnerships with potential acquirers (e.g. a large corporation). The inclusion, if deemed necessary, of external management and/or a CFO may also be agreed to at this stage (Metrick & Yasuda,

2011). If the venture capital firm is satisfied with the company's potential and comfortable with the due diligence results, they negotiate and sign off on the final terms of the deal. These terms will include, among other things, agreements on the pre- and post-investment valuation of the company, the size of the investment and the investment payment structure, and details concerning the shares held by the venture capital firm. Other investors may also be chosen, along with terms for employee stock options. Also, terms for governing decision-making protocols, financial reporting, actions of the board, and potential liquidation will be agreed on, with the emphasis on investor rights and liability protections. These terms almost always favour the venture capital firm as investor; such terms are viewed by managers and majority shareholders as necessary for effectively managing asymmetric information and potential agency costs (Metrick & Yasuda, 2011).

3.1.3. Investment Selection and the Role of Geographic Proximity

Because investment selection decisions are based on highly tacit and asymmetric information, close geographic proximity plays an important and varied role, as both a facilitating and determining mechanism, in the selection process (Mason, 2007). First, venture capital firms are more likely to screen and select companies that are referrals from other venture capital firms, angel investors, or other trusted sources within their *local* investment network; these are sources that the venture capital firm knows well, both professionally (e.g. co-investing on particular deals) and personally through business and social networks (Zook, 2004, 2005). Therefore, these direct referrals will generally be local entrepreneurs and their companies (Zook, 2005). Even when not based on direct referral, the tendency for entrepreneurial activity (including venture capital) to concentrate geographically drives a predominantly local deal flow: entrepreneurs approach venture capital firms that have solid reputations within the entrepreneur's local network. Such a reputation is built through a venture capital firm's success and the experiences of its investee companies, the latter made known through local business and social network interactions between entrepreneurs (Powell et al., 2002; Zook, 2005).

From a due diligence perspective, evaluating local entrepreneurs and their companies allows venture capital firms to meet *regularly* with them if necessary,

observing their personal strengths and weaknesses “in person” (i.e. the management test), and to begin developing relationships with them (i.e. building trust, expectations, and norms of interaction). If a company is selected, these prior associations can facilitate a smooth and amicable negotiation of deal terms, fostering a degree of trust between investor and investee that can then carry over through the life of the investment relationship and lessen potential problems associated with asymmetric information and instances of expropriation (see Gompers & Lerner, 2004; Zook, 2004). Close geographic proximity also allows venture capital firms to meet regularly, face-to-face, with trusted sources of knowledge and expertise for purposes of verifying references and information given to them by potential portfolio companies and to better assess product quality and market potential (i.e. the market test) (see Harrison, Mason & Cooper, 2004). What is sought through these consultations is a mix of intuitive and informed opinion —or reactions, really — that are difficult to express by phone or in e-mail (Camp, 2002). These sources are typically other venture capital firms but also include various industry and corporate contacts, scientific advisors, and potential customers (e.g. large corporations), some of whom may be eventual partners or enabling infrastructure for a portfolio company (Zook, 2004, 2005).

3.2. Post-selection Investment Monitoring and Value Adding

Following the selection of a portfolio company and coming to terms with it, a venture capital firm then turns to the challenging process of investing in that portfolio company over a period of 5 to 10 years (Metrick & Yasuda, 2011). Like the investment selection process, the post-selection process requires the venture capital firms to manage tremendous uncertainty as well as highly tacit and asymmetric information, requiring venture capital firms to engage in continual, time intensive monitoring and evaluation of portfolio companies as they progress from initial investment through to investment exit (see Figure 18). This monitoring has three related functions. First, it allows venture capital firms to periodically assess portfolio company performance and to promptly sell or liquidate underperforming companies. Second, monitoring is crucial for limiting agency costs, that is, situations in which the portfolio firm engages in actions that run counter to the interests of the venture capital firm and its investors. Third, regular

and substantive monitoring is necessary for determining the different funding and capacity needs of a portfolio company at different stages of the investment process (Gompers & Lerner, 2004).

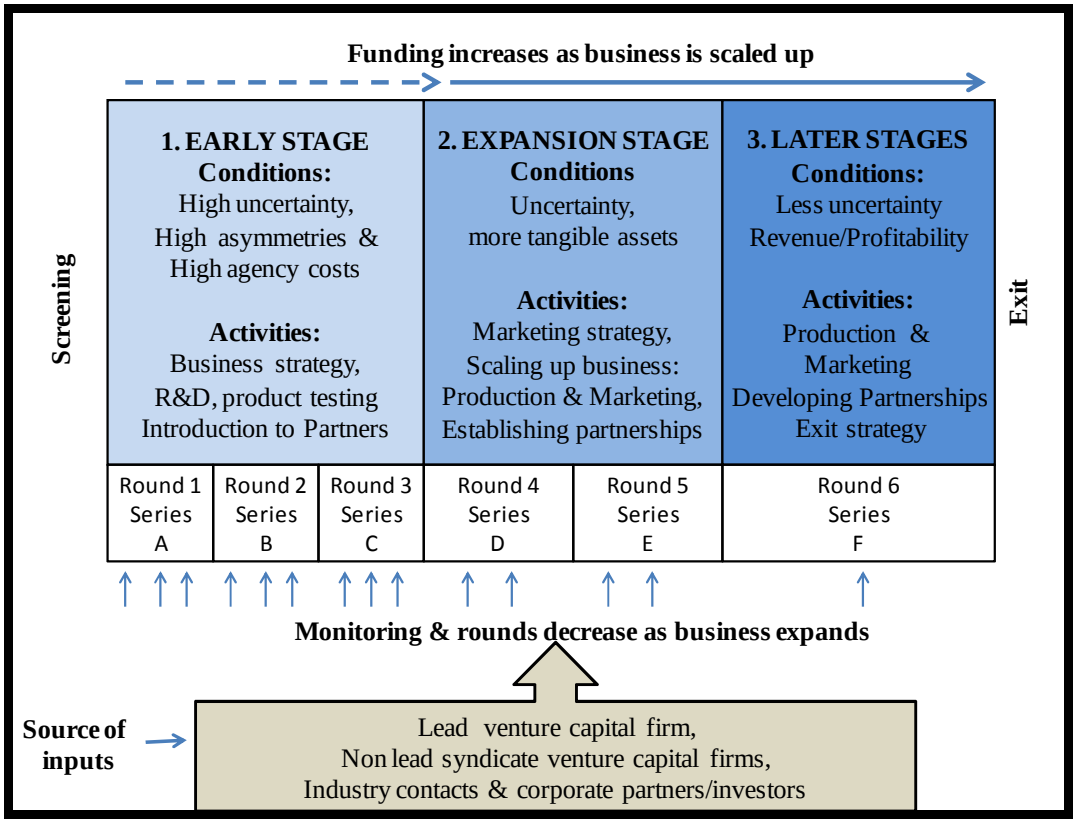
Studies by Zook (e.g. 2004, 2002) suggest that venture capital firms provide three types of value beyond finance to their portfolio companies. First, venture capital firms provide advice and guidance on how to grow the portfolio company's business and commercial capacities. The majority of this advice concerns business strategy and marketing, but may it also involve knowledge inputs regarding research and development and production. The specialisation and complexity of the inputs provided depend largely on the stage and sector focus of the investment, with early stage and R&D intensive companies requiring more specialised inputs. Venture capital firms provide this input directly or derive it from external sources (e.g. other venture capital firms, industry and corporate contacts). Second, "venture capitalists also serve companies by setting specific goals and metrics for companies to meet and holding managers accountable for these goals" (Zook, 2004, p. 636). Such directives are meant to develop the portfolio firm according to the expected investment timeframe and lessen potential agency costs.

Finally, venture capital firms facilitate the development of their portfolio companies by introducing them to additional sources of finance and enabling infrastructure, helping them establish relationships with key industry players such as suppliers and distributors, "as well as a host of service providers such as executive recruiters and lawyers" (Zook, 2004, p. 367). Of possibly more importance, however, are a venture capital firm's connections to potential customers and strategic partners, some of whom may be large corporations who can offer portfolio companies a range of potential partnerships involving R&D, production, and marketing (see Auerswald & Branscomb, 2003).

For effective monitoring that contributes to the development of portfolio companies (providing value added), however, venture capital firms apply an investment structure characterised by (1) multiple funding stages or rounds, (2) active participation on the boards of their portfolio companies, and (3) investment syndication with other venture capital firms. Like the investment screening

process, geographic proximity also plays a key facilitating role in this post-selection monitoring process, including activities geared toward the capacity building of portfolio companies (Gompers & Lerner, 2004).

Figure 18: The Post-selection Investment Monitoring Process



Source: Own interpretation based on Gompers and Lerner (2004)

3.2.1. Managing Agency Costs through Staged Investments

Venture capital firms frequently re-evaluate the progress of their portfolio companies and make subsequent investment adjustments by splitting the investment funds into stages or rounds rather than investing all of the funds up front. Gompers and Lerner (2004, p. 171) argue that "staged capital infusions are the most potent control mechanism a venture capitalist can employ." These periodic capital infusions correspond to what VCs refer to as funding series, for example, Series A, Series B, Series C, and so forth (refer to Figure 18). At the end of each round, the progress of the portfolio company is assessed, informing funding amounts for the next round and decisions regarding business strategy, personnel changes, and perhaps whether to end the investment relationship (Sahlman, 1990). Those investments that lead to an IPO are typically longer than

those that exit by acquisition and thus require more funding rounds. Likewise, portfolio companies that are R&D intensive generally involve more funding rounds than less R&D intensive companies, with less time between rounds, particularly at the early investment stages. The higher the uncertainty, the more monitoring and control the venture capital firm attempts to exert over the company (Gompers, 1995).

Gompers and Lerner (2004) argue that the main reason venture capital firms invest through stages or rounds is that it allows them to lessen the potential *agency costs* associated with investing in NHTCs. Related to asymmetric information, agency costs refer to situations where one party (the principle) cannot ensure that the other party (the agent), holding more information than the principle, will always behave in the principle's best interest (Jenson, 1986). In general, the higher the potential agency costs, the greater the number of stages employed and the more frequent and substantive the monitoring. Gompers and Lerner cite two types of agency costs prevalent in NHTCs. The first of these situations is when NHTCs pursue business strategies or invest in certain R&D projects that "have high personal returns [for the entrepreneur] but low expected monetary payoffs to shareholders" (Gompers & Lerner, 2004, p. 174). For example, a scientist-turned-company founder might invest more into "personally satisfying" basic research projects, while failing to bring such research to the development phase. Another common type of agency cost occurs when the NHTC holds potentially detrimental information knowingly, but chooses not to share it with investors or make the necessary adjustments the information warrants. For example, company founders might knowingly ignore "initial results from market trials indicating little demand for a new product," choosing instead "to keep the company going because they receive significant private benefits from managing their own firm" (Gompers & Lerner, 2004, p. 174).

Studies by Titman and Wessels (1988), Schleifer and Vishny (1992), and Rajan and Zingales (1995) suggest that for investments in which companies hold primarily intangible assets, agency costs are high. According to these arguments, the greater the intangible assets of a company, the more difficult and costly it is for investors to liquidate the company if it fails. Given these potential costs, therefore, companies whose assets are predominantly intangible require more frequent

monitoring from investors. In other words, the more intangible a company's assets, the less leverage investors have in curtailing and shaping that company's behaviour. Schleifer and Vishny (1992) also suggest that companies in sectors with high R&D intensity generally have very sector specific assets, also making liquidation costly and difficult for investors (i.e. specialised assets have a much narrower potential market). From a venture capital investment perspective, therefore, investing in early stage R&D intensive companies with predominantly intangible and sector specific assets has potentially high agency costs and requires frequent and substantive monitoring from investors (Gompers & Lerner, 2004).

3.2.2. Active Monitoring Through Company Board Participation

Closely related to the staged investment structure and key to the monitoring process, venture capital firms almost always have a seat on the board of directors of their portfolio companies (Gompers & Lerner, 2004). Having a position on the board of directors allows venture capital firms to directly shape a portfolio company's business and marketing strategy and to enforce performance benchmarks from one investment round to the next (Rosenstein et al., 1993). For a venture capital-backed portfolio company, the board of directors generally is comprised of "inside" representatives from the portfolio company itself, usually the lead entrepreneur(s) and/or company CEO and representatives from the lead venture capital investor and its syndicate partners. Also on the board are "outside" members such as academic scientists, investment bankers, former CEOs, and representatives from corporations or corporate VCs who are investing in or funding a research project in the company (Fried, Bruton, & Hisrich, 1998). As a primary mechanism for reducing agency costs, a venture capital firm tries to negotiate as many seats as possible for itself and outside members, stressing the need for experience on the board, particularly at the early investment stages (Lerner, 1995; Metrick & Yasuda, 2010).

Studies that look specifically at the board activities of venture capital-backed companies are few (e.g. Filatochev & Bishop, 2002; Lerner, 1995; Rosenstein et al., 1993), with Busenitz (2007) suggesting that the private, behind-closed-doors nature of boards makes them particularly difficult to capture empirically. What is

clear is that the makeup of the board changes, not only from stage to stage, but particularly from relative periods of stability and growth to "expected" times of uncertainty. For example, a study by Lerner (1995) involving venture capital-backed biotech companies suggests that a lead venture capital firm's representation on a board and that of outsiders will increase when there is a change in a portfolio company's leadership (e.g. the removal of an entrepreneur-turned-CEO), with Busenitz (2007) commenting that "the number of outsiders on the board … serve as signals of power to correct moral hazard and adverse selection issues in a venture should they arise" (p. 221). This study by Lerner also shows that the number of board members increases from early investment stages to later stages, and that the two most prominent types of outside board members are academic scientists and what are described as "corporate partners" (e.g. corporate VCs).

The inclusion of outside members on the board of directors of portfolio companies, members whom the lead venture capital firm plays a lead role in appointing to the board, is a clear example of venture capital firms using their connections to industry partners and other sources of external knowledge and expertise to not only effectively evaluate the progress of their portfolio companies, but also to support their subsequent development from early investment stages to expansion stages through to investment exit (Bottazzi, Da Rin, & Hellmann, 2008). As mentioned previously, NHTCs require more than just funding to bring their innovations successfully to market. Different stages require different amounts of funding coupled with different types of knowledge and resource inputs. For example, early investment stages, although requiring less overall funding than later stages, need specialised knowledge and expertise, possibly scientific and technical, for carrying out basic research and product testing, whereas expansion and other later investment stages require sizable investment amounts (scaling up the business and production) as well as knowledge in areas of development, production, and marketing (Metrick & Yasuda, 2011).

Staging investments and shaping company boards of directors with experienced and diverse members, therefore, facilitates the infusion of finance and different types of knowledge that are appropriate to the different needs of the portfolio company as it grows. As such, the varying knowledge and resource capacities

necessary to support a portfolio company's development are rarely held by a single VC or venture capital firm alone (Wright & Lockett, 2003).

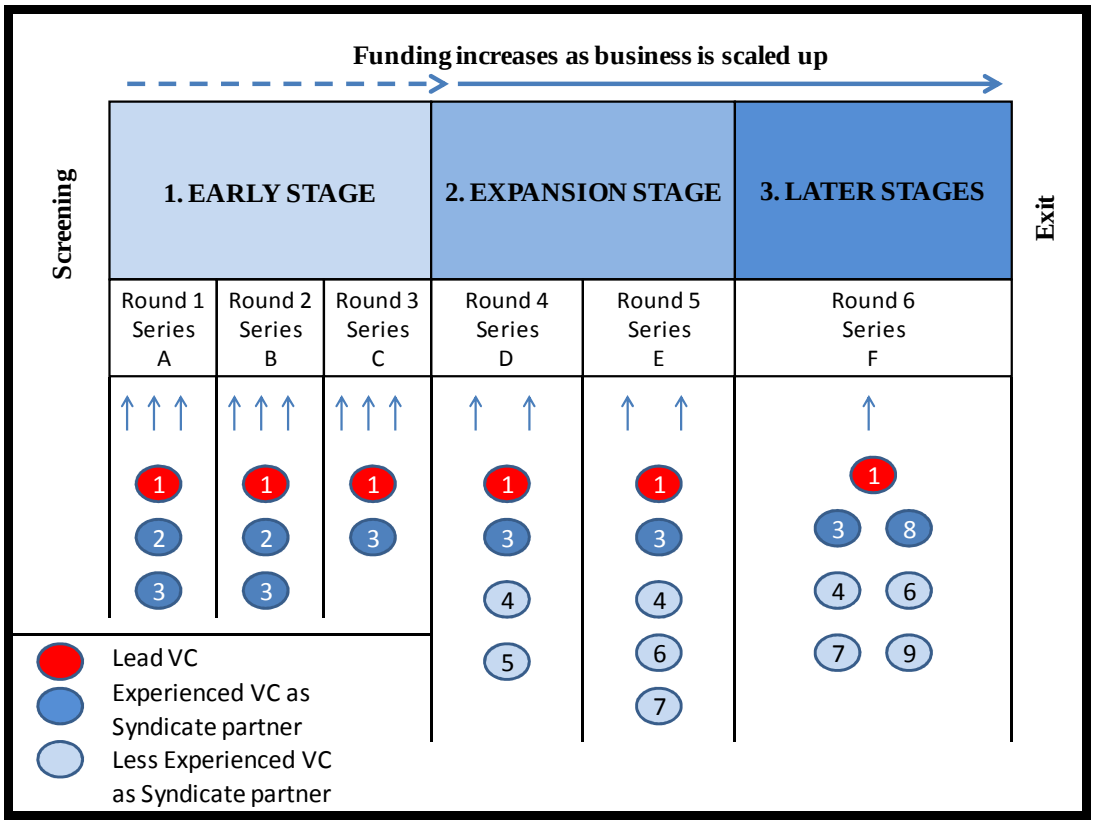
3.2.3. Adding Value through Investment Syndication

In this context, it is the common practice of venture capital firms to syndicate or co-invest with other venture capital firms (Sorenson & Stuart, 2001). A venture capital syndication deal includes a lead venture capital firm and generally several participating venture capital firms. The lead firm takes responsibility for selecting the portfolio company (with input from syndicate partners), negotiating the terms of the deal, and carrying out the majority of the investment monitoring, and almost always has the largest equity stake (Gompers & Lerner, 2004). In contrast, non-lead syndicate partners have smaller equity stakes in the portfolio company and vary in the degree to which they are actively involved in the monitoring process (Wright & Lockett, 2003). As shown in Figure 19, venture capital syndications are not static: although the lead venture capital firm generally continues to lead the investment through to exit (if successful), syndicate partners may enter into the investment at different stages and perhaps leave the syndication after only one or several investment rounds (Brander, Amit, & Antweiler, 2002).

Studies indicate that for early stage investment, experienced venture capital firms tend to syndicate with other experienced venture capital firms, generally opening the syndicate to venture capital firms that are less experienced at the expansion stage and later stages (Lerner, 1994). Also, the total number of syndicate partners tends to increase through subsequent stages and rounds. These trends may indicate a preference for experienced syndicate partners to help manage the high uncertainty and asymmetric information associated with early stage investing, and the need for specialised knowledge (e.g. science and technology) (Gompers & Lerner, 2004). A greater number of syndicate partners, some of those being less experienced, is probably advantageous at the expansion and later stages when uncertainty is less pronounced, assets become more tangible, and the emphasis is on scaling up commercial capacities, in part through larger capital infusions (Gompers & Lerner, 2004).

Studies have suggested and examined a number of interrelated motivations as to why venture capital firms enter into syndication with other venture capital firms (e.g. Lockett & Wright, 2001). These range from spreading risk and increasing deal flow to improving the investment selection process and the value adding activities associated with the monitoring and developing of portfolio companies (Manigart et al., 2006).

Figure 19: Venture Capital Syndication with Investment Stages and Rounds



Source: Own interpretation based on Gompers and Lerner (2004)

First, venture capital firms engage in syndication deals for purely *financial reasons*. In this way, syndication allows venture capital firms to invest in companies for which they are not a lead investor, thus increasing the number of companies they invest in and diversifying their investment portfolio, which decreases their portfolio's overall risk exposure (Cumming, 2006). Also, opening up an investment to syndicate partners allows a lead venture capital firm to spread the risk associated with a particular portfolio company and "provides more capital availability for current and follow-on cash needs" (Gompers & Lerner, 2004, p. 257), particularly important during the expansion and later stages when scaling up

the business requires large sums of capital. It is thought that these finance motives for syndication are particularly important for smaller venture capital firms which, on their own, may lack the capital to expand their investments beyond their limited portfolio. Likewise, Manigart et al. (2006) suggests that diversification through syndication may also hold importance for venture capital firms focused on early stage investments. Syndication is used to invest beyond the small number of highly uncertain yet promising portfolio companies for which they are the lead, and for spreading the considerable risk that their uncertain early stage investments carry among multiple investors.

Second, venture capital firms engage in syndication deals to *improve the quantity and quality of their deal flow* (Sorenson & Stuart, 2001). Through syndication venture capital firms can raise their visibility and reputation within a venture capital network, resulting in a greater number of high quality referrals (deal flow) from trusted syndicate partners. Also, by engaging in syndication, a venture capital firm is more likely to be invited to participate in additional syndicate deals. Not only does this repeat syndication enhance deal flow through reputation effects, but it allows the venture capital firm to participate in an increasing number of deals as a non-lead investor (Lerner, 1994). In this context, Bovaird (1990) suggests that venture capital firms enter into syndicate deals with the expectation that syndicate partners will be reciprocal. For example, early stage focused venture capital firms may invite (as lead investors) partners to syndicate on an early stage investment, with the expectation that they will then be invited by these syndicate partners to syndicate as non-lead investors on later stage investments. In this way, syndication allows the expansion of a venture capital firm's portfolio without assuming the risks and resource costs associated with being a lead investor (Bovaird, 1990).

Third, venture capital firms engage in syndication with other venture capital firms to improve the *investment selection process* (Sorenson & Stuart, 2001). As discussed earlier, when screening companies, venture capital firms often share company information with trusted members of their investment and related industry networks — other venture capital firms being the most prominent — to overcome asymmetric information and accurately verify a company's potential, thus reducing uncertainty (Lerner, 1994; Wright & Lockett, 2003). In doing so,

venture capital firms may approach one another to assess a willingness to co-invest (syndicate) in a particular company; a willingness to do so probably has considerable weight in any decision to select that company for investment (Wright & Lockett, 2003). Selection information sharing and syndication are reinforcing activities: repeat syndication between venture capital firms builds trust between firms (i.e. trust in one another's capabilities, insights, and opinions), which leads to regular information sharing for investment selection purposes (Bygrave 1987, 1988). This includes information regarding referrals from syndicate partners of promising new companies for potential investment.

Finally, venture capital firms syndicate with other venture capital firms to gain access to the specialised expertise and knowledge necessary for reducing investment uncertainty and providing nonfinancial *value added* toward the development of portfolio companies (Bruining & Wright, 2002). As discussed previously, value adding inputs can range from specialised expertise in science and technology, industry and market knowledge, and business development to related access to commercial infrastructure. Different syndicate partners bring different types or degrees of expertise and resources (value added) to an investment. A study by Brander, Amit, and Antweiler (2002) suggests that access to external value adding inputs is a primary driver of syndication for early stage focused venture capital firms; this supports a number of studies proposing that value adding is most important at the very early stages of a portfolio company's development, because this is when technical and market uncertainty are at their highest (e.g. Bygrave & Timmons, 1992; Gorman & Sahlman, 1989; Sapienza, 1992). Manigart et al. (2006) also suggests that smaller, less experienced venture capital firms syndicate with more experienced lead partners in uncertain yet promising companies to partake in and gain access to value adding inputs that alone they could not provide.

A syndication study by Manigart and colleagues (2006) groups motivations for syndication into (1) motivations for improving overall portfolio performance and (2) motivations for improving the performance of individual portfolio companies. In the first category are the *finance motive* and the *deal flow motive*; in the second category are the *selection motive* and the *value-adding motive*. Counter to

assumptions, Manigart's work demonstrated that venture capital firms, particularly in Europe, pursue syndication to enhance overall portfolio performance; improving the performance of individual portfolio companies was a far second. Manigart suggests that venture capital firms engage in syndication with other venture capital firms to realise certain performance benefits, most notably investment diversification and enhanced deal flow, benefits that may or may not be felt by individual portfolio companies.

Such findings might be indicative, at least in Europe, of a venture capital that does not provide substantial value added to portfolio companies (see Baines, 2009). On the other hand, such findings might suggest that venture capital firms derive value adding inputs either through their own capacities (e.g. the expertise and experience of individual VCs) or from other sources such as their connections to industry contacts and partners.

3.2.4. Monitoring and Value Adding: Geographic Proximity

Similar to the investment selection process, geographic proximity is a key facilitating mechanism in both the monitoring of portfolio companies and in supporting their growth from the early investment stages through to expansion and later funding rounds (Mason, 2007). For venture capital firms, active monitoring is absolutely essential to managing asymmetric information and lessening agency costs, particularly at the early investment stages (Mason, 2007). However, active monitoring, similar to investment selection activities, is very time-consuming. Being in close geographic proximity to the portfolio companies they invest in reduces the costs of monitoring by allowing venture capital firms to meet face-to-face with them regularly; this regular contact contributes heavily to the on-going evaluation of portfolio companies, and in determining potential adjustments in strategy and personnel and funding amounts from one investment round to the next (Zook, 2004). Furthermore, the uncertainty associated with NHTCs means that things can and often do change quickly. As such, close geographic proximity allows venture capital firms to move quickly, to personally intervene when a portfolio company is thought to have gone off course, and to assert a sense of company accountability and focus that could not be done from afar (Zook, 2004).

Regarding membership on a portfolio company's board of directors, Gompers and Lerner (2004) argue that board members are likely to reside (have offices) within close geographic proximity to the portfolio companies on whose boards they sit on. Lerner's (1995) study on venture-capital backed biotech companies found that "more than half the firms have a venture director [venture capitalist on the board] with an office within sixty miles of their headquarters" and 25% "have a venture director within seven miles" (Gompers & Lerner, 2004, p. 250); this in an indication that the opportunity for regular, intimate access to a portfolio company is important for board members, particularly during times of change or crisis. Zook (2004, p. 2002) goes further, suggesting that in pushing for board members with appropriate experience and diverse knowledge, venture capital firms recruit members from their own local networks of investment and industry contacts, including other VCs, corporate CEOs, and academic scientists from geographically proximate companies (e.g. large corporations) and universities. These are actors who are not only familiar with the lead venture capital investor, but are also previously or currently engaged with, if not the portfolio firm itself, the local industry network or cluster in which the portfolio firm resides.

The leaning on local actors and capacities for monitoring and value adding purposes is particularly apparent in venture capital syndication practices. Studies by Bygrave (1987) and Sorenson and Stuart (2001, 2008) demonstrate that venture capital firms generally syndicate with geographically proximate venture capital firms, that is, venture capital firms for whom they share the same local network. In other words, venture capital firms co-invest with venture capital firms whose capabilities and personalities they know and trust. As such, repeat syndication between venture capital firms is common and is thought to produce locally concentrated venture capital syndication networks that reinforce the local emphasis of venture capital investment, including local deal flow and the selection of local portfolio companies (Sorenson and Stuart, 2008). These local syndicate partners are also likely to sit on the boards of companies they are investing in through syndication, or sit on boards as a reciprocal favour to previous syndicate partners (Gompers & Lerner, 2004).

3.3. Investment Exit

Following what will generally be 5 to 7 years of capital investment and active monitoring (in some sectors such as life science, up to 10 years from selection to exit is not unusual), venture capital firms position a portfolio company for investment exit. Successful exits are necessary for VCs to fully profit from their investments (Gompers & Lerner, 2004). Furthermore, successful exits reinforce and can increase a venture capital firm's visibility and reputation within an investment and industry network, improving the venture capital firm's ability to raise additional funds and attract high quality deal flow and appropriate syndicate and strategic partners (Schwienbacker, 2010). In other words, although the exit phase represents the culmination of the venture capital cycle, it directly affects and facilitates the venture capital cycle's early phases. That being said, not all venture capital investment exits are successful or optimal. According to Cumming and MacIntosh (2003) five primary exit methods are employed by venture capital firms: (1) exit by initial public offering (IPO), (2) exit by acquisition, (3) exit by secondary sale, (4) exit by entrepreneurial buy-back, and (5) exit by write-off (see Table 3).

For venture capital firms, exit by IPO and exit by acquisition are the most optimal forms of exit in terms of potential profits and return on investment, with exits by IPO traditionally the most profitable and preferred. The other forms of investment exit are typically associated with smaller investment returns and/or losses. Furthermore, exits by IPO are also the preferred exit by most portfolio companies/entrepreneurs. Not only do IPOs offer potentially huge profit gain, but they, unlike exits by acquisition, allow the entrepreneur to maintain company control and ownership rights (Cumming & MacIntosh, 2003).

Table 3: Venture Capital Exit Options

Exit by Initial Public Offering (IPO): The first time the portfolio company sells shares to the public via a public stock exchange. The venture capital firm will sell their shares in the portfolio company as well, but generally not for a period of several months to a year following the IPO. Doing so signals confidence in the quality of the portfolio firm.
Exit by Acquisition: The VC firm sells the entire portfolio company, generally to a large established company within the same sector or industry. Acquisitions can often take the form of a merger between the two companies and are often based on prior alliances and contractual agreements between the two companies (e.g. production or licensing agreements).
Exit by Secondary Sale: A venture capital firm will sell its shares (ownership) in a portfolio company to a third party, either a large established company or another venture capital firm -- the portfolio company and other investors hold onto their shares. Secondary sales to another company are often followed by an outright acquisition by that company.
Exit by Entrepreneurial Buy-back: The venture capital firm will sell all of its shares in a portfolio company back to the portfolio company or respective entrepreneurs, ending the contractual investment relationship.
Exit by write-off: The venture capital firm ends its investment involvement in an underperforming or failed portfolio company, with no real profitable return for the venture capital firm. Following a write-off, the former portfolio company generally falls into bankruptcy or dissolves.

Source: Adapted by the Author from Cumming and MacIntosh (2003)

3.3.1. Venture capital exit decision making

Because venture capital firms will play a lead role in the decision to exit, much of the literature on venture capital exits looks at the timing of investment exits, particularly regarding IPOs, and the reasons why venture capital firms exit investments when they do (e.g. Cochrane, 2005; Darby & Zucker, 2002; Lerner, 1994; Neus & Walz, 2005). Such questions are important because while the IPO has traditionally been the preferred form of exit by venture capital firms and entrepreneurs, timing a successful IPO can be challenging, even during relatively stable market conditions. Furthermore, although a bull market can offer VCs abundant opportunities for highly profitable IPOs (e.g. the tech boom of the 1990s), economic downturns can severely diminish IPO markets (e.g. the recession of 2008–2009), making successful IPO exits nearly impossible. A study by Lerner (1994) demonstrated that experienced venture capital firms were able to successfully time IPO exits to coincide with favourable market conditions, and do so more effectively than less experienced venture capital firms. Gompers and

Lerner (2004) also suggests that more seasoned venture capital firms may have better connections to investment banks, allowing them to move more quickly during recognised peak markets.

For younger, less experienced venture capital firms, the decision to exit by IPO may be based less on market timing and more on building their reputations as capable venture capital firms – bringing a portfolio company to exit by IPO increases their network visibility (i.e. grandstanding) which helps them raise additional funds from institutional investors (Gompers and Lerner, 2004; Neus & Walz, 2005). Gompers & Lerner (2004) argue that young venture capital firms are under tremendous pressure to begin attracting institutional investors for future funds, and doing so much earlier than more established venture capital firms. For young venture capital firms, the only way to really do this is by demonstrating their proficiency in executing IPOs, with the amount a young VC raises for a new fund directly related to the number of IPOs it finances (Gompers & Lerner, 2004). As a result, young venture capital firms bring portfolio companies to an IPO exit earlier than more experienced venture capital firms (Neus & Walz, 2005). This grandstanding has costs, however, in that portfolio companies are generally brought to an IPO at lower valuations, costing the venture capital firm and institutional investors larger potential returns. This also has consequences for portfolio companies, as many of them are not yet ready to prosper as publically held companies (i.e. they are rushed to an IPO too early), jeopardising their post-IPO success (Gompers & Lerner, 2004).

While the literature on venture capital exit behaviour tends to focus on exits by IPO, an increasingly more common form of exit, particularly in venture capital markets outside the US are exits by acquisition or merger (Schwienbacher, 2008). Although generally not as lucrative as an IPO, selling a portfolio company to the likes of Microsoft can be significantly profitable, particularly if the potential for acquisition is developed very early in the investment process by adjusting the deal structure to better meet the expectations of an acquisition or merger exit (Gompers & Lerner, 2001; Schwienbacher, 2008). Schwienbacher (2008) suggests that the decision to forego the IPO exit in favour of an exit by acquisition or merger rests largely on how innovative or market disruptive a portfolio company's product is

determined to be. According to this view, the less innovative a product, the lower its potential IPO valuation, and the more likely a VC will position the portfolio company for an exit by acquisition. Schwienbacher argues that this determination can create agency costs in that entrepreneurs, preferring an exit by IPO, may attempt to oversell the innovativeness of their products to investors, or engage in more risky and expensive R&D projects in an attempt to make their products more innovative (Schwienbacher, 2008).

Finally, looking at venture capital investment exits more broadly, studies by Cumming (2008) and Cumming and MacIntosh (2001, 2003) propose that a venture capital firm's decision to exit an investment, is based on the current and projected costs associated with monitoring and providing value added to that particular portfolio company, what they describe as *maintenance costs*. According to this view, when the costs of maintenance in a portfolio company exceed or are projected to exceed the benefits of those maintenance efforts, the venture capital firm will move to exit the investment (Cumming & MacIntosh, 2003). In this context, the decision to exit an investment is tightly connected to the ongoing monitoring and evaluation of portfolio companies.

3.3.2. Investment Exit: The Role of Geographic Proximity

Unlike the investment selection and monitoring phases, the role, if any, that geographic proximity plays during the investment exit phase is far less clear and, perhaps for that reason, is unsubstantiated in the literature. As alluded to above, it might be expected that VC firms will meet frequently with portfolio companies in the lead up to and preparation for an investment exit. This preparation may also involve consultation with other local VC firms and industry contacts. What is certain, however, is that in a lead up to an investment exit, VC firms will need to consult and work with a number of financial and legal actors, particularly investment banks, corporate law offices, and perhaps patent attorneys. Given the geographic concentration of finance, including, in most instances, the co-location of venture capital and investment banking (e.g. London), these substantive interactions are bound to be local (Mason, 2007).

3.4. Sector Specificity and Propensities for Collaboration

So far, this chapter has explored and discussed the venture capital investment cycle, from investment selection and post-selection monitoring through to investment exit. More specifically, this discussion has emphasised the importance of both external knowledge and geographic proximity — particularly during the selection and post-selection monitoring phases — for managing potential agency costs and for adding value toward the development of portfolio companies. In doing so, venture capital firms leverage the knowledge and resource capacities of their *local* investment networks. These networks are comprised of other venture capital firms; the local entrepreneurial community; universities; investment banks; and most prominently, *large corporations* with their extensive, often global networks of suppliers, distributors, and customers. Besides being a main source of technical and market knowledge, and a primary source of enabling infrastructure, large corporations are also integral to the investment exit strategies of most venture capital firms and the companies they back (i.e. exit by corporate acquisition or merger).

In this way, relationships between venture capital firms and large corporations *within local investment networks* can be viewed as central to the venture capital investment process and probably play some determining role in each phase of the cycle. That being said, such relationships are likely to be complex and varied, with the specific structures, motivations, and conditions under which these relationships are established and maintained not yet sufficiently demonstrated empirically.

For understanding such relationships, it is important to consider that most early stage focused venture capital firms are sector specific in their investments (Metrick & Yasuda, 2011). This sector specificity allows them to apply specialised industry insight, experience, and connections to effectively meet the capital and resource requirements and overcome the varying barriers to market that different sectors and industries place on NHTCs (Gupta & Sapienza, 1992). It follows, therefore, that these sector differences correspond to different propensities for collaboration between venture capital firms and large corporations, *a main line of reasoning*

being that more specialised input requirements and higher barriers to market correlate with greater propensities for collaboration.

This dissertation considers the collaborative tendencies exhibited by venture capital investment in three prominent high-tech sectors, two of which have received the majority of technology oriented venture capital investment in the United Kingdom over the past two decades. These are the sectors of (1) *information and communication technology* (ICT), and (2) *life science* (including pharmaceuticals and biotechnology), along with a third sector (3) *clean technology* (i.e. clean-tech), which has received increasing amounts of venture capital over the last half decade (BVCA, 2011). What follows is an overview of each of these sectors from an investment perspective, emphasising (a) the expected capital costs and time to market, (b) the expected barriers to market, and (c) the expected life cycle of a particular technology or product. This overview is coupled with a brief discussion on relevant sector trends, particularly as they pertain to the United Kingdom, including respective corporate venturing activities.[21]

3.4.1. The ICT Sector

ICT is broadly defined as technologies and products that facilitate through the increasing integration of communication platforms and devices the access, storage, transmission, and manipulation of information (Brynjolfsson & Saunders, 2010). As a sector, ICT is all encompassing: typically included are all forms of broadcast media (visual and audio), telecommunications (landline and wireless), computer technology (hardware, software, and semiconductors), and Internet related technology and applications (Brynjolfsson & Saunders, 2010). The integration of these various forms of ICT constitutes its more recent definition, with the Internet quickly becoming the dominant transformative platform for ICT integration and the main conduit for the transmission of information and commerce.

[21] Modern high tech industries in the United Kingdom developed through a confluence of innovations in key technology areas (Owen, 1999). An early leader in aerospace and computer technology, the United Kingdom became a significant producer of semiconductors and telecommunications technology (1970s through the 1980s), later transitioning to become a prominent producer of mobile communications, software, and Internet related technology and applications (1990s to the present). Likewise, a historical strength in the chemical and pharmaceutical industries positioned the United Kingdom as a global leader in the burgeoning sectors of life science and biotechnology (1980s to the present) (Owen, 1999).

Unsurprisingly, “every year in the period 1995–2007, between 50 percent and 70 percent of venture capital went into the funding of companies in the IT-production and information industries” (Brynjolfsson & Saunders, 2010).

An incredibly diverse sector, venture capital investments in ICT go to companies engaged in material-intensive semiconductors and hardware and to less tangible and more knowledge-based software and related applications. The majority of global venture capital investment in ICT (in terms of the numbers of companies invested) flows to companies engaged in the latter (Brynjolfsson & Saunders, 2010).

The consistently high levels of venture capital investment in new ICT companies is due, in part, to it being a general purpose technology in that ICT might be used in many different ways, with one technology or product having multiple market opportunities, some of them unanticipated (David & Wright, 2003). This general purpose nature also implies that ICTs are particularly effective when used in combination with other ICTs and products. As Brynjolfsson and Saunders (2010) explain:

> If you combine Google Maps, GPS technology, cell phone technology, and a restaurant review, you get the ability to find the closest Thai restaurant … none of these inputs is necessarily new, but combining them can result in a significant improvement over using them separately. (p. 95)

Although this general-purpose designation provides investors and entrepreneurs with seemingly limitless opportunities, it also carries risks in that ICT and related products can be easily replicated and improved on by others when compared to other technology sectors such as life science. Furthermore, ICT is largely driven by tacit knowledge and the economising of intangible assets. Such intangibles can make ICT difficult to patent and to build a viable business model around, as well as present difficulties to investors in determining its value, both as a product and a business (Dos Santos, Patel, & D’Souza, 2011). Table 4 explains the common input and market requirements facing NHTCs and investors in commercialising a new ICT technology or product.

From an investor and management perspective, such factors can make building a successful business model around ICT difficult. Therefore, realizing returns through an acquisition or merger with a larger or better positioned competitor either during the development stage or soon after product launch may offer a more effective investment exit strategy.

In the United Kingdom much of the ICT focused venture capital investment flows into NHTCs that cluster in around Oxford and Cambridge and more recently within London (e.g. London's Silicon Roundabout) (BVCA, 2010).[22] This geographic concentration of both NHTCs and venture capital investment is probably driven by ICT's highly tacit information flows, requiring regular face-to-face interaction, and the advantages that regions such as London hold for entrepreneurs and investors in this sector and in others. Specifically the concentration of other entrepreneurs and large pools of highly trained and creative workers, the active presence of venture capital, and the countless formal and informal social networking opportunities that connect entrepreneurs to each other, to investors, and to a variety of untraded interdependencies (Simmie, Sennett, & Wood, 2002).

Second, some of the largest ICT companies have more recently established corporate venture capital and corporate venturing programmes, with several prominent companies setting up corporate venturing offices in London. For example, Intel Capital (the corporate venture capital arm of Intel Corporation) has invested nearly $10 billion in start-ups since 1991 and has its European offices in

[22] These clusters have developed over several decades, building on technology clustering activities that first emerged in and around Cambridge in the 1970s and 1980s (referred to as Silicon Fen), the origins of which coincide with the founding of the Cambridge Science Park (CSP) established in 1970 (Hall, Breheny, McQuaid, & Hart, 1987). CSP was formed to develop university–industry partnerships to commercialise science and technology spin-offs coming out of the Cambridge science base (Keeble, Lawson, Moore, & Wilkinson, 1999). Over the past four decades CSP has anchored one of the most innovative centres in Europe, focusing on computer related technology in the 1970s and emerging in the 1980s and 1990s as a centre of excellence in biotechnology, advanced materials, and nanotechnology. In the 1980s the Cambridge area and its clustering of small high tech firms, popularly referred to as the Cambridge Phenomenon (Garnsey & Cannon-Brookes, 1993), became increasingly viewed as a continuation to the East of a long clustering of high tech electronics firms "running from Hertfordshire to the north-west of London, through Berkshire and into Hampshire and Surrey" from the West, which Peter Hall and colleagues (1987, p. 5) called the "Western Crescent" (Hall, Breheny, McQuaid, & Hart, 1987). This was followed by a resurgence in the 1990s and more recently of high tech firms in and around Oxford (e.g. Oxford Science Park), particularly Internet and biotech companies (Lawton Smith, 2004).

London (Intel Capital, 2011). Another prominent corporate venture capital player is Qualcomm, whose Qualcomm Ventures has invested nearly $850 million in telecom and Internet start-ups since 2000, and whose European office is located in London (Qualcomm Ventures, 2011). Likewise, Motorola has engaged in corporate venture capital since 1999 through Motorola Ventures, whose European office is headquartered in Basingstoke outside London (Motorola Ventures, 2011). Although it has no official corporate venture capital programme, Microsoft has long engaged in corporate venturing as a means to scout and acquire promising new firms. More recently, Microsoft UK has based its Emerging Business division office in London, where it coordinates a programme called BizSpark, which identifies and supports U.K. based software start-ups (Global Corporate Venturing Report, 2010; Microsoft BizSpark, 2011).

Table 4: ICT: Input Requirements and Market Factors

Capital costs and time to market: Bringing an ICT product from concept to market takes between £20 and £60 million, with an investment timeframe of between 5 and 8 years. Although developing ICT technology and products involves considerable knowledge and technical know-how, it generally does not require narrow specialised expertise, nor does it require significant facilities on the scale of research laboratories, which require considerable capital cost to build and maintain. Rather, it normally employs a small number of technicians or code writers using a typical office with adequate server capacity and computer technology. ICT's general-purpose nature often allows developers to more cost-effectively recombine already proven technologies and products and make incremental improvements to existing technology involving relatively short development timeframes.
Barriers to market: Barriers to introducing a new ICT product are relatively low. Again, the general-purpose nature of much ICT provides a single ICT with multiple potential markets. Some of these markets may well be unanticipated during the development phase, allowing for a degree of development flexibility unmatched in other high-tech sectors. This general purpose status also grants ICT developers comparably more opportunities for partnerships and mergers, many outside the defined boundaries of the ICT sector. Additionally, market entry is not conditioned on narrow supplier and distribution chains but is generally available through the highly open and accessible Internet. Also, because much of what drives ICT is grounded in *intangibles*, patent constraints are relatively weak, providing opportunities for new market entrants.
Product life cycle: The general-purpose nature and high intangibles driving ICT, coupled with relatively weak patent constraints, can make the product life cycle of most ICT technologies and products relatively short. It follows that ICT products, compared to technologies and products in other high tech sectors, can be more easily replicated (copied) and improved on by competitors, resulting in shorter product life cycles.

Source: Brynjolfsson & Saunders, (2010) & Dos Santos, Patel, & D'Souza (2011).

By locating their corporate venturing divisions in the LMR, these large corporations, many of them MNEs, are probably scanning for new ideas emerging from these London based clusters, and participating through investments,

acquisitions, and partnerships in the profit opportunities these clusters generate. In pursuing these opportunities, these large corporations are almost sure to interact and build relationships with the local venture capital community (see Dushnitsky, 2006).

3.4.2. The Life Science Sector

In some respects, the life science sector is not nearly as diffuse as the ICT sector, but it still encompasses a highly diverse set of closely connected industries, most notably the pharmaceutical and biotech industries. The life science sector, although difficult to define "reflects a wide range of activity including the discovery, research, development and manufacture of therapeutics; diagnostics; medical devices and platform technologies as well as the specialist suppliers of products and services necessary for these organisations to function" (Scottish Government, 2009, p.4). The pharmaceutical industry, a leading life science player, is primarily concerned with the development and sale of life-science derived medicinal drugs for the treatment, prevention, and cure of infection, disease, and other degenerative conditions, as well as a plethora of psycho-physiological disorders (Baines, 2008, 2004). Closely connected to the pharmaceutical industry, the biotechnology industry "takes novel life science discoveries or technologies and turns them into products" (Baines, 2008, p. 5) is synonymous with advances in genetic engineering, and has applications that range "from pharmaceuticals and diagnostics, through speciality chemicals, food and agriculture, to the environment" (Lawton Smith, 2004, p. 2).

The life-science sector is differentiated from most other sectors in that it is (a) heavily science-based, making it very much dependent on basic research; and (b) its products are sold primarily for human medicinal/therapeutic and diagnostic purposes (Robbins Ruth, 2001). Therefore, products must meet safety and regulatory requirements often well beyond that of other sectors, and product development almost always involves substantial and costly human testing (Baines, 2008; Friedman, 2004). As a result, (c) the life science sector relies heavily on both collaborative university–industry links and inter-firm relationships between

large pharmaceutical companies and smaller biotech firms (see Owen, 1999, and Chapter 2). [23]

As previously noted, U.K. companies engaged in life science and biotech consistently receive a sizable amount of the technology oriented venture capital in the United Kingdom, second only to investment in ICT, and are the recipients of much of the early-stage venture capital invested by U.K. based venture capital firms. As shown in Table 5, for investing in life science focused NHTCs venture capital firms must consider specific input requirements and market factors.

In sum, the high degree of specialised scientific expertise and resource capacities necessary for the development of life science and biotech products and the correspondingly narrow path to market, determined by an increasingly small number of large pharmaceutical elites, define much of the industry's capital and market requirements. In this context, two trends in the life science sector are pertinent.

First, the mid- to late 1990s saw considerable consolidation and merger activity occurring among global pharmaceutical companies, including those based in the United Kingdom. For example, in 1995 U.K. based Glaxo and Wellcome merged to form GlaxoWellcome, then merged again with U.K. based SmithKline Beecham in 2000 to form GlaxoSmithKline (GSK, 2011). In 1999, U.K.-based Zeneca and Swiss-based Astra merged to form AstraZeneca (Owen, 1999). One potential consequence of this merger activity is that it may limit the number of partnering opportunities for smaller biotech firms looking for collaborative synergies with large pharmaceutical companies and at the same time decrease competition (among pharmaceutical companies) for technologies and products coming out of

[23] Although the biotech revolution first emerged in the United States, a U.K. biotech industry also arose in the early 1980s, with clusters of Cambridge based biotech firms soon positioning Cambridge as the leading centre of biotechnology in Europe — part of what came to be known as the "Cambridge phenomenon" — with the likes of Cambridge Life Sciences, established in 1981, leading the way and becoming a leader in autoimmune and clinical chemistry diagnostics (Cambridge Life Sciences, 2011; Owen, 1999). U.K. venture capital, including public venture capital, played an important role. Prominent among these early venture backed U.K. biotech firms was Celltech. Headquartered in Slough, Celltech was founded in 1980 with considerable venture capital backing from Biotech Investment Limited and the National Enterprise Board. Through a number of key acquisitions, Celltech, became a leading producer of therapeutic drugs to treat leukaemia, ADHD, and narcolepsy, among others (Bloomberg, 2011). Following this success Celltech was acquired by Belgian pharmaceutical company UCB in 2004 (Timmons, 2004).

the smaller biotech firms. In other words, the pathways to market for biotech firms may become increasingly limited and more closely controlled.[24]

Table 5: Life Science: Input Requirements and Market Factors

Capital costs and time to market: Capital costs for investing in and developing life science and biotech products are high, generally costing a total $350 million to develop and bring to market. Developing a new life science or biotech product takes laboratories with advanced instrumentation as well as PhD scientists trained in highly specialised fields such genetic engineering, advanced materials, and nanotechnology. Building and maintaining such facilities and employing such talent involve considerable capital costs. Likewise, development timeframes are long, ranging between 10 and 12 years for bringing an initial product concept to commercial market. Such development timeframes can be attributed to the overall complexity associated with the integration of science and technology for medical oriented products and, most significant, the related lag-time necessary to conduct the long and costly clinical trials. Additionally, the development and commercialisation process involves a lengthy and costly patent application process and later litigation period, employing a specialised and expensive patent team.
Barriers to market: Also known as introducing a new life science or biotech product, the barriers to market are comparably high. Life science and biotech products are developed because of a potentially large market (e.g. for anticancer drugs), but these markets require highly targeted and specialised products. Furthermore, for smaller companies bringing a new life science or biotech product to market requires some form of partnering with a large pharmaceutical company, whose backing and role as a large-scale drug manufacturer, marketing engine, and primary node in the Big Pharma supply and distribution chains are essential for successfully entering a market. Also, high patent constraints and inevitable litigation (everything is patented and everything is contested) add additional and often costly barriers to market.
Product life cycle: If developed and successfully introduced, a new life science or biotech product can have a comparably long product life cycle of a decade or more. The high capital and resource costs and barriers to market also make life science and biotech products difficult to replicate, improve on, and be sold by others. In many ways, the long development timeframes for most life science and biotech products reinforce long product life cycles, because it can take up to a decade for another company, which also must perform lengthy clinical trials, to develop a similar and improved product.

Source: Baines (2008) & Friedman (2004)

Second, although the corporate venture capital activities of Johnson and Johnson (The Johnson and Johnson Development Corporation) and DuPont (DuPont Ventures) have been active in some form since the 1970s, more recent corporate

[24] Greater consolidation in the pharmaceutical industry has coincided with the continued expansion of more specialised pharmaceutical R&D activities. What could be called more broadly corporate venturing activities, many of these facilities are located in a small number of globally diffuse university research hubs. For example, GSK has R&D facilities in Boston, MA; Research Triangle Park, NC; Les Ulis, France; Tres Cantos, Spain; and Shanghai, China — all life science hubs (GSK, 2011). GSK's traditional R&D base continues to be the South-East United Kingdom, between London and Cambridge in Ware, Harlow, and Stevenage, respectively (GSK, 2011). In Stevenage GSK recently opened its Bioscience Catalyst research campus, which has been set up as an "independent" research science campus for early stage biotech firms (GSK, 2011). Another example is Pfizer, which has several specialised R&D centres located in La Jolla and San Francisco, CA; Cambridge MA; and Pfizer's Neusentis, a recently established R&D facility in Cambridge, U.K., which seeks to discover and develop new antipain and regeneration medicine (Pfizer, 2011).

venture capital programmes and divisions have been formed and continue to operate at other leading pharmaceutical companies (Dushnitsky, 2006), several of these having lead offices in the London metropolitan region. For example, GSK operates the corporate venture capital fund SR One, which has invested nearly $600 million in biotech related companies since 1985, with heads of their European investment fund working out of offices in London (SR One, 2011). Others include Novartis Venture Funds (formed in 1997 with offices in Basel and Cambridge, UK), Pfizer Venture Investments (formed in 2004), and AstraZeneca's MedImmune Ventures (formed in 2002 with U.K. headquarters in Cambridge, UK), among others (Novartis, 2011; Pfizer, 2011; MedImmune, 2011).

As in other high-tech sectors, increasing corporate venture capital activities by leading life-science companies is generally aimed at overcoming internal R&D constraints, particularly growing capital costs and organisational inertia, by identifying and then investing in external ideas and technologies that are generally seen as complementary to their existing product lines, often leading to a the acquisition of or merger with a respective NHTC (see Chapter 1). Such activity might be seen as resulting in a strengthening of the already robust inter-firm relationships that exist in the life science sector, but they could also be viewed as possibly diminishing propensities for partnerships through increasing emphasis on acquisition and merger.

3.4.3. The Clean-tech Sector

According to Pernick and Wilder (2008, p. 2) *clean-tech* "refers to any product, service or process that delivers value using limited or zero non-renewable resources and/or creates significantly less waste than conventional offerings." This sector is generally divided between large-scale clean energy production in the form of solar, wind power, and bio-fuels, and technologies and processes geared toward greater efficiencies in energy consumption, such as smart grids, hybrid or clean transportation, "green" building materials, and more efficient manufacturing techniques. The sector also includes "such emerging technologies as tidal power, silicon based fuel cells, distributed-hydrogen generation, and nanotechnology-based materials" (Pernick & Wilder, 2008, p. 3).

Compared to the ICT and life science sectors, the clean technology sector is relatively new. Its origins can be found in the 1970s, when oil price shocks led to the development of the first commercial solar photovoltaic panels and the subsequent development of wind power generators in the 1980s (Pernick & Wilder, 2008). However, the clean-tech sector did not become a recipient of substantial venture capital investment until the late 1990s following a decade of government support and technology maturation.[25] Over the past decade venture capital investment in clean-tech companies has steadily increased, with the market for clean-tech expanding rapidly as the relative costs of producing and using the technology have declined coupled with increased government support for greenhouse gas abatement (see Mitchell & Connor, 2004; UK DOE, 2010). Importantly, the relative newness of the clean-tech sector renders the sector and market difficult to define. Although the industry appears to be characterised by a mix of large energy production companies (e.g. Siemens, GE, and Chevron) and small and to medium-sized firms, it is still rapidly evolving, probably offering opportunities for established players and new market entrants alike (Pernick & Wilder, 2008).

Although the clean tech sector remains somewhat difficult to define due to its relative newness and apparent mix of large established players and venture capital backed companies, assumptions can be suggested regarding probable input requirements and market factors (see Table 6).

Like the clean-tech market itself, identifying and then characterising the corporate venturing and venture capital involvement in the clean-tech sector is somewhat more difficult when compared to the ICT and life science sectors. However, indications are that large corporations, particularly those in the energy production

[25] Coinciding with the European Union's Renewable directives in 2001, the United Kingdom pushed forward, in 2002, a revamped Renewable Obligations policy (RO) which aimed at producing 10% of the United Kingdom's energy from renewable sources by 2010 and obligated electricity producers to provide a significant share of their output from renewable sources (Mitchell & Connor, 2004). Most notable is the inclusion of a trading scheme by which obligation certificates are given to qualified renewable providers that they can then sell directly to electricity providers and traders, thus facilitating the use of renewables. Probably more important, however, this past decade has also seen the U.K. government substantially increase its funding of renewable energy. This includes significant direct financial investment in wind power and biofuels most prominently, with reinvigorated efforts for offshore wind power and wave power (UK DOE, 2010; Mitchell & Connor, 2004).

industry, are engaging in corporate venturing and corporate venture capital that is focused on clean-tech and renewable energy more generally. For example, Siemens, a global leader in turbine technology has a corporate venture capital division that has invested in 160 companies to date, engaged in wind, solar, and hydro power (Siemens, 2011). General Electric operates a corporate venture capital division called GE Energy Financial Services that invests in established firms engaged in renewable energy (GE, 2011), whereas Chevron operates Chevron Technology Ventures, which invests in early stage companies with a focus on bio-fuels and other renewable sources that align with their corporate strategic interests (Chevron, 2011). Implications of this corporate venturing activity on the clean-tech sector and whether such activity will be increasingly prominent, are, like the clean-tech sector as whole, difficult to predict.

Table 6: Clean Technology: Input Requirements and Market Factors

Capital costs and time to market: Developing and introducing new clean-tech products will, in some areas of energy production, take considerable capital and resource inputs (some specialised technology and expertise, along with considerable manufacturing capacities). In other instances, such as energy efficiency and power conversion technologies, capital and resource costs may be moderate to low, with many clean-tech products integrating or recombining existing technologies with a focus on incremental improvements (e.g. improved solar photovoltaic cells and enhanced building materials). The prevalence of such incremental improvements coupled with a more open and forgiving market may result in comparably shorter development timeframes.
Barriers to market: The potential barriers to market are not exceedingly high because the market itself is not yet well-defined or controlled by a small number of companies (although several large companies currently dominate clean-energy production in solar, wind, and bio-fuels). The current expansion of this market is also aided by government support regarding climate change and the need for greenhouse gas abatement, which should create market opportunities for new entrants.
Product life cycle: The life cycle for certain clean-tech products and processes will probably vary from long product life cycles in areas of energy production such as wind power where infrastructure costs are high, whereas in other areas such as energy efficiency (e.g. improved solar photovoltaics and bio-fuels), product life cycles might be shorter, perhaps ranging from 5 to 7 years.

Source: Pernick & Wilder (2008)

3.5. Hypotheses and Conclusions

This study takes the view that propensities for collaboration between venture capital firms and large corporations are premised, in part, on the differing input requirements of portfolio companies, differences that are likely to be sector specific. First, as discussed in Chapters 1 and 2, theoretical constructs regarding the innovation process place the highest input requirements of science and

technology at the early stage of research and product development (Hirsh, 1965; Markusen, 1985; Perez & Soete, 1988). These inputs are likely to be highly specialised and are often the result of cumulative knowledge and experience, of which no one company, particularly NHTCs, will generally hold alone. It is at the early stage of the innovation process, therefore, when the importance of access to external inputs is thought to be most important, particularly for NHTCs (Perez & Soete, 1988). Again, such inputs vary among high tech sectors and industries. This variance corresponds to different sector specific finance requirements and development timeframes, as well as different barriers to market and related product life cycles, all of which inform investment decisions and behaviour, including propensities for collaboration with external partners.

From an investment perspective, it follows that technology sectors that require more specialised resource inputs (science and technology) generally have longer development timeframes and overall higher capital costs, resulting in higher propensities for collaboration with external partners during the research and development stages (e.g. life science) than sectors with more general purpose and less capital intensive technology and products (e.g. ICT). It is also expected that technology sectors that require more specialised resource inputs have relatively high barriers to market (e.g. life science) resulting in greater propensities for collaboration between new market entrants and market incumbents. Finally, technology sectors that require more specialised resource inputs tend to exhibit relatively longer product life cycles, because related technologies and products are not easily replicated by competitors. Acting as a barrier to market, longer product life cycles may result in greater propensities for collaboration between new market entrants and market incumbents. That being said, increasingly shorter product life cycles in all three sectors may also lead to more collaboration between the two, aimed at facilitating the corporate acquisition and merger of NHTCs by large corporations.

In this context, it is expected that venture capital firms will rely heavily on their relationships to industry as sources of knowledge and resource inputs for the selection, monitoring, and exit of the NHTCs they invest in. Such relationships are likely to range from less formal business and social network ties to more formal

strategic partnerships and co-investing arrangements. From these constructs, therefore, this study proposes that

> *(H1) the greater the science and technology inputs required by portfolio companies, the more important and formal collaboration between venture capital firms and large corporations becomes.*

For venture capital firms and the NHTCs they invest in, the benefits of this collaboration are likely numerous, ranging from enhanced financial performance and deal flow to more effective investment selection, monitoring, and exit (see Manigart et al., 2006). However, it is expected that the overarching motivation for this collaboration is to access the non-financial value-adding capacities of large corporations for better developing and positioning venture capital backed NHTCs. It follows that higher input requirements will correspond to more substantive value adding activities, with venture capital firms more readily connecting portfolio companies to critical external sources of specialised knowledge, resources, and commercial capacity, particularly as it relates to inputs of science and technology. In this way,

> *(H2) the greater the science and technology inputs required by portfolio companies, the more important collaboration between venture capital firms and large corporations becomes for value adding purposes.*

Although the benefits of this collaboration are probably felt at all phases of the venture capital cycle, particularly the selection, monitoring, and exit phases, the valued added obtained through this collaboration is more likely to be realised and therefore directed toward the post-selection monitoring of portfolio companies. It follows that the more value added a portfolio firm requires (i.e. the more specialised inputs for development needed) the more intense and substantive the monitoring and evaluation of portfolio firms will likely be. Therefore,

> *(H3) the greater the science and technology inputs required by portfolio companies, the more important collaboration between venture capital firms and large corporations becomes for investment monitoring and evaluation.*

As mentioned previously, venture capital firms tend to geographically concentrate both themselves and their investments within the environs of high capacity regions such as the LMR; this geographic proximity facilitates their management of highly asymmetric and tacit information and related agency costs associated with selecting and then developing NHTCs (see Zook, 2004). In this way, geographic proximity not only allows venture capital firms to regularly monitor their portfolio companies (facilitating necessary face-to-face interaction), but it also facilitates regular access to the capacities of their local investment networks, including syndicate venture capital firms, university scientists, investment banks, and corporate partners (e.g. corporate venture capital divisions). These actors are leveraged by venture capital firms to participate in the selection, monitoring, and exit of portfolio companies. Therefore,

> *(H4) collaboration between venture capital firms and large corporations will be facilitated through both geographic proximity and the capacities of the LMR.*

Finally, for venture capital firms, the importance of geographic proximity is thought to be felt most prominently during the investment monitoring and evaluation phases of the venture capital cycle (Zook, 2004). Given the connection between investment monitoring and value adding, this study further proposes that

> *(H5) for collaboration between venture capital firms and large corporations, the importance of geographic proximity will be most prominent during the post-selection monitoring and evaluation of portfolio companies.*

The overall argument proposed is that the complexity and uncertainty of high tech innovation drives collaboration between actors engaged in the commercialisation of new high tech products and processes, including venture capital firms and large corporations, and that this collaboration is facilitated by both geographic proximity and the capacities of large metropolitan regions such as London. The preceding constructs and hypotheses are explored and assessed through the empirical findings presented in Chapters 5, 6, and 7. Chapter 4 presents the methodological reasoning and approach employed, with findings derived from in-depth interviews

with 30 London based venture capital firms, and five corporate venturing divisions. Importantly, Chapter 4 expands the research context by detailing the criteria by which interviewee venture capital firms were selected, a process based in large part on early stage investing propensities, sector specificity, and the location of portfolio companies.

4. Methodological Challenges and Procedures for Understanding Collaborative Venture Capital

As stated and explained in previous chapters, the main objectives of this research are to capture and understand how, why, and under which circumstances VC firms collaborate with large corporations and their corporate venturing divisions. The research inquires as to the structures employed and the motivations, for which this collaborative activity is pursued, as well as the various opportunities and constraints that may shape collaborative behaviour between these two investment actors. Secondarily, this research is designed to establish the degree of importance that geographic proximity and the various location dynamics of the LMR play in facilitating collaboration between VC firms and large corporations.

Although these questions are derived from related studies grounded in separate research threads pertaining to venture capital's value adding capacities (e.g. Amit, Brander, & Zott, 1998; Fried & Hisrich, 1995; Hellman & Puri 2000, 2002; Sapienza, 1992), venture capital syndication (e.g. De Clercq & Dimov, 2004; Wright & Lockett, 2003; Manigart et al., 2006) and associated location dynamics (e.g. Bygrave, 1987; Sorenson & Stuart, 2001, 2008), as well as the structures and motivations regarding corporate venture capital and corporate venturing activities (e.g. Benson & Ziedonis, 2010; Kann, 2000; Keil, 2004; McNally, 2002; Siegel, Siegel, & Macmillan, 1988), the combination of these threads through an interface of "collaboration" offers a potentially valuable contribution to the understanding of VC firms as both collaborative and location specific actors, and as agents of "value added" beyond finance, for the development and capacity building of NHTCs.

The studies cited above use either quantitative approaches or qualitative case study methods. The quantitative studies are based on available and generally large sets of data composed of many units of analysis. Within this data the units of analysis are generally identified as either VC firms or investee firms, to the exclusion of other actors. Although these quantitative approaches can capture the frequency of venture capital activity along with related motivations and outcomes (e.g. Manigart et al., 2006), they generally cannot inquire methodologically into the processes involved and the procedures for pursuing and engaging in certain

types of investment behaviour. Such questions are important for understanding how and why things occur; they are necessary for bridging theoretical constructs with empirical reality and for informing policy (Patton, 1990, 2005). Additionally, quantitative studies generally produce a very broad level of analysis, treating units of analysis as homogenous (Silverman, 2010) and rarely distinguishing or accounting for the diversity lodged within the source data (e.g. VC firms differ markedly in the types of investments made, the stage of investment, or the sector specificity of investments). Understanding and accounting for such differences is essential for building accurate empirical constructs of reality (Miller & Glassner, 1997). To pursue such questions and account for empirical diversity, a qualitative approach using interviews and document sources, such as the case study work on corporate venturing practices by Keil (2004), is often more effective and sometimes the only approach considered appropriate (Silverman, 2010).

4.1. A Qualitative Approach to Capturing the Processes and Location Dynamics of Collaboration

This research employs a mainly qualitative approach based on in-depth semi-structured interviews with 30 technology-oriented VC firms located in the LMR. The interviews were conducted from September 2008 to June 2009 at the offices of the VC firms with a representative partner of each firm. Each interview took an average of 45 minutes. The unit of analysis, therefore, is the individual venture capital firm. Additional interviews were conducted with corporate venturing divisions with offices located in London. For the core interviews questions were split into three sets or themes of inquiry. The first set of questions focused on the structures or mechanisms employed and the arrangements that VC firms used for collaborating with large corporations: business networks, strategic partnerships, syndication or co-investment, and corporate spin-off/out arrangements. It follows that syndication and corporate spin-off/out arrangements will be more formal, involving the exchange of capital and proprietary assets, than arrangements based solely on business networks; strategic partnerships are thought to be both informal and formal depending on circumstances. More formal arrangements, however, are expected to be preceded and maintained by less formal interaction such as business networks that lead to more formal collaborative arrangements.

The second set of questions focused on the motivations that VC firms attribute to why they pursue and engage in collaboration with large corporations. As demonstrated in the literature on syndication and corporate venture capital, these include finance, deal flow, selection, exit, and value-adding motives. The expectation was that motivations centred on obtaining knowledge, such as selection and value adding, would prove more important reasons for collaboration than investment opportunity or performance motivations, such as the finance and deal flow motives. For the value-adding motive, further questions looked at the types of possible knowledge pursued through collaboration: industry and market knowledge, business development, and science and technology. It was expected that the more proprietary and specialised the knowledge exchanged through collaboration, the more formal the collaboration would be.

The third set of questions inquired about the conditions or circumstances for which collaboration with large corporations is deemed by VC firms to be either particularly advantageous or, conversely, as suboptimal, thus prompting the firms to avoid collaboration or pursue it with considerable caution. This line of questioning focused on which investment stage was deemed most advantageous for collaboration and why, coupled with questions concerning challenges or obstacles faced by VC firms in their collaborations with large corporations. Expectations were that the benefits of collaboration would be felt most strongly at the early stages of the investment cycle, when specialised knowledge inputs (e.g. science and technology) are most critical (see Chapter 3). Important objectives of this question set were to gauge the opportunities and constraints that collaboration with large corporations presents to VC firms for investing in NHTCs and offer insights about how this collaborative activity has evolved over time. Corresponding with previous expectations, it follows that repeat interaction, building from informal to more formal over time, will break down barriers associated with different cultures of operation and conflicting interests and thus allow complementary benefits to be realised.

A line of enquiry running through these three question sets, particularly questions regarding structures for collaboration, was the relative importance of geographic proximity and location in the LMR in facilitating collaboration between VC firms

and large corporations. This line of reasoning is based on the literature that presents VC firms as location specific actors (Sorenson & Stuart, 2008): VC firms will normally invest early stage funding in investee companies that are in close geographic proximity to them, this investment activity occurring in a select number of high-capacity regions such as the LMR (Mason & Harrison, 2003). This corresponds to the increasing number of corporate venturing and corporate venture capital operations that have opened offices or research facilities in the LMR (see Chapter 3). The overarching question is whether this co-location drives collaboration between VC firms and large corporations, or whether collaboration is more a passive and indirect outcome of residing within a high-capacity agglomeration such as the LMR.

The interviews for which the above question sets were posed form the unit of observation, with the LMR acting as overall research setting. In some ways the research setting, a variable that is held stable, is used as a selection mechanism for the unit of observation and informs the research question sets. A second variable held stable as a selection criterion for interviewee firms was an early stage investment focus. The idea was that those VC firms engaging in early stage investing will generally continue to invest in a portfolio company in subsequent funding rounds and stages, whereas propensities for collaboration might change over time. This early stage criterion, however, was not always strictly adhered to due to context constraints discussed later in this chapter. The third factor variable held stable to the strictest degree possible was the sector specificity of the VC firms selected and interviewed. All focused on one or a combination of the following high tech sectors: (1) ICT, (2) life science and biotech, and (3) clean technology. It was expected that different sectors would demonstrate different propensities for collaboration: the more science and technology intensive the sector, the more important the collaboration between VC firms and large corporations (see Chapters 1 and 3).

Finally, the geographic setting of this research is coupled with the additional context of time. Time is also a stable variable, with interviews having been conducted with VC firms at the height of the latest recessionary period. It was expected that recessionary conditions would have some effect on the behaviour

described by interviewee firms regarding collaboration with large corporations. These expectations, however, were not clearly defined going into the interviews. As previously discussed, venture capital is cyclic, following the ups and downs of the global economy. Facing recessionary conditions, venture capital investment amounts generally decrease. Yet alternative investment arrangements might well be deployed. In this way the research aims to capture venture capital activity within a specific time period while also illuminating adaptation behaviour brought about by sudden and in many ways unexpected changes to the environment experienced by the unit of observation (see Chapter 3).

This chapter explains the rationale and challenges associated with a qualitative interview-based approach to research and the procedures involved in setting up and conducting the interviews, with an emphasis on interview selection and access. The process of transcribing and coding the interviews is described, followed by an explanation of the procedures employed for the analysis and verification of the empirical findings.

4.2. In-Depth Interviews as a Methodological Approach: Contribution and Challenges

An overarching question concerning the use of qualitative methods is the degree to which the qualitative method employed can contribute both theoretical insights regarding the observed activity and insights to a larger body of related knowledge (Patton, 1990, 2005). Much of this question stems from the concern that qualitative research produces findings that are too complex and overly detailed to enable meaningful insight or structurally coherent understanding (Cho & Trent, 2006; Krefting, 1991; Pettigrew, 1990). The connection between the methods used and the contribution gained is, in some respects, a question of appropriateness: are the methods employed the most appropriate for the research question and the setting observed? As previously presented, this study involves a research topic and associated questions that could not be adequately pursued using a quantitative approach; questions regarding processes require in-depth inquiry and are thus rarely appropriate for more surface laden quantitative approaches (Eisenhardt, 1989).

More important, at the time of this research no reliable data existed concerning the types and frequency of collaboration between VC firms and large corporations. The primary contribution of qualitative research lies in such cases (Eisenhardt, 1989). In the absence of hard data, some form of qualitative research is often necessary for establishing the existence of an observed activity and providing potential yet credible explanations for how and why a particular activity occurs (Silverman, 2010). In turn, the explanations may later be tested using alternative methods of analysis, including those of a quantitative nature. In other words, qualitative methods are, in many cases, the most appropriate method for establishing new knowledge and observed relevance that additional research can build on (Patton, 1990, 2005).

This research aims at producing foundational knowledge regarding the how and the why of certain organisational behaviour, establishing the existence and varieties of collaboration between VC firms and large corporations. To make this contribution valuable, however — presenting key insights while constructing a coherent contextual understanding of the observed activity — the researcher needs to address and limit the potential drawbacks associated with a qualitative research approach, both in the development of the approach used and in the process by which the method is applied and outcomes interpreted (Creswell & Miller, 2000). Problems that arise most prominently in qualitative research are centred on questions concerning credibility and generalisation (Patton, 1990, 2005; Schofield, 2002). These two aspects have much to do with the question of how qualitative research can make a significant contribution of insight to theoretical constructs (Langley, 1999; Patton, 1999). In the following discussion each of these potential drawbacks is briefly explained along with measures taken by the author to limit or correct any adverse effect on the research approach and outcomes.

4.2.1. Qualitative Research and Credibility

Qualitative research, like all research approaches, is rarely if ever purely objective. (Cho & Trent 2006; Morrow, 2005; Patton, 2005). Subjectivity is inevitable because the research is often built on and guided by pre-existing theoretical constructs that are subject to the inherent biases of the researcher and prone to the

subjective intent of the research subjects (Miller & Glassner, 1997; Silverman, 2010). Conclusions are synthesised from a multiplicity of views of reality. Much care, therefore, must be put forth in strengthening credibility, efforts that Patton (1990) grounds in the application of "rigorous techniques" for method construction, data collection, and analysis; constant reflective awareness on the part of the researcher; and a "fundamental appreciation of qualitative methods, inductive analysis, and holistic thinking" (p. 461). A fundamental tool that can be applied to these related inquiry elements is the use of triangulation, particularly the use of multiple sources of data and multiple theories or perspectives to interpret the data and construct an observed reality (Creswell & Clark, 2007). Also necessary is a convergence of different methods for the communication of findings (Silverman, 2010).

In large part, this research is hypothesis driven, giving both the research method and the lines of inquiry a necessary degree of research rigour (Creswell & Clark, 2007). An important aspect of this research inquiry, however, is to explore rival explanations. The use of hypotheses actually allows for alternative interpretations to be more readily defined and evaluated as they are more effectively measured against the explanations posed by the hypotheses, thus increasing the degree of confidence in either the original hypothesis or a newly derived explanation from the data analysis (Cho & Trent, 2006). In formulating the hypotheses and subsequent interview questions, different and often opposing explanations for how collaboration might be arranged (e.g. informal versus formal) and the motivations for doing so (e.g. knowledge motivations versus finance motivations) were derived from the literature and reflected in the research questions (Silverman, 2010). For example, one hypothesis expected that access to and use of knowledge would be the primary motivations for collaboration; yet an alternative explanation, derived from the literature, positioned finance and risk centred motivations as more likely causes, with interview questions touching on both as possibilities. In fact, the main question sets of structures, motivations, and conditions were all prompted by alternative explanations grounded in the literature. Another example of this openness to counter-explanations — in some ways, the triangulation of theory — employed by the research was the consideration of rival interpretations regarding

co-location and the spatial clustering of innovative activity, with theories ranging from well-defined industrial districts to more diffuse networked regions to highly flexible pure agglomeration, all guiding the research inquiry and data analysis (Patton, 2005).

Further qualitative research rigour was achieved through quantifying the qualitative findings (Morse, Barrett, Mayan, Olson, & Spiers, 2008). The research questions were designed to lend quantifiable qualities to the answers given. The same sets of questions were posed to all 30 interviewee firms, with different degrees of propensity ascertained through the coding process, which combined initial answers with at-length explanations where appropriate. The research by no means bases its conclusions solely on the quantification of the qualitative data, but "it is worth using multiple methods … and convergent validity checks to enhance the quality and credibility of findings" (Patton, 1990, p. 467; Maanen, 1983). An aspect of that credibility is in the presentation of the findings. Quantification of the qualitative findings adds additional substance and clarity to the communication of qualitative findings and allows others to more easily verify or refute the research findings through their own observations (Kirk & Miller, 1988).

For interview based qualitative research the generation of credible findings occurs, in large part, through the interface of the interviewer and the interviewee (Denzin, 1989). The interview process must be orchestrated carefully to limit biases while capturing relevant data. Much of this can be accomplished through the careful construction of the interview questions (e.g. the embeddeness, in the question sets, of multiple explanations) and by conducting the interview in a manner that constrains the potential biases of the interviewer and the potential for misinterpretation (Rubin & Rubin, 2011. For the interviewer this can be a delicate balance to maintain (Denzin & Lincoln, 2002). The first consideration in doing so is awareness of the potential for biases (Patton, 2005). In conducting the interviews the author used question sets to keep the interviews structured and timely, but employed mostly open-ended questions within these sets, allowing the interviewee to guide the interview to a large degree (Rubin & Rubin, 2011). The author noted reflections following each interview regarding the attitude of the interviewee towards certain questions (i.e. instances in which questions provoked intense

seriousness, scepticism, or sarcasm) as well as self-reflection on the manner by which the questions were posed (i.e. instances in which questions might have been asked in a less than clear manner or when potentially helpful follow-up questions were not asked) (Denzin, 1989; Denzin & Lincoln, 2002). Such occurrences were ascertained during the transcribing process and necessary corrections were noted for subsequent interviews. The author also made particular note of contradictions made by interviewees within a particular interview or between interviews. Such contradictions were taken as relevant and considered within the empirical context.

In further controlling potential biases and misinterpretation, all interviews were conducted solely by the author with a full partner representative of the interviewee firm and at the firm's offices (Temple & Young, 2004). A precondition for all of the interviews was a strict agreement to keep interviewees and their respective firms, as well as names referenced in the interviews, as entirely anonymous; this helped establish rapport between the interviewer and interviewees and allowed for a more open and substantive dialogue (Rubin & Rubin, 2011 . Another precondition that facilitated a more productive interview exchange was revealing the interview questions to the interviewee prior to the interview, generally a week in advance. Admittedly, doing so may have fostered some biases on behalf of the interviewee. But such concerns were outweighed by the expected benefits of a more focused and productive interview by allowing more time to conduct the actual interview and less time explaining the aims of the research or the merits of the questions. In most cases, interviewees requested the interview questions in advance as a precondition for the interview; providing this information was instrumental in gaining access. Rapport was further strengthened by maintaining a neutral demeanour throughout the interview. The author gave little or no reaction response to particular answers, nor did the author purposefully lead the interviewee into discussions where hypotheses were clearly evident.

A position adopted by the interviewer was that of a well-trained and professional outsider holding holistic but not specialised knowledge. The assumption portrayed was that the interviewer had little practical knowledge regarding the reality of the research topic as experienced by the interviewee while allowing the interviewee to assume the position of expert. This promoted additional interviewer neutrality,

which subsequently placed the interviewee more at ease and encouraged a more open and forthright attitude in imparting his or her knowledge. This aura of neutrality and position as a non-expert also allowed the interviewer to more easily ask the interviewee to restate or explain an initial answer and clarify key points and concepts that were not initially understood, thus limiting instances of misinterpretation (Rubin & Rubin, 2011).

Finally, the credibility of the research findings was enhanced further through the triangulation of sources (Schofield, 2002). In addition to the 30 subject interviews, additional interviews were conducted with the corporate venturing divisions of five large corporations located in London. These interviews, each roughly 45 minutes in length, were not considered part of the core unit of observation, but they were used to verify the extent of collaboration occurring and to confirm or challenge overarching claims captured in the core unit of observation. These interviews were conducted in the same way as the core interviews, although the question format was less structured and more open-ended, with different question sets posed (emphasising the corporate perspective). Interviews were conducted by the author with a corporate representative and occurred at the respective corporate office in London. Furthermore, a significant amount of background research (most of which was Web-based) was conducted on the core interview subjects (e.g. firm characteristics and investment trends) as part of the subject selection process and following the interviews. This, along with other context related documentation (e.g. literature and reports published by industry and sector specific associations) was included in the analysis, thus "reducing systematic bias in the data" (Patton, 1990, p. 470).

4.2.2. Qualitative Research and Deriving Generalisations

In addition to credibility, a second issue commonly raised concerning qualitative approaches is the generalisability of the findings (Patton, 1990, 2005). Qualitative data, in contrast to quantitative data, is typically derived from a comparatively small sample size, leading to inevitable questions as to how wide-ranging generalisations can be made (Schofield, 2002). This is a legitimate concern but one that can be addressed through careful sample design and appropriate context-

specific research aims (Morse et al., 2008). In selecting the initial pool of targeted firms to interview, the author took significant care in constructing a purposive sampling through the convergence of the relevant theoretical constructs and contextual factors. This convergence proposed that collaboration would have greater resonance at the early stage of the investment cycle; thus, only firms that were identified as early stage investors were considered for the sample. This process led to the selection and contact of roughly 50 firms, 30 of which participated in the interviews. As previously mentioned, the research has an intentional geographic constraint: venture capital in the United Kingdom. The convergence of theory and context clearly placed the majority of early stage focused VC firms in the United Kingdom, either in London or within the environs of the LMR, which is where all 30 firms interviewed were based. In this way, the 30 VC firms that comprise the unit of observation can be described as a representative sample: the unit of observation is representative of U.K. based, early stage focused VC firms operating from offices in the LMR.

In short, this convergence allowed the author to sharpen the purposefulness of the sampling, making it possible to draw some generalisations regarding the role that specific contextual factors play in organisational behaviour and the existence and propensity of certain structural arrangements.

Even if the generalisations made here are deemed speculative, the qualitative approach used for this study does convey a significant depth of context based knowledge through the analysis of the findings, or what Stake (1978) first called the particularisation of an observed activity. For the purposes of this study, the in-depth interviews, the triangulation of other sources, the convergence of theoretical and contextual constructs, and the attempt to quantify the empirics captures the existence, propensity, and structure of complex collaborative processes within a particular context. Therefore, findings can be generalised for the particular activity and setting observed in the study. Still, the contextual richness of the data analysed, matched with the representativeness of the purposeful sample observed in this study, leads to possibilities of insightful extrapolation (Patton, 2005). Although this study aims to capture and understand collaborative venture capital

activity in the United Kingdom, it also comments on venture capital more generally.

4.3. Research Design, Procedure, and the Objects of Study

A structured yet reiterative and reflective process, similar to that proposed by Yin (2008), was implemented and followed in developing and conducting this study. Proceeding with a thorough and rational convergence of theoretical and contextual constructs leading to well-defined research questions and hypotheses, a research setting and units of analysis were selected and in-depth semi-structured interviews were conducted with a purposeful sample and later transcribed and coded. Findings were subjected to a cross-sector comparison that provided coherent answers, some of them unanticipated, for the research questions posed. Although this process was structured intentionally around a clear set of research questions and corresponding interview questions, reflection and refinement occurred throughout the research process; from sequential interviews, feedback loops led to topographical refinements of the interview questions and appreciation for nuances in the contextual vocabulary used by the objects of study, all feeding back to reflections on the underlying theoretical constructs used and the overall hypotheses guiding the research narrative. In other words, complexities observed in the unit of observation were used to reweave some of the relevant theoretical threads emanating from the constructs, leading to a more accurate and insightful analysis of the research findings.

Four aspects of the above design and procedure are particularly pertinent. Firstly, the research subjects were selected purposefully in that they met, to as great an extent possible, the predetermined criteria identified through a convergence of theory and context; were identified as potentially information rich objects of study; and were determined to be accessible as units of analysis (Patton, 2005). In sum, careful consideration and conscious decision making were applied in selecting units of analysis that were appropriate for the given research aims. Secondly, access to the objects of study was achieved through the auspices of an intermediary and was made easier because the author resided near the offices of the objects of study. Thirdly, the contents of the interviews were subjected to a

process of coding for which key concepts and points of departure were identified, allowing for the deciphering of commonalities and contradictions in the findings, as well as facilitating a basic quantifying of the qualitative findings. Finally, a triangulation of sources was engaged and a recursive system of analysis was employed throughout the research process, which allowed for iterative reflection and re-clarification of the main research constructs, thus lessoning instances of misinterpretation and aiding construction of an accurate picture of the observed reality.

4.4. Selection of the Region and Sectors of Investigation

As previously established (Chapters 1 and 3), the LMR— due to the high concentration of venture capital activity oriented toward high-tech innovation in this metropolitan region — was selected as the regional setting for this study. The heart of the region is London, a global centre of commerce, legal and financial services, and creative industries. As both a regional and global transport hub, London provides the LMR a gateway through which the wider region interfaces with itself and the world (Simmie, Sennett, & Wood, 2002). To the north of London are the counties of Oxford and Cambridge, often referred to as the Oxford to Cambridge Arc (O2C Arc). The county of Oxfordshire is home to Oxford University, 10 government laboratories, several science parks, and a prominent biotech cluster, as well as a growing number of science-driven entrepreneurial firms. Cambridge is home to Cambridge University, a number of related science parks and research institutes, technology clusters (including biotech), and 1,400 high-tech businesses. The LMR also hosts numerous formal and informal networks (the O2C Arc alone boasts nearly 220 active business networks) and a number of industry-leading corporations, including those in pharmaceuticals and medical technology (Lawton Smith & Virah-Sawmy, 2008).

As explained in Chapter 3, three high-tech sectors were chosen as a means to provide the study an insightful cross-sector comparison and demonstrate how different sectors, necessitating different input requirements and exhibiting different market factors, may show different propensities regarding collaboration between VC firms and large corporations. The three sectors are the ICT, the related sectors

of life science and biotech, and the clean tech sector. These sectors are the recipients of the majority of technology-focused venture capital investment in the United Kingdom (BVCA, 2010). Investments in ICT and life science and biotech have dominated global technology-focused venture capital over the past 2 decades, with the clean tech sector experiencing large increases in venture capital investment in the United Kingdom and elsewhere over the past decade and increasingly so during the past 5 years (BVCA, 2011).

4.5. Selection of Venture Capital Firms

For this research, venture capital is defined as "independent, professionally managed, dedicated pools of capital that focus on equity or equity linked investments in privately held, high growth companies" (Gompers & Lerner, 2001, p. 146) or defined more generally as *private firms that independently manage dedicated pools of capital that are devoted to equity or equity linked investments in privately held, generally young, technology based companies that are growth oriented* (Isaksson, 2006; Metrick & Yasuda, 2010). From these definitions two primary selection criteria are derived, with a third criterion based on the selected geographic setting of the study. VC firms that were eventually selected for interviews were initially identified as meeting all three of the following criteria:

(1) Engaged in significant early stage investing (i.e., investing in young companies)

(2) Investing in technology oriented companies (preferably companies engaged in high-tech endeavours)

(3) Actively investing in early stage, technology oriented companies located in the LMR.

Regarding Criterion 2, the sector specificities of this technology investment, although anticipated, were decided on following the initial selection process. In other words, although the expectation and aim of the study was to conduct a cross-sector comparison, firms were not initially selected on the sector specificity of their investments. Furthermore, the third, location specific, criterion was based on the available data that placed the majority of UK based venture capital investment flowing into companies located in the LMR, the selected research setting for this study. Additionally, although it was expected that the majority of the selected VC

firms would be located in the LMR, the location of a venture capital firm's office was not an initial selection criteria.

To this end, the process of identifying, selecting, and gaining access to the subjects of research involved much trial and error including an iterative refinement of the search criteria, additional background research on potential interviewee firms, multiple attempts at contacting appropriately identified firms, and the eventual use of an intermediary for gaining widespread access.

In identifying appropriate VC firms for potential selection, the author first used the online directory of the British Venture Capital & Private Equity Association (BVCA). At the time of this search the directory included 216 VC firms (the majority of UK based VC firms) and allowed for the searching of these firms by investment stage, sector specificity, and location (the updated version of the directory no longer allows these criteria based searches). Employing the research criteria, the author identified roughly 75 firms that qualified themselves as early-stage technology investors. When applying the location function, all 75 of these firms were identified as investing in companies located in the South East. In doing an address search for these firms, 62 had offices located in the LMR. The remaining firms were scattered throughout the United Kingdom, with notable clusters in Scotland and Northern Ireland. At this point in the selection process the sector specificity of the firms had not yet been identified, although the author had expectations (based on BVCA data) that many of these VC firms were investing in ICT, life science, and clean tech (see Chapter 3). When reviewing these VC firms, it was also evident that many of them specialised in a particular sector, with VC firms describing themselves as life-science or clean-tech investors (e.g. "we are a life science focused venture capital firm").

At this early point in the process the strategy was to contact several selected VC firms to gauge interest in the research topic and in a potential interview. This was an important first step because the author had no prior contacts in the venture capital community; gaining access to the research subjects was a highly uncertain proposition. Going on the assumption that a formal contact process was necessary, in July 2008 the author selected 20 VC firms to initially contact, posting 20 formal

letters, all on university letterhead, to the executive partners of these firms. The letters briefly explained the research aims and requested a 45 minute interview with a representative of the firm, stating that the interview would be recorded and that anonymity would be kept. The response rate was disappointingly low, garnering only two replies, both from life-science specific VC firms and both agreeing to interviews during the month of September 2008 (citing summer scheduling constraints). Although these interviews were agreed on, it was clear that a more aggressive form of access was required.

In late August 2008 the author contacted by e-mail and formal letter the offices of BVCA in London. The letter introduced the author, explained the aims of the research, and inquired about BVCA's interest in the research topic and potential findings and any assistance it might provide in facilitating the research. The reply was prompt and positive, leading to a meeting in mid-September 2008 at the BVCA office. During this meeting the author again explained the research topic and aims to representatives of BVCA's research division. The representatives admitted that they knew little regarding collaboration between VC firms and large corporations, although they saw the rationale for the study. They agreed that corporate involvement in venture capital investing did occur, although it was not well-represented in the available data and was not well understood. The BVCA representatives believed the research could make a valuable contribution in this regard and agreed to assist the author in contacting UK based VC firms for interviews. During this discussion the possibility of a survey based approach coupled with the interviews was raised by the author but rejected by BVCA. An interview based approach, assisted by BVCA, was then agreed on.

Additional aspects of the research, including details concerning the intermediary role BVCA would play in gaining access, also were discussed during this meeting and through immediate follow-up communications with BVCA via e-mail. First, the author expressed an intention to include a cross-sector comparison in the study, offering a rationale based on the available data for considering the ICT sector, the life science and biotech sectors, and the clean tech sector as the three sectors to compare. BVCA confirmed assumptions, based on the data, that the largest proportion of technology oriented venture capital investment went to those

companies engaged in ICT. In other words, ICT was the dominant sector invested in for UK based VC firms investing in technology oriented companies. However, it was also suggested in these discussions, and later confirmed, that the VC firms that invested most heavily in life science and biotech did so exclusively. Likewise, it was suggested that a number of VC firms that invested in clean tech also did so exclusively. Therefore, it was determined that doing some variation of a cross-sector analysis considering the three sectors would be possible following additional background research on individual VC firms to gauge their sector specificity. This analysis would inform the final selection of potential interviewee firms. It was also suggested that the selection of interviewee firms be narrowed to those with offices in the LMR, which would allow for easier access given the intention to hold face-to-face interviews at the offices of the respective VC firms.

In contacting VC firms to request interviews, the following procedure involving BVCA as intermediary was agreed on. First, the author revisited the identification of appropriate interviewee firms, doing more in-depth background research on potential firms with an additional emphasis on a firm's investment sector specificity. Again, BVCA's online directory was used for this purpose. This additional research narrowed the initial 62 VC firms to roughly 50. Contacting these 50 firms occurred in two waves, with 25 firms contacted in October 2008 and the additional 25 contacted in March 2009. In each instance the author provided BVCA with a formal letter to the respective VC firms as an e-mail attachment. BVCA then sent an e-mail to the respective VC firms with the attached letter and an introduction and explanation, written by BVCA, regarding the aims of the research study, the qualifications of the author, and the request for an interview. The e-mail asked the VC firms to contact the author to discuss interest, availability, or any additional questions not clarified in the formal letter. The author was copied on all e-mails.

The first wave of contacts directly resulted in 10 positive replies, all leading to interviews, carried out between late October 2008 and late February 2009. In three instances an interviewee introduced the author to a contact at another venture capital firm, resulting in an additional four interviews conducted during this time. This brought the total number of firms interviewed, based on the first wave, to 14.

The second wave of contacts resulted in 12 positive replies, 10 of which led to interviews. Referrals from two interviewees led to additional interviews with four VC firms. All 14 interviews occurred between March 2009 and June 2009. The total number of interviews comprising the object of analysis, including the initial two interviews, was 30. As previously explained, preconditions for all 30 interviews included providing interviewees with a copy of the general interview questions prior to the interview and an agreement (stated in the formal letter) to keep the contents of the interviews anonymous. These preconditions were necessary for gaining access in most instances.

4.6. Final Selection and Characteristics of Interviewee Firms

The makeup and characteristics of the 30 interviewee VC firms (comprising the unit of observation) can be seen in Table 7. Although balance in sector specificity among the firms was strived for, the sample, as expected, was dominated by firms investing heavily in ICT. Importantly, however, a number of ICT-intensive interviewee firms were identified as multi-sector in that they invested primarily in ICT related companies but also invested in companies that were applying ICT to other sectors such as healthcare services and the energy sector. These additional sectors did not meet the definition of life science or clean tech; thus, they were not classified as such. In all, seven such interviewee firms were identified as ICT (multi-sector). One firm was identified as investing heavily in both ICT and clean tech, and one firm was identified as investing in all three sectors. In both cases these firms were classified as ICT specific firms. Although not the ideal classification, a degree of single sector specificity was required to keep the coding of the findings consistent. That said, the author kept an awareness and appreciation of the multi-sector approaches of some interviewee firms during the analysis of the findings. Therefore, from the 30 firms selected, 18 firms are identified as investing heavily in ICT, seven as investing heavily in life science/biotech, and five are identified as investing heavily in clean tech.

Table 7: VC Firms Selected for Interviews and Firm Characteristics

VCF	LOCATION	SIZE	SECT.	EARLY	EXP	LATE	MBO	% UK INV
1	London	L	ICT	X	X	X	X	100
2	London	L	ICT		X	X		50
3	London	L	ICT	X	X	X		58
4	London/USA	L	ICT		X	X		33
5	Lon./Cam.	L	ICT, LS	X	X	X		38
6	London/Boston	L	ICT, LS	X				33
7	London/Global	L	ICT, CT		X	X		12
8	Oxford	L	ICT		X	X		83
9	London	M	ICT		X	X		55
10	London	M	ICT, LS		X	X		50
11	Oxford	M	ICT, LS	X				100
12	Cambridge	M	ICT, LS	X	X			75
13	London	S	ICT	X	X			100
14	London	S	ICT	X				100
15	Cambridge	S	ICT		X	X		100
16	Cambridge	S	ICT, LS	X	X			100
17	London	S	ICT	X		X		70
18	London/Beijing	L	ICT		X	X	X	13
19	London/Global	L	LS	X	X	X		12
20	London/Global	L	LS	X	X	X		17
21	London	M	LS	X	X	X		70
22	London	M	LS	X	X			33
23	Cambridge	S	LS	X				100
24	London	S	LS	X	X			80
25	London	S	LS	X	X			42
26	Lon./New York	L	CT	X	X	X		20
27	London/Global	L	CT		X	X	X	15
28	London	M	CT		X	X		58
29	London	M	CT		X	X		80
30	Lon./Munich	M	CT	X	X	X		38

NOTES:
Large: £300 million + invested in 40 or more active investee companies
Medium: £100–£300 million invested in 20 to 40 active investee companies
Small: £50–£100 mil. generally invested in 10 to 20 active investee companies
ICT: Information and communications technology
LS: Life science and biotech
CT: Clean tech

Two interviewee firms had their main offices in Oxford, four had their main offices in Cambridge, and the remaining 24 were located in London. Nine interviewee firms had offices both in the United Kingdom and internationally, with some firms having offices in the United States (e.g. Boston and San Francisco), Europe (e.g. Munich), or Asia (e.g. Beijing). The size of interviewee firms ranged

from large (£300 million + invested in 40 or more active investee companies) to medium (£100–£300 million invested in 20 to 40 active investee companies) and small VC firms (£50–£100 million generally invested in 10 to 20 active investee companies). The largest interviewee firm invested roughly £1 billion in about 70 active investee companies; the smallest invested around £50 million in roughly eight active investee companies.

Three fourths of the interviewee firms had active investment portfolios with a sizable number of investee firms located outside the United Kingdom. However, investee companies for some of the smaller interviewee VC firms were almost always located in the United Kingdom. An obvious connection, therefore, might be made between the size of a venture capital firm and the location of investee companies: the larger the venture capital firm, the greater its propensity to invest internationally.

Importantly, although the main criterion used for selecting interviewee firms was a stated early stage focus of investments, a close examination of investment strategy and portfolio companies showed that 13 of 30 firms selected were investing more in expansion and later stage companies, some avoiding early stage investing altogether. Reviewing this phenomenon by sector specificity, only 10 of the 18 firms engaged heavily in ICT investments were identified as focusing on early stage investments. A potential connection between investments in early stage companies and investments in life science may resonate; all seven interviewee firms engaged exclusively in life science investments focused on investments in early stage companies. The lack of an early stage focus was most apparent in the firms engaged exclusively in clean tech, where five of six firms focused on expansion and later stage investment. Also, interviewee firms that engaged exclusively in clean tech tended to be either large or medium in size, although a connection between interviewee firm size and a propensity for a particular investment stage was not immediately clear.

In sum, although all selected interviewee firms were investing in high-tech oriented companies located in the LMR, the core selection criterion of engaging in early stage investing indicated through the online directory of BVCA was not met

by all interviewee firms — a reality that was later verified through the actual interviews. This change in context was, in some ways, expected to be the result of changing investment patterns due to the sharp economic downturn. However, the expected implications for collaboration as captured by this study were less obvious going into the research procedure (i.e. conducting the interviews and analysing the findings). Possibilities ranged from a decrease in the propensity for collaboration — that is, less early stage investing might imply less need for early stage external inputs, resulting in less collaborative activity between VC firms and large corporations — to an increase in collaboration based on a need, in a down market, to facilitate both alternative investment inputs and investment exit options.

4.7. Interview Guideline and Data Collection Process

The author conducted expert semi-structured interviews with 30 VC firms, which represent the unit of observation for this study. Being semi-structured, the interviews allowed focused attention on the core topics, as determined by the author, while simultaneously providing for an open and sometimes divergent exchange. The discussion was allowed to traverse and move between the core topics, particularly when detailed explanations were offered or when certain topics did not hold relevance. The interviewee, to some extent, guided the discussion. Although openness and fluidity was encouraged in the interviews, having semi-structured as opposed to fully open or unstandardised interview guidelines was important. The 45-minute interview length was agreed on prior to the interview, and follow-up communication with the interviewee was not expected or built in as a critical aspect of the research procedure. For all 30 interviews, therefore, the author adhered as much as possible to questions related to the core topics, making sure that each core topic had been addressed within the 45 minutes allotted.

The author hoped that providing the interviewee with the general interview guideline prior to the interview would result in greater focus on the core topics during the interview, leading to more topical and thus valuable insights. Again, the relatively short 45 minute window of opportunity offered by the interview meant that off topic or unfocused musings could not be afforded.

As previously explained, the interview guideline was comprised of key question sets aligned with the core topics. The interview began with an open question regarding the propensity to collaborate with large corporations and was followed by the first set of questions, which concerned the structures and mechanism for collaboration. An open question on how collaboration took place was followed, when appropriate, by more pointed questions regarding the use of business networks, strategic partnerships, syndication, and spin-outs. The next set of questions began with an open inquiry into the motivations for collaboration. This was followed, when appropriate, by more pointed questions concerning the finance motive and the deal flow motive, the selection motive, the exit motive, and the value-adding motive. A set of questions regarding the conditions for collaboration was then posed. This question set was a bit more open-ended than the previous two but was focused on two aspects in particular: (1) the stage of investment for which collaboration is most advantageous, and (2) the challenges and obstacles that collaboration presents. When appropriate, related questions were explored concerning, for example, interest alignment and issues pertaining to competitive confusion. The final set of questions inquired into the spatial and location dynamics of collaboration, involving a number of open-ended questions pertaining to the importance of close spatial proximity for collaboration and the role that the LMR, as a high capacity region, plays in facilitating collaboration between UK based VC firms and large corporations.

This semi-structured interview guideline allowed for a focused yet flexible discussion on how and why firms collaborated with large corporations, including the types of knowledge pursued and exchanged and the opportunities and constraints associated with this collaborative activity. It also allowed for open discussion regarding the role that spatial proximity plays in facilitating collaboration — connecting the structures employed to location specific factors — and providing broad insights into how UK based VC firms leverage global and regional knowledge flows through collaboration.

As previously explained, all interviews were conducted by the author with general partners at the offices of the respective firms. This setting ensured the expert status of the interviewee, allowing for a more open and candid discussion. Although the

majority of interviews lasted 45 minutes, two interviews had to be cut short to about 30 minutes each, and three interviews lasted roughly 90 minutes. All interviews were recorded using a digital audio recorder. Additionally, notes were taken during the interviews, indicating where emphasis was placed regarding the question sets and noting aspects of the discussion when clarity was lacking. This necessitated some follow-up questioning, either at the end of the interview or in later correspondence. Importantly, prior to each interview the author reviewed the background information compiled on the interviewee firm, looking particularly at its portfolio of investee companies with an eye for sector specificity, stage of investment, and the propensity for exits by corporate acquisition or merger (all taken from the investee firm's website and supporting documents).

Shortly following the interviews, the audio recording was uploaded and reviewed. This first hearing was important because it provided a means for isolating parts of the interview (comments made and language used by the interviewee) that were not clear or may have been misinterpreted by the author. It also allowed the author to gauge the overall tone of the interview, particularly the attitude expressed by the interviewee toward certain questions, looking at where the interviewee emphasized either importance or a lack of relevance. Notes from this hearing were compared to notes taken during the interview. This process occurred after each subsequent interview, constituting a recursive process of theory and context refinement that was later integrated with the analysis of the interview transcripts and the triangulation of other sources. Furthermore, this hearing provided the author with a means to reflect on the overall conduct of the interview itself in terms of the delivery and pace of the questioning. From this review of the recording additional notes and reflections were written down concerning lines of questioning that needed modification and where the conducting of the interview needed improvement. The goal was to improve subsequent interviews and therefore the data collection, leading to more accurate and insightful findings. When necessary the author returned to the background information compiled on the interviewee firm to compare the established context (i.e. that which was known or expected prior to the interview) to the intent of the interviewee (i.e. the information given by the interviewee), looking for commonalities and contradictions.

The triangulation of sources used to verify answers and enhance the credibility of the findings included five additional interviews with the corporate venturing divisions of five large corporations. As with previous interviews, questions were sent to the interviewee ahead of time, a digital audio recorder was used, and the author agreed to keep the contents of the interview anonymous. One of these interviews was conducted in December 2008, but the bulk of these interviews occurred between February and April 2009, with one occurring in July 2009. Employing a set of questions regarding the structures, motivations, and conditions for collaboration similar to the set used for the unit of observation, these interviews were much more open-ended. Importantly, these additional interviews allowed the inclusion of different perspectives to counter the reality shaped by the unit of observation, thus providing a significant degree of critical analysis to the findings.

4.8. Transcribing the Interviews and Data Analysis

All interviews were transcribed by the author. The initial plan was to transcribe each interview within 2 days following the interview. This was not always possible due to other commitments and constraints, and preparation for upcoming interviews almost always took priority over transcribing the previous interview. This backlog of interviews for transcribing meant that at least half the interviews, comprising the first wave, were transcribed during the winter break 2008, with subsequent batches of interviews transcribed over the spring break period (2009) and several being transcribed in August 2009. Transcribing was done by listening to the audio recording and typing it — word by word — into a text document. Each interview took about 6 hours total to transcribe, longer interviews taking closer to 8 hours. When completed, the transcribed interviews comprising the unit of observation were organised by the identified sector specificity of the interviewee firm; that is, three groups of transcribed interviews were compiled and kept separate: (1) interviews with ICT focused firms, (2) interviews with life science/biotech focused firms, and (3) interviews with clean-tech focused firms.

Analysing and categorising the interview contents began sporadically in May 2009. However, the bulk of the analysis occurred from September 2009 through February 2010. Using Atlas.ti as a tool for qualitative text analysis, the author

subjected each interview to a two-part coding process. First, the entire interview was coded through an open coding process for capturing meaning in the data and classifying areas of emphasis at different levels of abstraction. This involved assigning codes based on key terms as articulated by the interviewee. For example, interviewees often referred to early stage investing or the first round of investing as “Series A” investing, thus, in such instances a code was assigned as “Series A.” Another example was the often phrased “deal tension” when interviewees discussed creating competitive bidding for an acquisition or merger; in such instances, the assigned code was “deal tension.” Another example would be when the term “corporate validation” was used to describe the use of corporate partners in the selection of portfolio firms; for this, the code “corporate validation” was assigned. Codes were also assigned when key terms or concepts derived from the literature were articulated by the interviewee, such as an interviewee using the term “deal flow” to describe benefits of collaboration, or when the term “exit by acquisition” was used; codes were assigned as “deal flow” and “exit by acquisition,” respectively.

A significant benefit of this process was that of better connecting the language used by interviewees with the language employed in the academic literature regarding venture capital. Differences in language ranged from subtle variations of key terms to widely different term usage when describing common investment activity. Although this connecting procedure was recursive throughout the research process — during the interviews, initial interpretation and reflection, and the eventual transcribing of the interviews — it was not until the interview was properly coded that these connections were accurately ascertained and appreciated. Such connections were essential in clarifying key concepts, bridging the theory with the context, and improving the credibility of the findings (Barriball & While, 1994).

The second part of this coding process involved reengaging the previously assigned codes and assigning “super codes” to key passages, or quotes, from where families of codes were identified and clustered. These super codes were derived from the key terms and concepts found in the literature on venture capital and were used to construct the core topics and question sets employed in the interview

guideline. Examples of super codes are “business networks,” “syndication,” “value adding,” and “transport networks.” In many instances initial codes and eventual super codes were the same; for example, in some instances “value adding” was assigned as an initial code and then a super code. This process was facilitated by the interview guideline, which was structured in accordance with the question sets, with questions regarding structures preceding proceeding questions about motivations and so forth. Certain assigned codes were generally found in clusters concentrated within the answers and explanations that corresponded to the main question sets. The code identification and search function employed by Atlas.ti also made locating previous codes throughout all 30 interviews and identifying code families relatively easy.

Based on the assigned super codes, interview quotes from across all interviews (the unit of observation) were lifted (copied) and categorised into three separate documents, each document corresponding to one of the three sectors compared. For example, all quotes super coded as “syndication” derived from interviews with life science/biotech-specific VC firms were amassed into the same document. Likewise, those quotes super coded for “syndication” derived from interviews with clean tech-focused VC firms were amassed in a separate clean tech-specific document. This process resulted in three content rich documents, each aligned with a specific sector, which tightly corresponded to the core research topics and related question sets as structured in the interview guideline. These three documents were then used to find patterns, commonalities, and differences within sectors and across them. Importantly, these documents were not analysed in isolation. The context established through background research was always considered, and the findings derived from the interviews with the corporate venture divisions was also analysed and compared to those derived from the unit of observation, with particular emphasis on apparent contradictions between the findings. This triangulation of sources played a significant role in the final analysis of the findings. The research procedure and process of analysis allowed for the credible capturing of collaborative activity between UK based VC firms and large corporations, as well as for different propensities for collaboration across sectors.

The overall research procedure, involving the selection of a purposeful sample for which representativeness could be argued and the use of the same interview guideline structured on core topics and question sets for all interviews comprising the unit of observation, lends itself to a basic quantifying of the qualitative findings. Quantification was employed for the analysis of two of the three core research topics addressed in the interview guideline: (1) structures for collaboration and (2) motivations for collaboration. Regarding structures for collaboration, four types of collaborative structures or arrangements were considered: business networks, strategic partnerships, syndication, and spin-outs. From each interview the propensity for each structure or arrangement type was measured as either NO (rarely if ever employed), YES WEAK (employed but on limited or infrequent basis), and YES STRONG (employed frequently as a standard mode of operation). Regarding motivations for collaboration, the same system was used to measure propensities for the following motivations: (1) the finance motive, (2) the deal flow motive, (3) the selection motive, (4) the exit motive, and (5) the value adding motive. This process of quantifying the qualitative findings carried with it two main benefits. First, it facilitated the disentangling of the rich empirical data gathered, establishing the existence (i.e. the frequency) of certain organisational constructs and bringing to the surface the core thrusts of the research inquiry: the how and the why regarding collaboration. Second, this facilitation carried over into the presentation of the empirical findings, complementing the deep qualitative content as presented in the proceeding chapters, thus sharpening the explanatory findings and enhancing the credibility of the conclusions made.

4.9. Coping With Inherent Limitations

Although all reasonable measures were employed in the research design and procedure to overcome some of the more pertinent issues associated with qualitative approaches, particularly issues of sample size and generalisability of the findings, some additional limitations remained present throughout the research process. First, the unit of observation and supporting sources from which the findings of this research are derived capture the intent of the research subjects and not the actual outcome of the activity observed; that is, the findings are based in

large part on what the interviewee stated as reality (Rubin & Rubin, 2011). For example, an interviewee might have claimed to use collaboration with large corporations to obtain knowledge regarding business development that then was employed to develop portfolio firms; yet the research does not verify with the respective portfolio firm as to whether such knowledge was actually being applied via the interviewee firm. Again, the purposeful sample selected, the triangulation of sources, and the recursive process applied to this study ensured that the intent captured in the findings was as accurate as possible given the inherent constraints of the study.

Second, the quality of the interviews was not consistent across all units of analysis. The interview procedure generally improved with each subsequent interview, and in some cases this progression improved the content of the interviews going forward. Allowing for recursive reflection and refinement is viewed as a strength of the research procedure; however, biases towards the content of later interviews may present themselves, although author awareness and the recursive process itself mitigated such instances to the greatest extent possible.

4.10. Conclusion

This chapter has sought to present a qualitative research approach in which expert semi-structured interviews are the most appropriate research method for capturing information on how, why, and under which conditions VC firms collaborate with large corporations. As required of all qualitative approaches, the research design and procedure used in this study addresses and limits some of the common issues and constraints associated with qualitative approaches to research, particularly issues concerning credibility and the making of generalisations. In doing so, the research design and procedure are built on predefined theoretical and contextual constructs that, along with the facilitation of an appropriate intermediary, inform the selection of a purposeful sample and development of an appropriate interview guideline. Credibility is further enhanced through measures taken that involved recursive reflections, feedback loops, and appropriate settings and demeanour to limit biases and misinterpretations that could arise through the conducting and transcribing of the interviews. In analysing the findings, a coding system and a

cross-sector comparison were used to capture commonalities, patterns, and contradictions within an information-rich empirical context. Finally, the findings derived from the unit of observation were triangulated with additional sources. Despite some inherent limitations (about which the author is aware and accountable) the combination of these design and procedural measures help to construct a credible and accurate interpretation of the particular observed activity, and these observations may be transferable to similar contexts.

Three empirical chapters follow, each chapter presenting and analysing findings associated with a particular set of questions regarding collaboration between UK based VC firms and large corporations. Chapter 5 explores the how of collaboration, with a particular focus on the various structures employed and the arrangements engaged in for collaboration. This chapter also connects structural propensities to the degree of significance that geographic proximity and the research setting have in facilitating collaboration. Chapter 6 then proceeds to capture the why of collaboration, focusing on the motivations for collaboration. Chapter 7 combines the last set of empirical findings, those regarding the conditions for collaboration with the importance of geographic proximity, with an overarching analysis involving the triangulation of other sources.

5. The Structures, and Processes of Collaboration, and the Importance of Geographic Proximity

Venture capital firms are collaborative investment actors (Feldman et al., 2005; Florida & Smith, 1991; Gompers & Lerner, 2004). As previously discussed, a potentially significant source of specialised inputs for investing in and developing NHTCs, and therefore an obvious target for collaboration, are large corporations (Maula, Autio, & Murray, 2005). The literature points to strong anecdotal evidence that such collaboration is common. Founded on informal contacts and professional ties between these two actors, the collaborations are rarely captured in the literature, with the extent of formal collaboration likely underreported in the existing data (Dutshnitsky, 2006). From an organisational perspective, such collaboration is generally understood through the mechanisms by which it is established and maintained (i.e. the structures employed) and the related level of formalisation by which it is structured. It follows that informal collaboration precedes more formal collaboration and that the more specialised and proprietary the inputs exchanged are (e.g. science and technology), the more formal the collaborative structures employed will be (Powell, Koput, & Smith-Doerr, 1996). Therefore:

> *(H1) the greater the science and technology inputs required by portfolio companies, the more important and formal collaboration between venture capital firms and large corporations becomes.*

Assessing such collaboration in three high tech sectors — ICT, life science, and clean tech — this chapter identifies and explores the extent to which four possible structures or arrangements are employed by venture capital firms in their collaboration with large corporations: (1) *business networks*, (2) *strategic partnerships*, (3) *syndication partnerships*, and (4) *corporate spin-outs*. The expectation is that with each consecutive structure (1 to 4) the potential level of formality increases. Corporate spin-outs are the possible exception, because the level of formality involved probably depends on the intentions of the corporate parent company toward a specific spin-out.

Additionally, collaboration often necessitates a certain degree of geographic proximity between participating actors (see Owen-Smith & Powell, 2004). Venture capital investment and venture capital firms tend to locate in a select number of high-capacity metropolitan regions (Martin, 1999; Mason & Harrison, 2002) for two reasons: (1) geographic proximity allows venture capital firms to better select and monitor portfolio companies (managing highly tacit knowledge, asymmetric information, and related agency costs), and (2) allows them to economise and leverage local investment and industry related networks for these purposes. The literature demonstrates that syndication between venture capital firms is strongly facilitated by geographic proximity and that the process of syndication results in dense geographically concentrated syndication networks (Sorenson & Stuart, 2001). Furthermore, Chapter 3 established that a growing number of large multinational corporations have their UK and European corporate venturing offices in London. Compared to collaboration between venture capital firms, however, the degree of importance of geographic proximity and location as it applies to collaboration between venture capital firms and large corporations is much less clear. In exploring these constructs, this chapter proposes that,

> *(H4) collaboration between venture capital firms and large corporations will be facilitated through both geographic proximity and the capacities of the LMR.*

For assessing hypotheses (H1) and (H4), this chapter has three objectives. First, by capturing the various structures used by venture capital firms to collaborate with large corporations, this chapter verifies the frequency and extent of collaboration between these two investment actors in the United Kingdom (Sect. 5.1). Second, the bulk of this chapter presents the types of structures (identified through interviews) that are employed by UK venture capital firms to collaborate with large corporations (Sect. 5.2, 5.3, 5.4, 5.5). In other words, this chapter illustrates what collaboration between venture capital firms and large corporations *looks like*, rather than capturing or explaining what drives this collaboration. Therefore, findings presented in this chapter form the schematic foundation on which a potentially rich and complex collaborative activity occurs.

Finally, this chapter (Sect. 5.6) explores the potential location dynamics of collaboration between venture capital firms in the United Kingdom and large corporations. Therefore, this chapter attempts to verify whether the importance of geographic proximity and the capacities of the London metropolitan region more generally extend to collaborative activity between venture capital firms and large corporations. A more detailed analysis of these findings is offered in Chapter 7.

5.1. Structures for Collaboration

Interviews with venture capital firms demonstrate that interaction and collaboration between venture capital firms and large corporations is not only common, but also has become a critical component to venture capital activity in the United Kingdom. From investment selection, investment structure, and oversight to investment exit, interaction with corporations is pervasive and integral. The interviews describe collaborative structures ranging from informal consultation and networking to formal strategic partnerships, as well as highly formal syndication or co-investing arrangements. Furthermore, collaborative activity between venture capital firms and large corporations was described as having become more prevalent and more open as an investment practice over the past decade and particularly over the past 5 years or so. An interviewee at a life science-focused venture capital firm captured the essence of this collaborative activity, as described by a number of venture capital firms interviewed:

> We have quite specific initiatives set up to collaborate with pharmaceutical companies. Recently, they have become much more open about what they are doing. In the past, they have been quite secretive, they would be developing a drug, and they would not be specific about what stage they were at. For about the past 2 years, they have been doing venture capital pharma days, where they actually invite you in, and they actually give you an overview of the areas they are looking to invest in, with the hope that you will go away, and maybe you have a portfolio firm that is developing something they are interested in, and a licensing deal might be established, or that you might start up a company in that particular area. Also, they tell you quite specifically what areas they are not interested in, which is also very helpful. You might think that everyone is interested in antibiotics, which might take 10 years to develop — if the big firms say that they already have it covered, then you don't waste time and money setting it up.

For venture capital firms the foundation for collaborative activity with large corporations frequently includes both informal and formal interactions with personal and business contacts in the business development, corporate venturing, and R&D divisions. Almost all venture capital partners interviewed had substantial previous industry experience, particularly those venture capitalists focused on life science or clean tech (previously holding senior positions at leading pharmaceutical and energy companies). These past industry ties were said to be crucial in developing and maintaining relationships with corporations. Accordingly, the use and importance of informal and formal *business networks* were coded 27% Yes Weak and 73% Yes Strong. The summary findings from the interviews regarding the four types of collaborative structures coded for are shown in Table 8.

Table 8: Relative Importance of Structures for Collaboration

	BUSINESS NETWORKS	**STRATEGIC PARTNER.**	**SYNDI-CATION**	**SPIN-OUTS**
NO	0	6.7	47	40
YES WEAK	27	36.7	33	43
YES STRONG	73	56.7	20	17
	100% N=30	**100% N=30**	**100% N=30**	**100% N=30**

Mature, more formal relationships with corporations were described as *strategic partnerships*, in which venture capital firms use formal channels of interaction with a select number industry leading corporations. Although not as widely employed as *business networks*, the use and importance of strategic partnerships are still significant, being coded 6.7% No, 36.7% Yes Weak, and 56.7% Yes Strong. Through formal strategic partnerships corporate pipeline needs and portfolio companies are routinely discussed for potential partnering, investing, and acquisition. Such partnerships often involve the placing of high-level individuals from these corporations on the advisory boards of both the venture capital firm and individual portfolio companies.

The use of co-investing or *syndication partnerships* between venture capital firms and large corporations was described by the venture capital firms interviewed as

far less common. However, some venture capital firms, particularly those investing exclusively in life science, characterised syndication partnerships as regularly occurring on a case-by-case basis. Overall, the importance of syndication partnerships as a form of collaboration with large corporations was coded 47% No, 33% Yes Weak, and 20% Yes Strong.

Likewise, collaboration between venture capital firms and large corporations involving corporate spin-outs was relatively rare among the venture capital firms interviewed. The firms cited particular challenges associated with spin-outs and pervasive scepticism about the quality of spin-outs as investment opportunities. The importance of spin-outs was coded 40% No, 43% Yes Weak, and 17% Yes Strong.

The summary findings indicate a collaborative activity with foundations of extensive informal and formal business networks. However, and somewhat surprisingly, more formal structures, particularly co-investing activity between venture capital firms and large corporations, is less frequently employed (some reasons will be more fully explained in Chapters 6 and 7).

The following sections contain a more detailed look at the four types of collaborative structures employed, with an emphasis on how these structures are used by venture capital firms investing in different sectors. This sector comparison begins to illuminate the connection between the formality of collaboration and the level of science and technology intensity of a given sector.

Prior to discussing this connection it is important to clarify several contextual factors confirmed through the interviews that may contribute to the findings presented here and those of proceeding chapters. First, many of the venture capital firms interviewed confirmed that they had moved or were in the process of moving away from early stage investing, placing an increasing amount of their funding into more established (later stage) portfolio companies because of the severe downturn in the economy. The implication is that later stage firms need fewer inputs of specialised knowledge and less frequent oversight; thus, any related collaboration is less formal. Second, a number of interviewees, particularly those engaged in clean tech, described their funds as relatively “young” (i.e. the overall

fund had been active for only 2 to 5 years with few to no exits having yet occurred). This implies that for such funds formal collaboration may not yet have had the opportunity to mature, thus prompting the comparable lack of formal structures coded for.

Finally, the findings suggest some relation between venture capital firm size, the size of the overall fund, and the extent or degree of formalisation for collaboration with large corporations, although this connection, using these initial findings, is difficult to ascertain. A probable connection is that larger venture capital firms have higher propensities for formal collaboration than those of modest size. The contribution of these factors toward collaboration between venture capital firms and large corporations, although considered here, are further developed in Chapters 6 and 7.

5.2. Business Networks

The first type of structure employed by venture capital firms for interacting and collaborating with large corporations (probably viewed more accurately as a mechanism) explored through the interviews is a *business network*. Business networks can be described as socioeconomic interactions among three or more individuals within the same professional context that are engaged to exchange and act on information related to commercial opportunities (see Chapter 2). Such networks can range from informal interaction between an individual and several professional contacts, to informal or semiformal interaction through a website interface, to a face-to-face gathering or a community of professionals interacting through a formal business network organisation (e.g. professional associations, industry meetings, and conferences). Again, from the findings below, the use of business networks as a mechanism for collaboration is the most significant structure coded for, lending support to the idea that informal interaction between venture capital firms and large corporations lead to more formal collaborative structures. Findings for business networks, by sector, are shown in Table 9.

Again, venture capital firms that described both informal and formal business networks as very important for facilitating collaboration with large corporations were coded as Yes Strong; firms attributing importance to either one or the other

(informal or formal business networks) were generally coded as Yes Weak. Importantly, not one venture capital firm is coded as No for the use or importance of business networks for collaboration with large corporations. In comparing differences between sectors, venture capital firms investing inclusively in life science are coded 100% Yes Strong. Those venture capital firms investing primarily in information technology were coded 33% Yes Weak and 67% Yes Strong, respectively. Likewise, those venture capital firms engaged heavily in clean tech are coded 40% Yes Weak and 60% Yes Strong.

Table 9: Relative Significance of Business Networks by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	0	0	0	**0**
YES WEAK	33	0	40	**27**
YES STRONG	67	100	60	**73**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

As quoted earlier in the summary findings, business networks along with other forms of collaboration facilitate the exchange of information regarding current and potential investments, informing investment decisions, and strategy (to be explained in detail in Chapter 6). All venture capital firms interviewed described business networks, at their core, as interactions between individual venture capital firm partners and their corporate contacts. Three mechanisms, in particular, were described by interviewees as contributing to the facilitation and development of these business networks: (1) past industry (corporate) experience and ties of venture capitalists, (2) initiative by venture capital firms to facilitate relationships between venture capital firm partners and corporate contacts, and (3) outreach efforts by large corporations geared toward building relationships with venture capital firms. Past industry ties were the more critical for the exchange of valuable information, whereas initiative and outreach efforts were important for catalysing relationships between large corporations and those venture capital partners with less past industry experience.

A venture capitalist at a life science-focused venture capital firm explained the importance and extent of past industry ties in facilitating collaboration between venture capital firms and, in this case, large pharmaceutical companies, ties that extend high up the corporate hierarchy:

> We've got the links to very senior levels. I know almost all the heads of R&D at all the Big Pharma companies, just because of my background. So we do have extremely strong links into pharma, and that is critical to our success. If you look at our partners (venture capitalist), almost all have had very senior positions in pharma. So I came from Big Pharma, as do most of the partners here and in our U.S. offices. And we have a bunch of what we call part-time venture partners, almost all of whom, especially those dealing in therapeutics, have had senior roles in Big Pharma. So the Pharma relationship is almost embedded in what we do, because most of us have come from Big Pharma.

This comment, and similar comments made by other interviewees, corresponds to collaborative activity, as described in the literature, based on common industry affiliation and complementary aims and built on experienced-based trust (Arrow, 1974.). The other important point, emphasized by this and other comments, is how completely integral this type of collaboration is for the majority of UK venture capital firms, being "almost embedded" in what they do. The importance of business networks, based on past industry ties, transcends sectors, although it is felt more acutely by those venture capital firms investing in life science and clean tech. An interviewee at a clean tech-focused venture capital firm commented:

> I would say that many if not most of us in clean tech have worked for the big corporates, and we use these connections regularly; they are very important for informing investment strategy and for building corporate partnerships which, in turn, are very important for our investee companies.

The importance of business networks was felt by those interviewees working for information technology-focused venture capital firms, but the emphasis on past corporate ties to facilitate these networks was not shared. For these interviewees past entrepreneurial experience was a more common career characteristic of venture capital partners than past corporate experience. That being said, many of these interviewees described frequent interaction between themselves and representatives of corporate venturing divisions at many of the largest global

computer and information technology players (e.g. Microsoft, Oracle, Intel). An interviewee at an ICT focused venture capital firm commented:

> We have a lot of contact with the big IT players. More recently, they have been much more open and aggressive in contacting us, and it really is helpful for us in seeing what their pipeline needs are and what they might be interested in.

Such comments indicate collaboration in which certain potential barriers, such as a lack of corporate ties and experience, are likely overcome by both parties' need to collaborate. However, collaboration, occurring even in this absence of direct corporate experience, may also indicate that information technology as a sector needs fewer resource inputs, leading to less formal collaboration between venture capital firms and large corporations.

Second, the importance of these business networks between venture capital partners and contacts at large corporations is well-recognized by the venture capital firms themselves. Several interviewees described firm-based initiatives to coordinate relationship building between their partners and large corporations. An interviewee at a life science-focused venture capital firm explained:

> We also have another big drive, this internally, to getting the right contact within the pharmaceutical company. It is very important to speak to the right person when formalizing a licensing deal. You need to know who the actual person is who makes the decision on the licensing deal. These deals can take a very long time, so knowing the right person is critical; you could end up talking to 20 different people and getting nowhere. Getting in contact and getting to know these right people is very important. So here, we have a program that involves maybe the top 20 pharma/biotech companies, and it is split among the partners, and it is their responsibility to go and build these relationships, probably meeting individually, seeing what they are interested in, what they might want to spin-out.

The third mechanism for facilitating the development and use of business networks is industry meetings or conferences sponsored and run by large corporations, often in conjunction with industry network organizations. In connecting the use of industry meetings in facilitating collaboration with large corporations the same interviewee above from a life science-focused venture capital firm continued:

> All the major pharmaceutical companies, they set up these functions in Europe and the United States; we've been to all of these. So what we do is

> collate the information. I'm in charge of all of this; I set up a spreadsheet indicating who is interested in what and who is not interested. That information, for us, is actually really useful. Obviously, if you have a product in phase 2 then everybody will be interested, but sometimes when you have something that is a bit more niche, it is important to go and target the firms, because you don't want to go out and sell your products to everybody — that is not how it works. However, if you have something really interesting, often everybody comes to you. But these industry meetings have been quite a new thing …. And in fact, just last week there was this big conference in San Francisco that JP Morgan sponsored that is probably "the" biotech conference of the year. Everybody in the biotech world is there, all the Big Pharma players, all the biotech companies, all the investors, the bankers, the lawyers, headhunters, everybody is there, 10,000 people attend this conference. And we spend all week talking to Big Pharma. We use it as a mechanism to meet Big Pharma corporate players.

The use of industry meetings and conferences, as described above, to catalyze relationships with large corporations was noted by just about every venture capital firm interviewed — transcending all three sectors. Such meetings were described as occurring in London and the LMR more generally, particularly in and around Oxford and Cambridge, as well as globally, frequently in the United States (California and Massachusetts in particular) and more recently in Asia. However, the importance of these meetings was particularly felt by those firms engaged in life science and clean tech. The likely reason for this is that, in the case of life science, the number of key corporate players is smaller than in other sectors, creating higher barriers of entry in the life science sector.

Some interviewees were skeptical concerning the relevance of industry meetings in building corporate relationships. When asked whether industry venture meetings were important for collaboration with large corporations, an interviewee at an information technology-focused venture capital firm replied:

> There is so much interaction and partnering anyway, I'm not sure. Other people might do things differently. I think there is a lot exaggeration, talking it up! Often it is just through your investment pool, which generally has industry folks. We have made introductions that way. But I have not seen as much as what appears to be talked about — some level of skepticism needs to be applied.

This comment is notable because it reiterates the importance of personal corporate contacts as the primary mechanism through which venture capital firms develop and maintain relationships with large corporations, and it also hints at the use of

corporate relationships as a means of building a venture capital firm's reputation within the venture capital community. Most notably, however, is the skepticism toward industry meetings as meaningful venues for collaboration purposes. Many of these meetings were described as being sponsored or organized by industry or related network associations, the importance and recent proliferation of which were questioned by a number of interviewees:

> There are too many of these network organisations; to be effective they need to be better coordinated. Otherwise, I can't see much use for them. I mean, I can see how they might be useful to those with less industry experience; these relationships need to start somewhere. But for me, the interaction comes through my own contacts.

This lack of coordination concerning network organisations corresponds to findings in the literature regarding broader innovation networks and clustering. With findings here placing an emphasis on the importance of establishing and developing the right contacts, policy might focus on better coordinating and streamlining the collective efforts of regionally based network organisations, more effectively facilitating the establishment of quality contacts that can better lead to the development of more formal collaborative relationships between venture capital firms and large corporations.

5.3. Strategic Partnerships

The second structure explored through the interviews is a *formal strategic partnership*. *Strategic partnerships* can be defined as formal but not legally binding agreements between two parties, often commercial and generally in the same industry, to facilitate knowledge and resource sharing toward common objectives (Hagedoorn, 2002). As formal agreements, strategic partnerships differ from business networks in that they will probably be negotiated, authorised, and implemented at the executive level of the firm and often are publically promoted as a strategic asset. For venture capital firms, strategic partnerships with large corporations might involve a combination of activities ranging from the exchange of information regarding corporate pipeline needs, new portfolio companies, and overall industry dynamics (informing investment decisions and strategy) to placing corporate representatives on the venture capital firm's advisory board or on the

boards of individual portfolio companies. Findings for corporate strategic partnerships are shown in Table 10.

Table 10: Relative Significance of Strategic Partnerships, by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	11	0	0	**6.7**
YES WEAK	56	0	20	**36.7**
YES STRONG	33	100	80	**56.7**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (*N*=30)**

The findings place strategic partnerships as the second most frequently employed structure for collaboration behind business networks. Formal strategic partnerships with large corporations were described as important and frequently used by roughly half the interviewees. This is not all that surprising, given that strategic partnerships were expected to build on the experience and trust established through business networks, encompassing a variety of more formal relationships between venture capital firms and large corporations. However, the propensity for venture capital firms to engage in strategic partnerships with large corporations outside the life science sector is somewhat weaker than expected. Venture capital firms investing exclusively in life science are coded 100% Yes Strong, showing a high propensity for using strategic partnership with large corporations in this sector. In contrast, venture capital firms investing heavily in information technology are coded 11% No, 56% Yes Weak, and 33% Yes Strong. Clean tech focused venture capital firms, however, are coded comparably higher, at 20% Yes Weak and 80% Yes Strong.

Importantly, though, strategic partnerships were the most difficult structure for collaboration to code for: no particular model dominated, with the use of strategic partnerships involving a number of diffuse arrangements. Nor was it clear, in all cases, how formal these strategic partnerships were. A number of interviewees described strategic partnerships with large corporations as being loosely coordinated at the executive level of the venture capital firm, and then often carried out by individual venture capital firm partners. Other interviewees

described very little firm-wide coordination, with the maintenance of strategic partnerships being the responsibility of the individual partners. Yet interviewees still described such arrangements as “strategic partnerships,” and they were coded accordingly.

For the majority of strategic partnerships described in the interviews, venture capital firms have a number of nonbinding agreements with a variety of corporate partners, including large corporations that operate in the same sector as the venture capital firm, leading investment banks and accounting firms, and major consulting outfits. Some venture capital firms promote these strategic partnerships on their websites as “our strategic partners” and claim that they add value to their operations. This promotion seems aimed at both investors and potential investee firms. The general function of these strategic partnerships, as briefly articulated during this structure phase of questioning, is to exchange information and expertise regarding specific portfolio companies, industry trends, and due diligence, and to bolster a venture capital firm’s reputation. These functions and others are extensively discussed and analysed in Chapters 6 and 7.

As to whom venture capital firms are interacting with through these strategic partnerships, the interviews indicated a mix of corporate R&D personnel, corporate venture capitalists, and corporate executives (more commonly top-level management). However, corporate contacts in product development and at the executive level or in top management seemed to hold the most relevance regarding the value of the strategic partnership. As one interviewee at a life science-focused venture capital firm described:

> We work very closely; we meet with their PD [product development] people quite frequently to discuss opportunities in our portfolio, for licensing agreements and for acquisitions. We have close relationships with their R&D people, etc.; we have very strong, ongoing relationships.

Likewise, an interviewee at an information technology-focused venture capital firm commented:

> So it is important, but primarily it is important for the exit, and corporate venture groups tend to play a relatively minor part in that, because really we are selling a set of assets and capabilities to an organization. It is the

> functional representatives of that organization that need to buy in and want whatever we got.

There are two points to consider from the comment above, both of which will be discussed in greater detail in Chapters 6 and 7. First, strategic partnerships with large corporations appear to function as a mechanism through which the venture capital firm can position its portfolio firm for an exit via corporate acquisition: selling a portfolio firm to a corporate strategic partner. Second, significant interaction with corporate venture capitalists (i.e. corporate venturing divisions of large corporations) was downplayed by the majority of interviewees, suggesting collaboration where co-investing (i.e. syndication) between venture capital firms and large corporations is less common, and where corporate power resides in the parent company rather than in the corporate venturing division. In other words, a strategic partnership will often involve interaction with a corporate venturing division that lacks significant autonomy from their parent company, which may have implications for collaboration.

Within these strategic partnerships the venture capital firm does seem to play an intermediary role, exchanging information with a corporate partner and then relaying it to portfolio companies. An interviewee at a life science-focused venture capital firm explained:

> Well, first all, we supply this information to our portfolio companies — their development people. So it is not just used by us. I mean, clearly we are not going to give out anything confidential, but portfolio companies will know what big firms are interested in what. That is also useful for them if they have a meeting with a large corporate for something else; they all know that they are actually interested in a particular area. So we don't just supply them with the information, but we also consult with them on approaches and strategy for meetings with corporate partners.

Alluded to in this comment is the often cited role of the venture capital firm in actively assisting their portfolio companies in making connections to large corporate players. This is seen in the literature as a primary function of venture capital firms as active investors and as crucial for the business development of NHTCs (see Chapter 3).

Along these same lines, a common activity facilitated through strategic partnerships is the placing of corporate representatives on the advisory board of the venture capital firm or boards of specific portfolio companies. An interviewee at an information technology-focused venture capital firm explained:

> I was just at a meeting (with a corporate partner) where I walked them through the process of VC investment. One person (a corporate representative) asked if they could sit on a board of one of our portfolio companies. It had to be a firm where there was no direct interest. He met the directors of a firm and agreed on this arrangement. He comes to all the meetings, reads all the papers, and gives his input — it has worked very well. Building these relationships is very important to us.

In most instances, even when a corporate representative sits on the board, the involvement of the corporate partner in decisions regarding venture capital firm strategy or portfolio firm development was described as fairly hands-off, although the input of a corporate board member is often used by the venture capital firm in their valuation of a portfolio firm from one investment round to the next. An interviewee at life science-focused venture capital firm commented:

> Actually, they tend to be very passive. Quite often they might have observer seats; if they are on the board, they aren't aggressive. Sometimes it is very good to have one of these people on the board, because in a sense they set the price when going into the next round. That price has to be set externally. They know the company because of this interaction, and they are the market, so they can set an accurate price going into the next round; there is price validation.

Again, the interaction between the venture capital firm and the corporate strategic partner, as with almost all collaboration involving large corporations, is generally facilitated through individual venture capital firm partners and their corporate contacts rather than through the executive level of the venture capital firm. Occasional meetings are held between venture capital firm partners and their corporate contacts, and information is exchanged. But decisions ultimately are made and carried out by the venture capital firm without intimate corporate involvement, indicating a type of collaboration in which flexibility is desired and less formal structures are the norm.

In moving from less formal to more formal collaborative structures, a number of factors need to be considered. A common sentiment expressed by interviewees is

that with formality comes increasing risk associated with both increased commitment on the part of the venture capital firm (a lack a flexibility about an inherently uncertain investment) and a loss of control (less ownership stake and more limited exit options); these are risks that not all venture capital firms are willing or able to assume. As an interviewee at a clean tech-focused venture capital firm explained:

> There are two different types of collaboration. One is having investment collaboration, and two, the businesses themselves collaborating [investee firms collaborating with large corporations]. The major concerns are about the investment collaboration. That is quite different from the businesses themselves having partnerships. In the commercial collaborations where they ultimately become a customer or have a license agreement, there is a scale, a continuum of arrangements of different business models. You have the distribution model, where you just sell to them and they sell it on, to a kind of co-development model, partnership or 50-50 of everything. It is interesting — the really, really big ones that have huge amounts of money to spend, I think that have lots more models for financing businesses, they have loads of money and can afford to take the optimal model in my point of view, which is put lots of money in so the business is self-financing, you control that and assume the risk, go year-to-year with the next round of funding based on achieving certain things. Any partnering they do, they don't need for cash flow, if you do a major deal with a big backer, you only do it for strategic purposes; you don't need the cash. So they do deals that are very back-ended; they don't need the money up-front. The idea being, if the product is successful, that royalty stream is so expensive for the corporate, that it makes entire sense to buy the company — great exit strategy for us [venture capital firm]! If you have the funds to do that type of thing, then that is how it should work. If you don't have those types of funds, then partnering is a way to strike a balance to get those funds, but it does come with some costs.

The costs associated with more formal collaboration, according to the above statement, are better managed by larger, better funded venture capital firms. Notions of obstacles and challenges as they relate to collaboration between venture capital firms and large corporations will be discussed in detail in Chapter 7. The implication, however, is that engaging in more formal collaboration with strategic corporate partners may bring a venture capital firm — one that is able to manage the associated costs — more valuable strategic benefits.

5.4. Syndication Partnerships

The third type of structure employed by venture capital firms to collaborate with large corporations is a syndication partnership. Syndication partnerships, in the context of venture capital, are formal contractual agreements between two or more investment entities (e.g. venture capital firms) to co-invest in an individual portfolio firm or group of portfolio companies within the same investment round (see Chapter 3). Syndication partnerships are more formal than strategic partnerships in that, among other things, they involve the contractual transfer of investment funds (Lockett & Wright, 2001). Unlike in a limited partnership, each syndicate partner shares in the risk of the investment, including profits and any accruing losses. It is assumed that syndication involves not only the sharing of funds but also the sharing of information regarding investment selection and strategy (Gompers & Lerner, 2004). Findings for syndication partnerships between venture capital firms and large corporations, by sector, are found in Table 11.

Table 11: Relative Significance of Syndication Partnerships, by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	72	0	20	**47**
YES WEAK	22	29	80	**33**
YES STRONG	6	71	0	**20**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

Based on the findings, the use of syndication partnerships as a form of collaboration between venture capital firms and large corporations is less common than either business networks or strategic partnerships. It was expected that syndication partnerships would be employed less often than other forms of collaboration due to the greater formality involved. However, it was thought that the use of syndication partnerships would be more aligned with the findings on formal strategic partnerships as a mechanism for building capacities for more formal syndication partnerships. In comparing sectors, those venture capital firms investing exclusively in life science are coded 29% Yes Weak and 71% Yes Strong. Again, life science-specific venture capital firms showed a higher

propensity for formal collaboration with large corporations compared with firms investing in either information technology (coded 72% No, 22% Yes Weak, and 6% Yes Strong) or clean tech (coded 20% No and 80% Yes Weak).

As the findings indicate, those venture capital firms investing specifically in life science had a higher propensity to engage in syndication with large corporations than those investing in information technologies and clean tech, adding support to H1, which proposes that the more science and technology intensive the sector of investment, the greater the propensity for more formal collaboration. Interviewees described much of the formal syndication partnerships with large pharmaceutical companies as occurring through interaction with the corporate venturing and CVC divisions of these large companies. An interviewee at a life science-focused venture capital firm explained:

> A number of pharmaceutical companies have their own venture funds, and we work with many of the major pharma players; they have their own funds in house, and indeed they are syndicate partners with us in a number of our investments. We work very closely with their R&D people; we frequently meet to discuss opportunities in our portfolio — investment opportunities — and in potential spin-outs. This might also include discussion on possible licensing agreements and acquisitions.

Another interviewee at a life science-focused venture capital firm stated:

> Syndication with Big Pharma does happen. Big Pharma do engage in venture portfolio funding, sort of a venture capital fund, if you like, and they do invest in many of our portfolio companies, and they do their investing along-side us.

When syndication or co-investing with large corporations was noted as having occurred or as being a relatively common arrangement (a minority of those firms interviewed), the syndication structure employed was described as similar to syndication arrangements between venture capital firms. In these instances the preference of the venture capital firm was for the large corporation to enter the syndication at the early stage and remain as a syndicate partner in that investment through to the exit stage. The interviewee quoted immediately above went on to comment:

> That is the ideal situation and expectation. When we build a syndicate, we want our syndicate partners to be with us right through. And in fact, in the term sheets/agreements we have pretty stringent pay-to-play provisions. So it is a worry for us. We don't want syndicate players who don't follow their money; this includes syndication with Big Pharma.

That being said, syndication involving a large corporation was more commonly described as occurring during the later stages of the investment cycle, as the preference of the corporate partner, rather than at early or expansion stages, indicating a formal collaborative structure in which the optimal arrangement is often difficult to achieve. Similarly, an interviewee at another comparably smaller life science-focused venture capital firm expanded on the above notion:

> Yes, you do have situations when a company comes in as a co-investor, but that is something that we as a small fund would be very wary of — but not always. It depends on the circumstances and whether that partner could acquire the company in the end. I have come across a situation where a pharma fund had pharma people on the board, but they were beholden to the pharma company and thus were constrained in raising additional funds. Pharma ended up buying the company when the negotiating level was very low — the [venture capital] fund lost out. So you have to be very careful. They just sort of get in the way; they can stall you and then pick you up on the cheap. You want to avoid this kind of situation.

The above comment adds to earlier suggestions that smaller venture capital firms — those with less capitalisation — generally forgo more formal collaboration with large corporations, preferring a more flexible path. Findings regarding when collaboration takes place in relation to the venture capital investment cycle, and the challenges involved, are confirmed and discussed in more detail in Chapters 6 and 7.

Outside the life science sector, syndication between venture capital firms and large corporations is rare. However, this does not imply that these venture capital firms are not engaged in investment partnerships with large corporations. The difference is that these partnerships do not follow a syndication model of equally shared risks or the significant involvement by the non-lead partner (e.g. corporate partner) in the strategy and monitoring of either the fund or individual portfolio firm. The large corporation is essentially a limited partner. An interviewee at an information technology-focused venture capital firm commented:

> We do have corporations, through their corporate venturing divisions, that may have equity investments in our companies, but in those circumstances it is unusual for a corporation to take an active role in the company at all…. Certainly, if someone were to come along and ask us if we could run a fund for them that would be parallel to our funds and that would invest in selected things, then that is something we would consider.

Likewise, an interviewee at a different information technology-focused venture capital firm said:

> We have corporate investors who invest directly into our funds, and we have been approached by corporations now to develop some very specific strategic funds with them, to help them. So it is a major ongoing activity these days, and relationships between us and corporations on various levels are very strong, and we work with them to build these relationships.

Most notable in the comments above is the mentioning of what are commonly referred to as dedicated funds: an arrangement in which a venture capital firm sets up and manages an investment fund for which a large corporation is the sole investor. Several interviewees mentioned that dedicated funds had been employed in the past with varying degrees of success, but not one of the 30 interviewees described such funds as active or as being planned. Yet even in the absence of such structures, the majority of interviewees, like those above, spoke of an openness and anticipation to such deals and a willingness to work toward more formal collaborative arrangements with large corporations. However, it is clear from the findings that for venture capital firms, moving from less formal to more formal collaboration with large corporations, particularly syndication deals, necessitates that the interests of the two parties are relatively aligned. In discussing the complexities of the syndication process, an interviewee at an ICT focused venture capital firm explained:

> When forming a syndicate, if we are leading the financing [lead investor], then we generally have control over the formation of the syndicate — getting the right people in for additional rounds — making sure that the syndicate partners have the same interests. So when you are trying to form the next round of financing, you are not all fighting about what the price should be. Looking to exit, the higher price is desirable; but if you are looking to raise more money, you might want a lower price, showing prospects for growth. It is not a simple process of just getting as much money as possible, for instance. So you want to make sure that all the investors are aligned in their interests, and that just means that everyone

involved wants the same thing for the company, making it easier going forward.

Aligning the potentially competing interests of venture capital firms and large corporations is probably the most significant obstacle facing more formal collaboration between these two actors. However, Chapters 6 and 7 show how these interests are becoming increasingly complementary and perhaps more supportive of collaboration. For now, however, the challenges associated with collaboration, particularly the aligning of interests, are effectively illuminated in the context of collaboration between venture capital firms and large corporations as it relates to the corporate spin-out.

5.5. Corporate Spin-Outs

The fourth type of collaborative structure explored in the interviews involves investment arrangements associated with *corporate spin-outs*. A spin-out (often referred to as a spin-off) is an independent business that has been intentionally separated (spun-out) from the core organisation. This differs from another definition of a spin-out, which refers to entrepreneurs formally employed by an incumbent firm starting their own businesses. In most cases, a spin-out will take personnel, intellectual property, technology, and often a specific product from the parent company (Tidd & Barnes, 2000). Spin-outs may have strong strategic connections to the parent company, or the relationship may be more hands-off. For venture capital firms spin-outs represent another possible investment opportunity as portfolio companies. The expectation is that a venture capital firm's investment in a spin-out will involve some level of collaboration with the parent company, usually a large corporation. It was thought that spin-outs could be very formal, perhaps involving a syndication partnership between the venture capital firm and parent company. On the other hand, the spin-out might be less formal, involving very little collaboration between the venture capital firm and the parent company. Findings for collaboration between venture capital firms and large corporations associated with corporate spin-outs are found in Table 12.

Somewhat surprisingly, collaboration between venture capital firms and large corporations associated with corporate spin-outs is the least common form of

collaboration coded for. Although spin-outs are expected to involve considerable formality and collaborative complexity, they also can be thought of as an obvious investment opportunity for venture capital firms. Indeed, they are thought to be a more common form of venture capital investment than the findings here indicate. Importantly, the findings should not be interpreted as an indication of limited venture capital investment in spin-outs, but rather as a lack of collaboration between venture capital firms and large corporations in relation to spin-outs. In comparing sectors, those venture capital firms investing exclusively in life science are coded 43%t Yes Weak and 57% Yes Strong, continuing a pattern in which life science-specific venture capital firms are more formally engaged in collaboration with large corporations than are other sectors. Those venture capital firms engaged heavily in information technology are coded 56% No, 39% Yes Weak, and 6% Yes Strong. Likewise, those venture capital firms investing exclusively in clean tech are coded 40% No and 60% Yes Weak.

Table 12: Relative Significance of Corporate Spin-outs, by Sector

	IT	**LIFE SCIENCE**	**CLEAN TECH**	
NO	56	0	40	**40**
YES WEAK	39	43	60	**43**
YES STRONG	6	57	0	**17**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

Interviewees described two types of corporate spin-outs. The first involves a large corporation spin-out of a technology or product team with the aim of better developing that product through an external business in which the parent company will often invest knowledge and capital. Venture capital firms view such a spin-out as a potentially valuable investment opportunity because the spin-out has the assumed backing of the parent company (i.e. the parent company is invested in the success of the spin-out). For the venture capital firm investing in such a spin-out, collaboration with the parent company, typified by significant corporate involvement, was described by interviewees in this study as both “formal” and “ideal” from an investment perspective. An interviewee from a life science-focused venture capital firm explained:

> There are some circumstances and certain deals where at the outset, say if a Big Pharma is spinning out something that we then take on, that the corporate venture groups of that company would get involved, and they could make an investment on the back of an asset that they know about. And that has been done with one of my companies where we actually hard-wire in a deal with that company at the beginning. So, that is a very easy one to handle.

In the second type of spin-out described by interviewees, a large corporation spins out a technology or product (but usually not the product team) because they have not yet identified a particular need for it, so continued development costs are not yet justified, or other projects take priority due to changing pipeline needs. There could be any number of possible reasons. That the development or product team is retained is, according to some interviewees, a decent indicator as to the large corporation's lack of interest in the spin-out. In such instances the parent company generally takes a very hands-off approach to the spin-out — a "let's see what happens" attitude. The spin-out then becomes a riskier investment for the venture capital firm. The same interviewee from a life science-focused venture capital firm continues:

> The flip side is when they just spin something out. Now, these are tricky for us to do, because for these products, you need to determine why they spinning them out. Sometimes it is generally the case that they don't have the dedicated in-house resources to carry it out — developing the products — and they think that someone else can do a better job, developing it faster, cheaper, and they keep an option to it later on. This does happen. With a company I worked on, it was the technology that they did not think was interesting, so they spun it out, and we developed it, and a different corporate bought it. We made a lot of money, and it is still doing well. You need to be careful though; a lack of corporate interest might signal a lack of quality [in the spin-out], so it can be very tricky.

The experience of most interviewees was that spin-outs are generally of the second type; that is, they are spun-out due to a lack of corporate interest and thus must be approached with certain amount of skepticism regarding quality. This does not mean that the interviewees were not investing in spin-outs. But there was a pervasive attitude in the interviews that spoke of wariness and caution regarding spin-outs. An interviewee at an information technology-focused venture capital firm commented:

> We've been involved in a number of spin-out deals, some successful, others not so. Sometimes it feels like they just unload these things [spin-outs]. The ones that have corporate backing are ideal; we prefer this, but that is just not always the case, so you need to be careful. Sometimes they say they have corporate backing, but it might be just talking it up. As an investor, you need to ask yourself: Why are they spinning this out? The spin-out might very well be junk!

Considering these comments, corporate spin-outs illustrate not only the importance of aligned interests when it comes to collaboration between venture capital firms and large corporations, but also the inherent tension and the resulting balance that is sought between the need for flexibility and the need, at times, for formalization when investing in and developing NHTCs. With most of the structures for collaboration explored in this chapter, the desire for significant flexibility on behalf of the venture capital firm seems paramount. This need for flexibility drives, in part, the preferred model of less formal collaborative structures between venture capital firms and large corporations. Therefore, the example of the corporate spin-out is interesting in that the more valuable and preferred spin-out arrangement, as described by interviewees, is one in which the parent company (large corporation) is heavily involved in the development of the spin-out. Increased corporate involvement might very well cause secondary problems for the venture capital firm participating in the spin-out (as discussed in more detail in Chapter 7), but the willingness of the venture capital firm to trade some flexibility (in some cases considerable flexibility) for enhanced investment confidence in the said spin-out is informative.

In considering the structures coded for, including corporate spin-outs, the findings clearly indicate that those venture capital firms investing specifically in life science show a higher propensity for engaging in formal collaboration with large corporations than those engaged in information technology or clean tech. Again, on a structural level this seems to support the main hypothesis of this chapter (H1), which proposes that the more science and technology intensive the sector of investment, the greater the propensity for more formal collaboration. This is based on the notion that formalisation is necessary to secure specialised inputs of knowledge and resources, expected to be comparably higher in life science than in other high-tech sectors. The full basis of this hypothesis, though, is not confirmed

here. Although uncertainty and the related need for investor confidence are noted, the role, if any, that sector-specific inputs play in the careful balancing act between flexibility and formalisation remains inconclusive, and will be addressed in the next chapter.

5.6. Collaboration, Co-location, and the LMR

Given the importance that geographic proximity and face-to-face interaction holds for venture capital investment and related monitoring activities (e.g. investment syndication behaviour), it was thought that some degree of geographic proximity between venture capital firms and large corporations would be a precondition for collaboration between these two actors, or for at least some aspect of the collaboration process (see Chapters 2 and 3; see Florida & Smith, 1991). The tendency for large corporations to locate their R&D centres and corporate venturing divisions in innovative regions, including the LMR, reinforced such expectations (see Chapter 3). In this way, it was thought that some degree of co-location of these two actors in the LMR would both facilitate face-to-face interaction and subsequent collaboration between them, and that the LMR itself would reinforce this collaboration through its capacities for innovation and knowledge exchange. In assessing the relevance of geographic proximity for collaboration as proposed by (H4), this chapter first connects propensities for certain collaborative mechanisms and structures to the importance of face-to-face interaction. This is followed by a discussion on how interviewees (VCs) interpreted the role of co-location and the LMR in facilitating collaboration with their corporate connections and partners.

5.6.1. Geographic Proximity and Face-to-Face Interaction

First, the propensity of venture capital firms to use both *personal* and *business networks* to initiate and maintain collaborative relationships with large corporations would seem to be a clear indication that some degree of geographic proximity is necessary for facilitating such relationships. With information being exchanged regarding complementary assets, as some interviewees implied, and with much of this information understood as tacit in form, it is almost certain that some face-to-face interaction, even if not taking place regularly, will be required to

facilitate this information exchange. Furthermore, with many of these relationships, as described by interviewees, built initially on the past industry ties of venture capitalists, the use of face-to-face interaction to either strengthen or maintain a necessary degree of trust between parties, would seem preferred, if not integral.

Therefore, face-to-face interaction should be particularly important for VCs without significant industry experience or connections, not only for initial introductions, but, just as for more experienced VCs, for follow-up discussions regarding possibly proprietary and confidential information about corporate pipeline needs and complementary portfolio companies. In this context, the sizable number of interviewees who stressed the importance of industry association meetings and conferences for initiating and maintaining relationships with large corporations, particularly for those VCs without significant previous industry ties or contacts, adds further importance to face-to-face interaction in this regard. The fact that many of these meetings and conferences are held in the LMR speaks to not only of the LMR as a centre of innovative activity and venture capital investment, but also to the importance of local industry networks and related intermediaries, in this case industry associations, in bringing complementary actors together. Such notions also demonstrate that large corporations have an active presence within these local networks, hinting at a supposed co-location dynamic within the LMR between the local venture capital community and large corporations.

Furthermore, for those venture capital firms engaging large corporations in strategic partnerships, some degree of geographic proximity between the venture capital firm and large corporation, or at least a corporate representative, would appear to be necessary. For example, a number of interviewees described strategic partnerships involving the placing of corporate representatives on the boards of directors of both individual portfolio companies and on a venture capital firm's scientific advisory board. The literature on venture capital board member makeup clearly suggests that most board members reside within close geographic proximity of the portfolio companies or venture capital firms on whose boards they sit, geographic proximity facilitating the board's critical monitoring activity of

portfolio companies (see Chapter 3). Therefore, it is assumed that corporate representatives appointed by venture capital firms to sit on respective boards will reside in close geographic proximity to either the respective venture capital firm, the portfolio company, or both.

Likewise, for those venture capital firms engaging in investment syndication partnerships with large corporations, some degree of geographic proximity between the parties would seem to be required given the assumed need for regular face-to-face interaction in coordinating monitoring activities and exchanging relevant and likely specialised information and knowledge regarding investment decision making and the evaluation of portfolio companies. Indeed, as some interviewees indicated, regular meetings between VCs and corporate R&D heads and scientists was a common occurrence in the life science sector where syndication partnerships are more prominent. Finally, in instances involving venture capital investment in a corporate spin-out, it is assumed that face-to-face interaction, thus some degree of geographic proximity, would be important between the venture capital firm (as lead investor) and the large corporation (as the parent company), particularly when there is strong corporate interest and thus corporate involvement in the monitoring of the spin-out. Furthermore, it is assumed that most spin-outs will locate within close geographic proximity of both the lead venture capital investor and the corporate parent company because being close to the parent company allows the spin-out better access to corporate expertise and supply chains.

Overall, when looking at the findings regarding the structures and mechanism for collaboration between venture capital firms and large corporations, geographic proximity would seem to play an important role, particularly in facilitating face-to-face interaction between the two parties. The question, then, is whether co-location within the LMR is advantageous or necessary for these productive face-to-face interactions between venture capital firms and large corporations to occur.

5.6.2 Co-location or Regional Capacities?

Initial interview questions regarding the role that geographic proximity plays in facilitating collaboration between venture capital firms and large corporations

focused on the significance of co-location within the LMR and to the advantages that the LMR held in this regard. In other words, the line of inquiry focused on whether co-location within the LMR facilitates face-to-face interactions between venture capital firms and large corporations toward the coordination and development of collaborative relationships between them. And in what ways does the LMR directly or indirectly facilitate this collaboration, even in the possible absence of any substantial co-location synergies between actors? Importantly, these initial questions did not focus on *when* geographic proximity was most beneficial for facilitating collaboration between venture capital firms and large corporations. Such conclusions are drawn later from the findings in Chapter 6 and the analysis in Chapter 7. Partially as a result, perhaps, answers from these initial questions downplayed the role of geographic proximity, particularly in terms of co-location as a mechanism for face-to-face interaction, while emphasising the importance of the LMR as a centre of innovative activity and international knowledge exchange — regional capacities that, according to interviewees, held relevance for collaboration between the two actors.

According to interviewees, close geographic proximity does play a facilitating role in collaboration with large corporations: all interviewees expressed the need for face-to-face interaction with corporate contacts and partners, which provides some support for (H4). But interviewees stressed that such face-to-face meetings were not as frequent as between venture capital firms, describing much of their interaction with corporate contacts as “over the phone” and “periodic rather than frequent.” Furthermore, although some regular interaction with corporate contacts facilitates the development and maintenance of collaborative relationships, interviewees explained, those corporate contacts do not need to be in constant geographic proximity for these relationships to be initiated, maintained, and leveraged. Likewise, most interviewees commented that although the presence of large corporations in the LMR (e.g. headquarters, corporate venturing offices, and R&D facilities) offers some advantages by facilitating face-to-face contact and adding to the overall investment and innovative milieu, co-location does not appear to be a determining factor in whether collaboration between a venture

capital firm and a large corporation will occur. Regarding geographic proximity, an interviewee at an ICT focused venture capital firm commented:

> I think [geographic proximity] must add something in terms of convenience for going to meetings. I think it is easy to underestimate the burden of being far away and removed. However, the space is global, especially in modeling these partnerships; you don't do the home market first and then expand. The market that really matters is the U.S.; the U.S. subsidizes the rest of the world. We see the U.S. as an 'A' market and Europe being more different markets, although the U.S. can be seen as different markets but with a common language — different drivers, dynamics, and cultures. British companies often fail to realize this when entering the U.S. market; thus, a high failure rate.

That being said, interviewees from life science focused venture capital firms stressed the advantages of having the R&D centres of major pharmaceutical companies located in the LMR for exchanging information with corporate contacts, indicating that some degree of co-location is important for this type of collaboration in the life science sector. This aligns somewhat with (H1), which proposed that collaboration would be more important and more formal when the science and technology inputs required by portfolio companies are high. This argument might be extended to geographic proximity in that the more formal the collaboration, as in a syndication partnership, the more important co-location becomes for coordinating joint investment monitoring and evaluation activities. If this is indeed the case, then overall propensities for less formal collaboration among the venture capital firms engaged in ICT and clean tech may well be contributing overall to the lessened emphasis placed co-location in the findings. In other words, less formal collaboration may require less co-location between actors.

As indicated in the comment above, however, a more important factor contributing to the lower value given to co-location by interviewees might be the global nature and focus of both venture capital investment and related corporate partnerships. In fact, when asked about the importance of geographic proximity in relation to co-location, the majority of venture capital firms interviewed responded (almost immediately) that "this is a global industry" with "global partners" and "global markets" and pointed to the "international flows" thought to increasingly characterise venture capital investment. Furthermore, these responses were fairly

uniform across sectors. An interviewee at a life science-focused venture capital firm explained:

> Local, global, it makes no difference at all. We don't have any particular U.K. focus. We have three main offices: San Francisco, Boston, and London. And we invest in three sectors: pharmaceuticals, medical devices, and healthcare services. Devices and healthcare services are predominately U.S. But therapeutics is done through the London and San Francisco office. So out of the London office we will deal with the East Coast of the U.S. and all of Europe. In San Francisco we deal with all of North America; so along with Boston, we here in London sort of overlap on the East Coast. We see ourselves as a global life sciences venture capital firm: we invest globally. The fact that we are in London doesn't really matter. We could just as easily be in Paris. There is a strong regional element to all of this, but it is not driven by the location of Big Pharma.

This comment, and there were many like it, is interesting in several respects, not least because it shows some contradictions concerning geographic proximity. First, it makes the point that many London based venture capital firms, regardless of sector focus, are investing not only in portfolio companies located in the LMR, but also those located in other innovative regions across the globe. However, the comment also makes clear that London based venture capital firms coordinate with their branch offices, which are located in these innovative regions, to carry out this investment activity. In other words, some degree of geographic proximity between venture capital firms and portfolio companies is still necessary, even if this proximity involves a branch office or regional headquarters.

Second, the comment "the fact that we are in London doesn't really matter — we could just as easily be in Paris" might well be true, but it is doubtful that a venture capital firm would locate to a region that is not considered a centre of venture capital activity. In other words, even if, according to the above interviewee, London itself "doesn't matter" in that there are alternative locations, metropolitan regions such as London (e.g. Paris, Boston, San Francisco) *do matter* when it comes to venture capital investment activity. Furthermore, although co-location by large corporations may not drive the geographic concentration of venture capital investment, they must certainly play a role in anchoring the clusters of NHTCs in these innovative regions. Therefore, it is possible that the importance of co-

location in facilitating collaboration between venture capital firms and large corporations may be more significant than most interviewees admit or realise.

According to interviewees, playing a more significant, if not direct, role in facilitating collaboration between venture capital firms and large corporations — and venture capital related collaboration more generally — is the LMR itself, both as a high-capacity region and as a global gateway. All 30 interviewees stressed the importance of the London region as a magnet for venture capital investment and innovative activity, pointing particularly to "the best entrepreneurial culture outside the United States," robust science and technological capacities (e.g. Oxford and Cambridge), a substantial industry base, and unrivalled financial expertise present in the region. According to the interviewees, these capacities attract global investment, talent, and skills, including large corporations and their corporate venturing divisions, creating synergies and opportunities for collaboration. An interviewee at a life science-focused venture capital firm explained:

> So if you look at the UK, you've got the so-called biotech golden triangle of Oxford, Cambridge, London; and obviously GSK and Pfizer are close, but AstraZeneca is more near Manchester, so I think it has more to do with the academic base, due to the fact that Oxford, Cambridge and Imperial have had tech transfer programs longer than most places, where they have been very effective in creating companies. And then, of course, all of the life science venture capital firms are based in London, along with most of the patent lawyers are here, the banks, so you have a critical mass on multiple fronts. And then, the serial entrepreneur wants to be where there are multiple companies and opportunities — manage personal risk.

Similar comments point to the agglomeration advantages that large metropolitan regions such as London offer individuals, firms, and organizations engaged in innovative activity. An interviewee at a clean tech-focused venture capital firm further expanded:

> It is very important to attract top management to wherever the deals are occurring. One attraction for top management is other opportunities if things go bust. You will have a very difficult time recruiting top management for a company in the north of Scotland because of the lack of other companies. This would be an enormous risk, moving their family, etc. Cambridge is much more attractive because of the cluster. The same can be said about the Oxford cluster, where it is really valuable in the early stage technology area. So this cluster dynamic is definitely important: the more companies you

> have, the more talent you have, the more innovation you have. There is an innovation culture, and we benefit from this.

However, London's global transport links, particularly Heathrow Airport play a more direct role in facilitating collaboration between venture capital firms, large corporations, and collaboration more generally. The LMR is not only a magnet for global knowledge and finance. The region is also highly accessible to these flows (e.g. London is a primary meeting place for venture capital partners and their global corporate contacts and a location for international industry meetings and conferences). In summing up the attributes of the London region, an interviewee at an information technology-focused venture capital firm stated:

> When we are talking about the advantages of London, we are talking about two things. The first is academic; you've got the University of London, Imperial College, and Oxford and Cambridge, all of which are a big advantage to us in that they are all important for new ideas, due diligence, and looking at new companies. One area is that London acts as a magnet. It can't be stressed enough that people flying to Europe often fly through Heathrow. If they have time, they often come into London to see some firms or universities, and they can stop by and see us. It makes setting up and conducting meetings very easy, and we can easily introduce them to others; really helps build our network and helps with our investments. For example, I first set up a company in Cambridge, and an identical company was set up in Kent. We absolutely hammered them!

These findings add to a growing and assumed construct indicating that geographic location and the capacities of the LMR matter when it comes to innovative activity in the United Kingdom, activity in which London based venture capital and large corporations play a significant facilitating role. These initial findings, however, do not identify a direct connection between location and geographic proximity more specifically, and the formalisation of collaboration between venture capital firms and large corporations. That being said, the importance of geographic proximity in facilitating collaboration between venture capital firms and large corporations is probably downplayed in these initial findings and, as shown in Chapters 6 and 7, somewhat contradicts findings associated with why venture capital firms collaborate with large corporations and when such collaboration is most beneficial. The frequency with which the interviewees above mentioned the role of meetings between venture capitalists and corporate contacts coupled with the importance of industry associations and conferences occurring in the LMR as relationship

mechanisms would seem to imply that geographic proximity or at least the presence of large corporations or their representatives within the LMR facilitates the strategic partnerships and less common syndication relationships between venture capital firms and large corporations.

5.7. Conclusion

Findings derived from the interviews demonstrate that collaboration between venture capital firms and large corporations is pervasive, with all 30 venture capital firms interviewed confirming that such collaboration plays a significant and important role in the venture capital investment process. The majority of those firms interviewed also described such collaboration as being more openly pursued and discussed within the venture capital community and related industry networks, with large corporations being increasingly aggressive in courting venture capital firms for collaborative purposes. The foundations for all collaborative structures employed are informal and formal business networks that are based on the past corporate experience and industry ties of venture capitalists, many of whom formerly held corporate positions. Formal strategic partnerships with large corporations were described by roughly half the interviewees as important and frequently used. Such partnerships were viewed as an important mechanism for exchanging information, often through the use of corporate board members. In most instances, however, the involvement of the corporate strategic partner in decisions regarding venture capital firm strategy or portfolio firm development was described as fairly “hands-off.”

More formal collaborative structures involving large corporations such as syndication and corporate spin-outs were described as occurring, but were less common. Syndication was described as the exception, even by interviewees employing strategic partnerships with large corporations. Somewhat surprisingly, instances of venture capital firms collaborating with large corporations on a corporate spin-out were, like syndication arrangements, not all that common. Interviewees cited the need for scepticism about the quality of spin-outs and corporate intentions. The challenges involving formal syndication and spin-out deals with large corporations are discussed in more detail in Chapter 7. However,

the findings presented here do speak to collaboration where obstacles barring the aligning of interests (e.g. differences in strategic aims and culture) may result in the propensity for more flexible and informal collaborative arrangements.

When the three sectors are compared, those venture capital firms investing specifically in life science placed greater importance on collaboration with large corporations and showed a higher propensity to engage in more formal collaboration than was evident in other sectors, although venture capital firms investing in clean tech also showed a propensity for formal collaboration, particularly when compared to firms engaged in information technology. The primary explanation is that for venture capital firms investing in life science, and perhaps clean tech, the science and technology inputs required by their portfolio companies are greater than those in information technology, lending support to (H1) which proposed that *the greater the science and technology inputs required by portfolio companies, the more important and formal collaboration between venture capital firms and large corporations becomes.* This hypothesis is further developed in Chapters 6 and 7.

In assessing (H4), which proposed that *collaboration between venture capital firms and large corporations will be facilitated through both geographic proximity and the capacities of the LMR,* support is more mixed. The findings demonstrate that collaboration between venture capital firms and large corporations is facilitated by geographic proximity in that it enables face-to-face interaction between the two parties, but the importance of co-location in the LMR is surprisingly downplayed. Rather, interviewees pointed to the global focus of their investments, explaining that although co-location made it easier to meet with corporate contacts and partners, it did not offer any decisive advantages in developing and maintaining corporate partnerships. Playing a more significant, if not direct, role in facilitating collaboration between venture capital firms and large corporations and venture capital related collaboration more generally is the London region itself. All 30 venture capital firms interviewed stressed the importance of the London region as a centre for venture capital investment, innovation, and international knowledge exchange.

These constructs and themes are further explored and expanded on in Chapters 6 and 7. With the structures and mechanism for collaboration between venture capital firms and large corporations identified and the role of geographic proximity for this collaboration tentatively established, Chapter 6 looks at the motivations for venture capital firms to collaborate with large corporations, thus presenting a richer, perhaps more complex picture of both the process dynamics of this collaboration and the investment objectives and behaviour of venture capital firms operating in the LMR.

6. The Motivations for Collaboration: from Pure Finance and Deal Flow, to Enhanced Selection and Value Adding

For VC firms it is thought that the commercial development and capacity building of portfolio companies is intrinsically linked to venture capital investment return: developing quality portfolio companies is the surest route to profitable investment exits. It is from this notion that VC firms are thought to provide their portfolio companies with considerable nonfinancial value-added toward their development (Flynn & Forman, 2001; MacMillan, Kulow, & Khoylian, 1989; Sapienza, 1992). In this way, portfolio companies themselves are as much a product of venture capital as are returns to institutional investors. A key mechanism used by VC firms to develop their portfolio companies is collaboration and information exchange with other VC firms via syndication and alliances with other investment partners and connections to local industry networks (Sorenson & Stuart, 2008). This chapter and this research more generally propose that it is from collaboration with these other partners, large corporations in particular, that VC firms seek, obtain, and use significant knowledge and expertise for better investment selection, monitoring, and the capacity building of their portfolio companies, leading to improved investment performance, investment exit, and higher investment returns.

The previous chapter captured the frequency of collaboration between VC firms and large corporations, the mechanisms and structures employed, and the importance of geographic proximity for this collaboration. This chapter presents the second group of empirical findings: the motivations for VC firms to collaborate with large corporations. The purpose of this chapter is to clarify why VC firms collaborate with large corporations and to verify whether this collaboration is used by VC firms to develop the capacities of their portfolio companies.

Questions regarding motivations for collaboration are derived mainly from the literature on venture capital syndication — syndication being one of the primary mechanism by which VC firms share risks and exchange information about the development of portfolio companies (see Chapter 3). The syndication study by Manigart and colleagues (2006) is particularly informative because it groups reasons for syndication into motivations for improving either overall portfolio

management and performance or the management and performance of individual portfolio companies. Within the first category are the *finance motive* and the *deal flow motive*; within the second category are the *selection motive* and the *value adding motive* (see Chapter 3). In looking at why VC firms collaborate with large corporations, five main motives are considered. These include the four above, as described by Manigart, in addition to the *exit motive* (i.e. collaborating with large corporations to improve investment exit).

It was expected that all five motivations would to some extent be identified as reasons for VC firms to collaborate with large corporations, particularly the selection motive, the value adding motive, and the exit motive. With venture capital's focus on developing NHTCs, though, it was expected that the value adding motive would hold particular prominence as a reason for collaboration. It follows that higher input requirements will correspond to more substantive value adding activities, with VC firms more readily connecting portfolio companies to critical external sources of specialised knowledge, resources, and commercial capacity. In this way:

> *(H2) the greater the science and technology inputs required by portfolio companies, the more important collaboration between venture capital firms and large corporations becomes for value adding purposes.*

This chapter is structured by first presenting the summary findings (6.1), showing the extent to which all 30 VC firms were coded for each motivation. Findings are then presented for each type of motivation, showing sector comparisons. Motivations for enhancing overall portfolio management are presented first: the finance motive (6.2) and the deal flow motive (6.3). Motivations for enhancing the management of individual portfolio companies are then presented: the selection motive (6.4), the exit motive (6.5), and the value-adding motive (6.6). The value-adding motive is further broken down into sub-motives pertaining to corporate industry and market knowledge (6.6.1), commercial and business development (6.6.2), and science and technology (6.6.3). Findings are discussed for each motivation, with a particular emphasis on connections made between them. The chapter concludes with a synthesis of the main findings and analysis and connects

these findings with those presented in Chapter 5, thus offering some broader implications for venture capital behaviour and setting up the final empirical chapter.

6.1. Summary Findings

In considering the overall findings (see Table 13) a broad mix of motivations were identified for why VC firms collaborate with large corporations. As expected, motivations for better management and performance of individual portfolio companies (the selection motive, the exit motive, and the value-adding motive) are described and coded as being more important than those associated with better portfolio performance (the finance motive and the deal flow motive). That being said, the finance motive and the deal flow motive in particular are still identified as significant motivations for collaboration, indication perhaps of the secondary benefits or outcomes of collaboration with large corporations. Furthermore, whereas all firms interviewed indicated that the value-adding motive was important in their decisions to collaborate with large corporations, the value-adding motive is less significant than the selection motive and the exit motive. Thus, while the value adding motive is important, these findings do not fully support (H2).

Table 13: Relative Importance of Motivations for Collaboration

	FINANCE	DEAL FLOW	SELEC-TION	EXIT	VALUE ADDED
NO	43.3	7	0	0	0
YES WEAK	43.3	43	13	10	50
YES STRONG	13.3	50	87	90	50
	100% (N=30)	**100% (N=30)**	**100% (N=30)**	**100% (N=30)**	**100% (N=30)**

What is clear from the summary findings, however, is the considerable importance that VC firms place on this collaboration for enhancing investment selection and exit. By looking at each motivation separately and in detail and by sector, interdependent connections might be drawn between various motivations (e.g. connections between the selection motive and the value adding motive). These connections may lend support to the importance of some motivations over others

in ways not apparent in the summary findings, offering greater insight to into why VC firms collaborate with large corporations and the impact that collaboration may have on the development and success of portfolio companies.

6.2. The Finance Motive

The finance motive refers here to motivations for collaboration geared toward increasing venture capital portfolio diversification (sharing and mitigating investment risk) and access to investment funds (large corporations as a source of funding) (Manigart et al., 2006). Importantly, large corporations as "sources of funding" refers here to them as co-investors in individual portfolio companies (e.g. syndicate partners) and not as institutional investors. In comparison to the other possible motives for collaboration the finance motive is the least significant motive described. This finding is not especially surprising given the expectation that VC firms will collaborate with large corporations primarily for obtaining resources associated with knowledge rather than capital. Additionally, the previous chapter explained that although co-investment and syndication between VC firms does occur, such instances are the exception. However, some interesting variation emerges when looking more closely at the finance motive in regard to sector specificity, showing that the finance motive is indeed relevant for a number of VC firms interviewed. For findings associated with the finance motive, refer to Table14.

Table 14: Relative Significance of the Finance Motive, by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	56	0	60	**43.3**
YES WEAK	44	43	40	**43.3**
YES STRONG	0	57	0	**13.3**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

All life science focused VC firms described the finance motive as being significant, with 43% of those firms coded as Yes Weak, and 57% Yes Strong. For VC firms investing primarily in ICT the finance motive is considerably weaker: 56% of these firms ascribed little to no significance to the finance motive, and

44% coded as Yes Weak. Similar results were found for those firms investing primarily in clean tech: 60% attributed little to no significance to the finance motive, and 40% coded as Yes Weak. Why do the life science-focused VC firms assign such high importance to the finance motive compared to those firms investing in ICT and clean tech?

As shown in the previous chapter, VC firms investing in life science have a much higher propensity to co-invest and syndicate with large corporations than do firms investing primarily in ICT and clean tech. Unlike other potential forms of collaboration discussed, co-investing and syndication involve the transfer of not only knowledge and expertise, but also capital in the form of investment funds. In this way, the large corporation behaves very much like a traditional venture capital syndicate partner for which the motives to syndicate are at least as much a matter of finance as of knowledge. Furthermore, this corresponds (as explained in Chapter 5) with a high propensity for life science-focused VC firms to engage directly with the corporate venture capital divisions of Big Pharma. These finance motives probably involve motivations of validation and reputation, as discussed later in this chapter. The majority of life science-specific VC firms interviewed described co-investing with large corporations as a mechanism that drives additional funding for their high-risk portfolio companies. Having a large corporation invest in a specific portfolio company signals confidence in that company, attracting further investment; as one interviewee said, “One of the challenges is that it is very difficult to get any of those businesses funded adequately, so bringing in corporate partners drives funding.”

As described by several life science focused VC firms, having corporate partners as co-investors also helped drive additional funding during later investment stages, leading to exit. In this way, the presence of a corporate investor builds overall investor confidence in a soon-to-be exiting portfolio company, thus driving further investment during the last critical investment stages, signaling a heightened value of a specific portfolio company, and increasing the potential profitability of an IPO, merger, or acquisition:

> We often look to our corporate partners as an important source of funds. Sometimes we will bring in a corporate venture group if we need to raise a bit more money as we are getting closer to the exit … so, important for both funding and investor confidence as we prepare a business for exit.

Comments like the one above were also shared by several VC firms investing heavily in ICT and clean tech, but such funding through corporate partnerships was much less important when compared to the life science-focused VC firms. This difference is almost certainly attributed to the comparably higher risk and higher resource intensity of life science companies: the higher the uncertainty, the more important corporate partners become for building investor confidence. More specifically, confidence seems to be substantially heightened when a corporate partner is not just supporting a portfolio company through engagement with that company, but is also placing its own money in the portfolio company. Such formal co-investing may be deemed necessary in the life science sector but not all that necessary in other high tech sectors. Investing in information technologies and clean tech might be considered less risky; thus, it may be easier to raise funds, making inclusion of a corporate investor less important. Going forward, this interpretation will be further assessed and developed, particularly in regard to the interesting and somewhat surprising connection between the finance motive and the management of individual portfolio companies.

The finance motive is weakest for VC firms investing heavily in clean tech, coded as 40% No and 60% Yes Weak. Much of this might be due to the lack of corporate co-investing and syndication as described by clean tech focused VC firms. An additional explanation might be found in the relative youth of the majority of clean tech-focused VC firms interviewed, which were established only in the past 5 to 7 years. Several of them had not yet successfully exited a portfolio company, so perhaps the need for corporate investors as confidence builders during the later and exit stage had not been realised. Also, co-investment relationships take time to develop, and a related issue of experience might therefore be at play. Second, clean tech is currently a hot sector, making it relatively easy for these VC firms to raise funds. Therefore, the need for corporate investors, both as signals of confidence and as sources of funds, is less critical than in other sectors.

Three further points need mentioning. First, few if any of the VC firms interviewed discussed the finance motive in terms of increasing diversification or sharing risk. Diversification benefits were downplayed even for life science-focused VC firms engaged in co-investing with large corporations. Although risk sharing was mentioned, it was not discussed or coded to any significant degree. The benefits of the finance motive, if attributed, were clearly the funding that corporate partners provided as co-investors, and perhaps more important, the reputation effects those corporate funds have on individual portfolio companies, which drive additional funding. Second, answers to questions regarding the finance motive and diversification were often quickly interjected by the interviewees, with comments articulating deal flow as a significant benefit: "not diversification really, but rather the deal flow which corporate partners provide." This comment, typical of interviewees, is interesting because it shows both a clear distinction between the finance motive and the deal flow motive in the minds of venture capitalists — aligning with the distinction made in the literature — as well as the inclusion of the two motives within the same conceptual motive category, that is, questions regarding the finance motive bring about answers involving deal flow.

6.3. The Deal Flow Motive

The second motive associated with improving overall portfolio performance is the deal flow motive, which prompts collaboration with large corporations as a way for VC firms to increase the quantity and quality of future investment opportunities (Manigart et al., 2006). The main assumptions are that by collaborating with large corporations VC firms will realise enhanced deal flow through access to a large corporation's corporate venturing portfolio, corporate spin-outs, and the ability of the relationship to raise a VC firm's reputation and visibility, all increasing the number and quality of potential investment opportunities. Based on the literature and the previous chapter, it was initially assumed that the deal flow motive would be connected primarily to instances of co-investing and syndication between VC firms and large corporations. Therefore, the significance of this motivation was expected to be relatively less when compared to other motivations. However, the findings present a surprising level of importance attributed to the deal flow motive in regard to collaboration with large corporations for a majority of the VC firms

interviewed. For findings associated with the deal flow motive and sector comparisons, refer to Table 15.

Table 15: Relative Significance of the Deal Flow Motive, by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	11	0	0	**7**
YES WEAK	61	0	40	**43**
YES STRONG	28	100	60	**50**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

For life science-focused VC firms, the deal flow motive was described as a significant reason to collaborate with large corporations, with 100% of these firms coded as Yes Strong. Somewhat less so, ICT-focused VC firms were coded 11% No, 61% Yes Weak, and 28% Yes Strong. Clean tech-focused VC firms were coded 40% Yes Weak and 60% Yes Strong. At first glance, the strength of this motivation for life science-focused VC firms appears to be strongly connected to their high propensity to co-invest and syndicate with large corporations; collaboration with large corporations gives these VC firms access to both technology and firms within corporate venturing portfolios, as well as related deals involving corporate spin-outs. Comments like the following from an interviewee were repeatedly given by those VC firms heavily engaged in life science:

> They are an important source of new deals for us. They are increasingly looking at their own investees. They may not be able to afford developing some things in their pipeline, or they have certain things they would either like to get rid of entirely, or to outsource the development of these programs in some way, so there is that aspect as well.

In this way, the deal flow motive very much involves the exchange of information about technology and portfolio companies between the VC firm and the corporate partner, which can lead to new investment deals; increasing the volume and quality of deal flow can be viewed as the result of this information exchange. The unexpected importance that some ICT and clean tech-focused VC firms attribute to the deal flow motive implies, however, that the importance of increasing deal flow through collaboration with large corporations is not entirely based on a propensity to co-invest with these corporate partners on a particular deal. Motivations for

obtaining investment access to the portfolio of corporate partners was not coded as significantly important by the majority of VC firms interviewed. As mentioned in the previous chapter, the exchange of information regarding potential deals and/or leading to new deals appears to occur regardless of the collaborative structure employed. So in the absence of co-investing, how might this pursuit or outcome of enhanced deal flow (the apparent importance given to this motive) be more fully explained?

One possibility is that collaboration between VC firms and corporate partners will indeed transpire as described above: collaboration will involve the exchange of information regarding the technology and portfolio companies within a corporate venturing investee, resulting in a spin-out for which the VC firm then develops within its own investee. In this scenario, however, this spin-out will be developed without any substantial co-investment from the corporate partner; that is, it will be a traditional spin-out. Although reasonable, this explanation is not-well supported by the research (see Chapter 5). Excluding the life science-focused VC firms, spin-outs resulting from corporate collaborations are not all that common and are often avoided.

An alternative explanation is grounded in the connection between collaboration and compounding reputation effects. For this explanation, most forms (structures) of collaboration between a VC firm and a large, often industry-leading, corporation improve the reputation and raise the visibility of the VC firm and its investee in the eyes of the wider venture capital community, including other VC firms, investment banks, entrepreneurs, and other large corporations. This heightened visibility attracts additional investors and partners who bring with them their own knowledge and expertise regarding sector trends, promising entrepreneurs, and quality portfolio companies. The result is new investment opportunities for the VC firm, which increase the amount and quality of deal flow. This notion of increased reputation through collaboration likely corresponds to the previously discussed view that collaboration with large corporations often drives funding; the presence of an interested and engaged corporate partner breeds confidence in the value of a VC firm’s portfolio or specific portfolio company. Therefore, the reputation effects of collaboration can be viewed as transcending

both the finance motive and the deal flow motive, making increased reputation not only an outcome of collaboration, but also a likely motivation for collaboration.

Finally, the propensity for VC firms to attribute significance to the deal flow motive in regard to collaboration with large corporations can also be explained in the context of knowledge exchange and investment selection. Increasing deal flow is an outcome of improved investment discovery and selection through corporate collaboration. Based on this explanation, new deals come about not so much from a VC firm's enhanced access to a corporate venturing investee and spin-outs as from a combination of idea exchange concerning corporate pipeline needs and the capabilities of a VC firm's current and potential portfolio companies. The result of this exchange is either the selection of a particular company to invest in (new portfolio company) or of a promising technology or product that a portfolio company is then created to develop. In other words, through collaboration, new investment opportunities are discovered and assessed and investment decisions are made, increasing the amount and quality of a VC firm's deal flow.

6.4. The Selection Motive

Correspondingly, the first motive associated with improving the management of individual portfolio companies is the selection motive. The selection motive refers to the improvement of information assessment as provided by potential portfolio companies to deliver more accurate due diligence and validation of proposed technology, products, and entrepreneurial team, leading to the selection of higher quality portfolio companies (Manigart et al., 2006). Mirroring the overall findings, the selection motive is coded as the second most important reason in all sectors that VC firms collaborate with large corporations. Findings for the selection motive, by sector, are shown in Table 16. VC firms focused on life science are coded 14% Yes Weak and 86% Yes Strong. Likewise, VC firms investing heavily in ICT are coded 11% Yes Weak and 89% Yes Strong. Similarly, VC firms engaged exclusively in clean tech investments are coded 20% Yes Weak and 80% Yes Strong. For the selection motive, not one of the VC firms interviewed is coded No.

The importance of the selection motive was described using similar comments, and common points of emphasis were articulated. As an interviewee at an ICT-focused VC firm commented: “For us, corporate validation is crucial for selecting companies to invest in: It demonstrates commercial viability and that there is a credible end-user. It is also important in that it [corporate validation] drives further funding.”

Table 16: Relative Significance of the Selection Motive, by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	0	0	0	**0**
YES WEAK	11	14	20	**13**
YES STRONG	89	86	80	**87**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

Despite these similarities some variation does exist, with several VC firms questioning the importance of collaboration with large corporations for selecting new portfolio companies. Furthermore, the selection motive is described primarily as the commercial validation of a technology or product rather than as a validation of a proposed business plan or entrepreneurial team. Overall, three scenarios in which the selection motive applies emerged from the interviews.

The majority of VC firms interviewed emphasised the importance of collaboration with large corporations for better assessment of potential portfolio companies, leading to a decision to take them on. In this scenario the VC firm discusses a potential portfolio company with a corporate partner. Again, the emphasis of this discussion centres on the commercial viability of the technology or product the potential portfolio company proposes to develop and sell. Such discussions are likely to unfold as previously described, with commercial viability being determined through information exchanges regarding corporate pipeline needs, recent moves by corporate competitors, market/industry trends, and the VC firm’s assessment of a potential portfolio company (i.e. the firm’s capabilities and potential). A corporate partner may show interest in a particular technology or product that a potential portfolio company is proposing; sometimes the corporate

partner agrees to provide guidance and, less frequently, investment funding to the potential portfolio company. If so, the VC firm will likely select the firm as an investee. As one interviewee at a life science-focused VC firm explained:

> The validation aspect that our corporate partners bring is huge. We spend a whole lot of our time assessing businesses for investment. This is a time consuming but critically important process — choosing the appropriate businesses is key! What we are looking for from our corporate partners is the commercial validation that this is something they might use. Again, we do the due diligence, but having that end-user interest from the corporate is huge, it provides additional confidence.

An interviewee whose firm invests primarily in ICT went so far as to claim, "We won't invest in a company without first talking to our corporate partners. If they [corporate partners] are not interested, we will likely not invest in the company."

Although very direct in espousing the importance of corporate validation in the selection process, such a comment was very much the norm among VC firms interviewed; these firms coded as Yes Strong. Whether occurring through informal corporate contacts, formal corporate strategic partners, or formal corporate syndicate partnerships (either separately or in combination), collaboration between VC firms and large corporations was described by most VC firms as performing a crucial role in portfolio company selection and validation. Without prior corporate validation, a decision to invest in a particular firm is much less likely to occur.

However, the need for corporate validation at the investment selection stage was not held by all interviewees, with a minority arguing that the validation of a potential portfolio company is determined more by the venture capitalist than by any corporate stamp of approval. This view accounted for those firms coded Yes Weak. The following quote comes from interviewee at a life science-focused VC firm. Most revealing is the caution described concerning venture capital's drive for corporate validation of potential investments:

> Life science and biotech companies try to do deals with Big Pharma, and one of the reasons they do that is they see it as validation. Now, there is an element of truth to that, but for us, we don't see that as a validation. Because we will do our own due diligence, we are all from Big Pharma, and we know that in Big Pharma there is a massive herd mentality, very evident in the genomics revolution — one company does a big genomics deal and then

> everybody thinks they should be doing one, so to a degree it validates. But because of this herd mentality, you have to be careful that it is not a false validation. So, we don't see them as validation really, we just see them as another investor that happens to have a corporate link. Now, some of the companies [portfolio companies] think it is validated — thinking they have persuaded a corporate venture group, but we don't necessarily see it that way.

This notion of false validation and herd mentality has resonance. For now, several important interpretations can be derived from the above quote and reaffirmed from previous chapters. First, as previously assumed, the process of selecting a portfolio company through collaboration involves the exchange of information, probably complimentary, between the VC firm and the large corporate; no one party holds all relevant information. It is reasonable to assume or even expect that large corporations will have difficulty in accurately assessing their current or future pipeline needs, particularly when forecasting these needs and matching them to potential portfolio companies with 5- to 10-year development timelines. Collaborating with VC firms can help large corporations identify these pipeline needs (i.e. "I'll know it when I see it"). Likewise, it is safe to assume that in selecting portfolio companies experienced venture capitalists rely as much on their own expertise and intuition as on the corporate partner's knowledge. Finally, a likely assumption could also be made that many of the potential portfolio companies brought forward for corporate validation have already been well-vetted and have the confidence of the VC firm. The goal of collaboration, therefore, is not to validate a technology or product, but rather to gain corporate interest that can then be promoted to drive funding (i.e. reputation effects).

However, the same life science interviewee quoted above goes on to describe the validation benefits that large corporations can bring to an investment deal:

> From the commercial validation standpoint, I can see the benefits. On a spin-out deal I led earlier this year, they already had substantial early funding from a large molecular company. So, that funding partnership gave us confidence in the investment, an interest in the end user, which is obviously very valuable to us.

This quote, as well as the one just previous, lends support to the second scenario for which the selection motive applies: VC firms often select portfolio companies that already have corporate backing, irrespective of any collaboration between the

VC firm and the said corporation. This prior corporate backing weighs heavily in the VC firm's decision to invest. The scenario was readily described by interviewees as being quite common and important for the selection process, although some skepticism was aired. An interviewee at a VC firm focused on ICT observed:

> We absolutely encourage firms to get corporate backing, and we look favourably upon those that do. This is very common, and we would be shocked if they hadn't already [spoken with a large a corporate] every single one them [potential portfolio companies] claims to have corporate backing. However, you never know how in-depth those discussions have been. But everyone tries to say that they are engaged in intense discussions with company X or Y. But it doesn't really mean anything.

A likely interpretation of the quote above is that the promotion of corporate backing by a potential portfolio company obviously will be followed up and verified by the VC firm as the firm performs the necessary due diligence of the entrepreneurs involved and the proposed business plan. Again, much more than just corporate validation is needed when selecting portfolio companies. Two important points deserve mentioning (and will be readdressed later in this chapter and in Chapter 7). First, it is clear that entrepreneurial firms often establish relationships with large corporations without the use of a VC firm as an intermediary. This propensity adds to earlier suggestions that collaboration with large corporations by other actors of the venturing milieu is common, which indicates a certain level of collaborative embeddedness, thus placing large corporations firmly within venture capital networks. Correspondingly, initial questions might be raised regarding just how important the intermediary role of VC firms is in connecting portfolio companies to corporate partners (i.e. business development). Second, the propensity for VC firms to select portfolio companies with prior corporate backing might suggest that the firms being selected are not traditional early stage firms.

The third scenario associated with the selection motive involves not the selection of portfolio companies but rather the continuing validation of portfolio companies after selection. Collaboration plays a significant role in a VC firm's evaluation of portfolio companies from one funding round to the next. In this way, a large

corporation's measured interest in an portfolio company will be a contributing factor in how a VC firm proceeds with that portfolio company after selection (e.g. in decisions regarding strategy and funding). Several of the VC firms interviewed described this continuing corporate validation as more important than any initial validation for selecting portfolio companies. As an interviewee at a life science-focused VC firm explained:

> The greatest thing for our portfolio companies in terms of corporate collaboration is the validation of the technology, meaning that big corporate is prepared to back them. Our companies think it's good, that it will work, and that it's worth money in terms of their reputation and share price. For us, corporate validation is important for raising money for additional rounds, because that is really the only validation you can get besides the product getting approved, so that is the greatest thing really.

The use of corporate validation to drive funding is again alluded to here, as is the notion that collaboration between VC firms and large corporations is something that can and does occur beyond the selection stage of the venture capital cycle (i.e. beyond the decision to invest in a new portfolio company). Therefore, a VC firm's collaboration with a large corporation might be viewed as contributing in some capacity to the ongoing development of a portfolio company through subsequent funding rounds. An interviewee at a clean tech-focused VC firm commented:

> These corporate relationships very much help us in our due diligence of our investee companies [post-selection]. We can ask a corporate partner what they think about a particular product being developed by an investee company. It is clearly part of the ongoing process in positioning our investee companies, just to gauge and maintain their interest.

As with much of the collaborative activity described here, the extent to which such post-selection validation includes or leads to additional portfolio company development is likely to change on a case-by-case basis and is explored a bit later in the chapter. The quote above, however, presents a common theme from the interviews: for VC firms the goal of post-selection validation through collaboration with large corporations is to maintain the interest of the large corporations in particular portfolio companies to position these portfolio companies for corporate acquisition or merger. Therefore, a clear and direct connection exists between the two most important motives for collaboration described by interviewees. The selection motive is pursued not only to drive funding but also to initialise a

relationship-building process between corporate partners and portfolio companies, a process that continues after selection, to realise the exit motive.

6.5. The Exit Motive

The second motive associated with improving the management and performance of individual portfolio companies is the exit motive. The exit motive describes VC firms' collaboration with large corporations to increase potential exit opportunities by positioning their portfolio companies for corporate acquisition or merger. As shown in Table17, the exit motive is coded as very significant for all sectors; it is a primary, possibly overarching, reason for VC firms' collaboration with large corporations. For the exit motive, VC firms focused on life science are coded 100% Yes Strong. Similarly, VC firms investing heavily in ICT are coded 89% Yes Strong and 11% Yes Weak. Greater variation is exhibited by those firms engaged exclusively in clean tech, coded 60% Yes Strong and 40% Yes Weak.

Table 17: Relative Significance of the Exit Motive, by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	0	0	0	**0**
YES WEAK	11	0	40	**10**
YES STRONG	89	100	60	**90**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

Of all the motivations for collaboration discussed here, the exit motive carries the least amount of ambiguity. Descriptions of the exit motive by interviewees are fairly straightforward, leaving little room for different interpretations or circumstances for which the exit motive might apply. The overriding explanation for such pursuit is that corporate acquisition or merger has become, in an era of weakening IPO markets, the only viable exit for most VC firms in the United Kingdom. An interviewee at an ICT-focused VC firm, in describing the importance of corporations as exit mechanisms, explains:

> To a large degree, [large corporations] are our customers. They are the people we want to sell our companies to. Currently, public markets are a poor route to liquidity for venture capital funds these days, so it has become

> a much more merger and acquisition exit market, so first of all they are our customers.

Similar comments were made by interviewees at several life science-focused VC firms. Adding further clarification:

> Just to put it into context, the major route for exit for our investments is through trade sale of our biotech companies to Big Pharma. So the relationship between our investee companies and Big Pharma is crucial. You do have other exit routes, you could sell to other investors or IPO, but the IPO industry has been so fragile for so long, and so the big exits, they would come from a corporate.

Another interviewee at a life science-focused VC firm said:

> Acquisition does occur, and it is a very important exit; in fact, they merge generally. It is very, very important. Two ways to exit, IPO or acquisition – Pharma and big biotech are the only ones who have the money to do this. So yes, this is essential to our business. If they weren't there, you would be stuck with the IPOs, and the market right now is shot. Without acquisition, exit would be impossible.

Although pervasive for the majority of firms interviewed, the importance of the exit motive is coded comparably weaker for VC firms engaged heavily in clean tech. Two overarching factors may be contributing: (1) the newness of clean tech funds and (2) the type of portfolio companies in which these funds invest. First, as discussed previously, the clean tech-focused VC firms interviewed here and the funds they manage are relatively young for the most part, with most funds (investees) in the fifth year of funding. Therefore, a possible explanation might be that these firms have yet to feel the imperative or necessity of an exit by acquisition in a severely downgraded IPO market. The firms also might expect the IPO market to improve by the time their portfolio companies reach the exit stage, thus placing less emphasis on the exit motive. This might coincide with an expectation that because clean tech is a currently hot sector, an IPO market will eventually materialize. Such explanations could also be indicative of a propensity, at least for VC firms investing exclusively in clean tech, to court corporate partners for acquisition purposes only during the later stages of the investment cycle. Again, the importance of the exit motive has yet to be realized and thus is downplayed by the clean tech-focused VC firms.

Findings regarding when collaboration is more likely to occur (discussed more fully in Chapter 7) lend support to the notion that collaboration between VC firms and large corporations is generally more intense during the later stages of the investment cycle. But this is evident across sectors. Also, the relative newness of the clean tech-focused VC firms as a contributing factor is ambiguous at best when placing the interviews in context. As with the majority of venture capitalists interviewed, those focused on clean tech had extensive experience in venture capital and in the energy industry, making it highly unlikely that they were unaware or unconcerned about the poor IPO market and the opportunities for exit via corporate acquisition. A more plausible explanation, if not more compelling, is that the clean tech-focused VC firms, due to the relative newness of their funds, were more reluctant to discuss exit strategies with the author. In other words, if exits via corporate acquisition are being pursued, such information might be withheld because of the sensitivities surrounding the early development of such exits (e.g. competitive confusion, dislike of publicizing the pursuit of acquisition exits in a hot sector where expectations for new technologies and new firms are high).

A second possible factor contributing to the comparably weaker importance that some clean tech firms attribute to the exit motive might be the propensity of these VC firms to invest in already established firms. Many of these portfolio companies are not start-ups or young firms developing novel technologies, but rather small or medium-sized firms established in the broader energy sector. They are probably engaged in the development of more energy efficient processes that they can then sell to large energy corporations seeking ways to reduce emissions and cost or diversify their production output. The reasoning follows that these more established portfolio companies are deemed less risky than their early-stage counterparts; they may already be profitable and thus produce a steady stream of returns and fees to the VC firm without the need for intense oversight and monitoring. The point for the VC firms and portfolio companies alike is development of venture capital deals that produce intellectual property, license agreements, and corporate partnerships. Exits are then structured more around

mergers and formal alliances with large corporations and other established firms rather than outright acquisition.

Multiple factors are probably contributing to the varying degrees of importance attributed to the exit motive. What is abundantly clear, however, is that the exit motive is a primary motivation driving VC firms in the United Kingdom to collaborate with large corporations. As explained by an interviewee at a life science-focused VC firm:

> The other desire that drives partnering is the end market. These markets have huge barriers to entry, so the corporate partnering drives that . . . and of course it makes more sense if you are identifying corporate venture groups with partners that are more likely than not to be interested in your assets.

The prominence of the exit motive is indicative of a UK venture capital industry focused on first selecting those portfolio companies that have some form of corporate backing and then positioning these firms as niche businesses that compliment the pipeline needs and product lines of large, industry leading corporations. Such positioning makes these portfolio companies very attractive for corporate acquisition or merger, which is the only really viable venture capital exit in an environment of limited exit options.

This exit positioning occurs through post-selection monitoring and evaluation involving collaboration with a corporate partner. It is assumed that this process of positioning will result in adjustments made to the portfolio company. For example, one could imagine that through collaboration with a corporate partner, a VC firm may well conclude that a portfolio company, in developing a new product, will need to change its production processes to comply with new industry standards. As a result, adjustments to that portfolio company might be made in the form of new personnel, new manufacturing partners, increased funding, and perhaps upgrades to facilitates, all geared toward overcoming the technical challenges and costs posed in realigning production processes.

6.6. The Value-Adding Motive

The third motive associated with improving the management of individual portfolio companies is the value-adding motive. As previously defined, the value-

adding motive explains VC firms' collaboration with large corporations to connect to and use specialised corporate knowledge and expertise to help develop their portfolio companies. Applied after selection, this corporate knowledge and expertise can be broken down into three broad, often interconnected types: (1) industry and market knowledge, (2) commercial and business development knowledge, and (3) expertise in science and technology. As explored in this way, value adding is very much understood as an input of knowledge as opposed to a finance or resource input. Subsequently, it is expected that the more science and technology intensive a given portfolio company is, the more important and hands-on the value adding gained through collaboration will be. Findings for the value-adding motive, by sector, are found in Table 18.

For life science-focused VC firms the importance of the value-adding motive is coded 100% Yes Strong. This differs significantly from VC firms engaged heavily in ICT, coded 72% Yes Weak and 28% Yes Strong. Clean tech-focused VC firms attributed a comparably stronger importance to the value-adding motive, coded 40% Yes Weak and 60% Yes Strong. Importantly, not one VC firm interviewed spoke of the value-adding motive as being irrelevant; all firms acknowledged that value adding was either a motivation or an outcome of collaboration with large corporations.

In comparing sectors, the varying importance attributed to the value-adding motive is not entirely surprising. When connecting these findings to those from Chapter 5 (i.e. structures of collaboration), it is possible to build assumptions regarding the importance of value adding and the extent to which collaboration between VC firms and large corporations is formalised between the two parties: the more formal collaboration is, the more value added is accrued and used by the VC firm. For the value-adding motive, the 100% Yes Strong coded for the life science-specific VC firms corresponds to the high propensity of these firms to have both formal corporate strategic partnerships and co-investment/syndication partnerships with large pharmaceutical companies. Likewise, the 60% Yes Strong that clean tech-focused VC firms attribute to the value-adding motive corresponds to the high propensity of these firms to engage in formal strategic partnerships with leading energy companies. In contrast, the comparably weaker importance that ICT-

focused VC firms attribute to the value-adding motive, coded only at 28% Yes Strong, corresponds to a comparably lower propensity exhibited by these firms to engage in formal collaboration with the leading ICT companies.

Table 18: Relative Significance of the Value Adding Motive, by Sector

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	0	0	0	**0**
YES WEAK	72	0	40	**50**
YES STRONG	28	100	60	**50**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

Also emerging from the findings in conjunction with the above assumption is a clear connection between the value-adding motive and the science and technology intensity of a given sector, lending some support to hypothesis (H2).

Although all three sectors studied here can be considered high tech and all involve substantial inputs of science and/or technology, it was assumed that the life science sector employs a comparably higher degree of science and technology than ICT or clean tech. It was expected, therefore, that collaboration between the life science-focused VC firms and large corporations would be more likely to occur and be more intensive than such collaboration involving other sectors. Accordingly, it was expected that the value-adding motive would be more important for life science-specific VC firms than other sector-specific VC firms.

This expectation, however, was thought to be countered somewhat by the early stage focus of the VC firms interviewed on the assumption that at the early stage all three sectors exhibit high propensities for initial inputs of either science, technology, or both. Thus, all sectors were expected to place relatively high importance on the value-adding benefits of collaboration with large corporations. Indeed, the value-adding motive was expected to be the most important reason for VC firms to collaborate with large corporations. Additionally, VC firms were expected to show propensities for different types of value-adding at different points of the venture capital cycle. For example, it was reasonable to assume that most VC firms would initially seek and use, through collaboration, value adding in the form of science and technology expertise. This would be followed up in the

expansion stages with value adding in the form of commercial and business development. This relative weakness for the value-adding motive, particularly regarding science and technology, can likely be attributed to factors previously discussed: the comparable newness of the clean-tech focused VC firms and a shifting of investment, particularly among the ICT focused firms, from early stage portfolio companies to more established later stage firms. A more plausible explanation for this weakness rests in the probable embeddedness of the value-adding motive within the other motivations for collaboration (i.e. the value adding importance becomes diluted in the findings). Some of this can be seen when looking at the different types of value adding.

6.6.1. The Value-Adding Motive: Industry and Market Knowledge

The first type of value adding explored with the interviewees was the importance of industry and market knowledge. It was expected that, through their collaboration with large corporations, VC firms seek and obtain valuable corporate knowledge and expertise related to information on changing market trends, new market opportunities, emerging industry players, and changing regulatory environments. It was expected that this knowledge, along with other forms of nonfinancial value adding, would be used to better position and develop portfolio companies. Of the three types of value adding, industry and market knowledge were expected to be easiest to obtain through corporate collaboration (i.e. taking the least amount of interaction and formality) and the least sector driven of the value-adding types. Thus, industry and market knowledge should be the most common form of value adding sought and obtained. It was also thought that industry and market knowledge would be more an outcome of collaboration than a direct reason for collaboration with large corporations.

Findings associated with industry and market knowledge are presented in Table 19. VC firms focused specifically on life science were coded 100% Yes Strong, attributing a very high importance to the industry and market knowledge accrued through collaboration with large pharmaceutical companies. In contrast, VC firms investing primarily in ICT were coded 56% Yes Weak and 44% Yes Strong. For clean tech-focused VC firms the significance of industry and market knowledge

was stronger, coded 40% Yes Weak and 60% Yes Strong. Overall, these findings are surprising, particularly the weaker significance that ICT-intensive VC firms attribute to this motive, with simple explanations being difficult to ascertain.

Table 19: Relative Significance of Value Adding: Industry and Market

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	0	0	0	**0**
YES WEAK	56	0	40	**40**
YES STRONG	44	100	60	**60**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

Although the relative weakness attributed to industry and market knowledge is surprising, this type of value added is still, as expected, the most common form of value added sought and used by VC firms through collaboration with large corporations. Not one firm identified this type of value adding as insignificant — 40% of ICT-focused VC firms were still coded as Yes Strong. Industry and market knowledge was typically described as a combination of information regarding changing market trends and industry dynamics, particularly changing regulation, which was frequently mentioned by VC firms engaged in life science and clean tech investments. An interviewee at a clean tech-specific VC firm commented:

> We use our corporate partners to keep up-to-date on what are often changing industry and market environments, particularly changing regulation — this is invaluable for developing our companies … this is probably the most significant contribution our corporate relations bring to our companies.

Most comments by VC firms regarding industry and market knowledge, such as that above, were made in conjunction with explanations regarding the process of seeking out corporate validation for their portfolio companies, both during the selection process and for evaluating portfolio companies from one funding round to the next. In other words, this type of knowledge is used in large part for the commercial validation of portfolio companies. Therefore, the importance of industry and market knowledge can be viewed as being far more significant than the findings in Table 19 indicate. Taking this further, it seems appropriate to expand the categorization of nonfinancial value added, as Large and colleagues

(2008) propose, to include validation as a form of passive value adding that VC firms confer on their portfolio companies. This also reaffirms that the use of corporate knowledge by VC firms occurs throughout the investment cycle; such knowledge is not used simply as a mechanism for portfolio company selection, but also for monitoring.

The many instances when VC firms attributed a weak significance (Yes Weak) to the importance of industry and market knowledge do not imply that such value adding is unimportant, but rather indicate that collaboration with large corporations is not a significant source of industry and market knowledge for these firms. Instead, industry and market knowledge is derived from and used by the VC firms themselves, most VC firms citing a wealth of internal industry and entrepreneurial experience and knowledge. Much of this knowledge is sector specific and held by individual venture capitalists, many of whom previously worked in corporate executive positions. In such instances, collaboration with large corporations becomes a more subtle, less direct, and less formalized exchange of complementary knowledge, indicating collaborative relationships based on fairly low barriers of entry and a high degree of embeddedness. This type of knowledge exchange is very passive and inherently fluid in its transmission between parties.

That being said, an interviewee at a VC firm investing primarily in ICT hinted at a more involved relationship, one that connects the use of industry and market knowledge with the business development of portfolio companies. Using the example of a portfolio company formed around a university spin-out, the interviewee commented:

> Very often these spin-outs have a very nice and sexy technology, but because they are basically academic, they find it very difficult to position their technology from an industrial point of view. And so these corporate venture groups can be very helpful and supportive in helping these companies in terms of the commercial positioning, not the commercialization, but the commercial positioning of whatever they have …. These corporate venturing groups also help position our firms by bringing a managerial rigor to their operations.

Similar comments point to a collaborative relationship in which corporate knowledge translates into managerial adjustments regarding a portfolio company's strategy and operations.

6.6.2. The Value-Adding Motive: Business Development

The second type of value adding explored here as a function of collaboration with large corporations is the importance VC firms attribute to knowledge and expertise associated with the commercial and business development of their portfolio companies. It was expected that VC firms would collaborate with large corporations to seek and obtain knowledge and expertise regarding the development of a portfolio companies' production, distribution, marketing, and sales functions. Such knowledge and expertise is understood as applying to the growth and expansion of a portfolio company; thus, it is expected that the use of business development through collaboration will most likely occur during the expansion and later stages of the venture capital cycle (Flynn & Foreman, 2001). Furthermore, business development, in the context of venture capital, is commonly understood as the process of connecting portfolio companies to external actors; it is relationship building with complementary firms, business organisations, and customers (Fried & Hisrich, 1995; Maula et al., 2005).

The findings derived from the interviews here are not conclusive; although the relative weakness attributed to business development as an important type of value adding accrued through collaboration with large corporations may point to the former. A likely possibility, however, is that large corporations are indeed important for business development purposes but are viewed by VC firms as a component or member of these business development networks, rather than as a central network node by which other network members are accessed. Of course, another interpretation might be that VC firms in the United Kingdom are not all that engaged in the business development of their portfolio companies, thus making the findings regarding commercial and business development weaker than expected. Findings for the value-adding motive associated with commercial and business development are shown in Table 20.

Table 20: Relative Significance of Value Adding: Business Development

	ICT	LIFE SCIENCE	CLEAN TECH	
NO	11	0	0	**7**
YES WEAK	56	43	60	**53**
YES STRONG	33	57	40	**40**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

Compared to the significance of industry and market knowledge, the findings associated with the importance of commercial and business development as a form of value-adding obtained through collaboration with large corporations is noticeably weaker. For life science-specific VC firms the importance of business development was coded 43% Yes Weak and 57% Yes Strong. The importance was significantly weaker for VC firms investing primarily in ICT, coded 11% No, 56% Yes Weak, and 33% Yes Strong. In contrast, clean tech-specific VC firms were coded 60% Yes Weak and 40% Yes Strong and were thus more in line with the importance that clean tech VC firms assign to commercial and market knowledge.

In discussing the importance of corporate partners — in this case, corporate venture capital divisions of large pharmaceutical companies — as sources of commercial and business development, an interviewee at a life science-specific VC firm explained:

> Because of where they sit in Big Pharma organizations, they are very helpful to these small companies from a business development standpoint because they are usually well-networked within the industry and can help them not only to make the necessary contacts with different business development groups within the pharmaceutical industry, they can help these companies construct the story that would make them attractive to a corporate partner … they also provide management expertise, and manufacturing expertise. They have a valuable network back to the corporation which the portfolio company can utilize.

Strong comments such as that above regarding corporate collaboration and business development were typical of life science-specific VC firms but were shared less frequently by those firms engaged in ICT and clean tech, even when such firms were coded Yes Strong. The propensity to invest in more established portfolio companies may be a contributing factor. However, an additional factor

perhaps offers a stronger explanation: the barriers to entry in the life science sector are far higher than those for ICT and clean tech, which is a result of the more intense R&D (e.g. clinical trials) for life sciences coupled with a greater degree of specialisation and related resource and capital intensity. Such conditions have created an industry that, while being large and relatively diverse, continues to be dominated by a small number of large pharmaceutical companies. For a new entrant to successfully establish itself within the life science sector, perhaps the only viable path is through the large pharmaceutical companies.

Perhaps this explains why life science-specific VC firms place such strong importance on collaboration with large corporations regarding commercial and business development and the value-adding motive more generally. These VC firms correctly identify the large pharmaceutical companies as the primary nodes in the global life-science network, actors with which they must partner to gain access to the broader network of life science players and customers. Such access is absolutely vital for the business development of their portfolio companies.

Again, the comparably lower importance attributed to business development through collaboration with large corporations by those VC firms focused on ICT and clean tech is somewhat surprising, given that business development is the heart of what is thought to be active investing. However, these findings do align with the hands-off relationship described in Chapter 5 by the ICT- and clean tech-specific VC firms regarding structures for collaboration. Furthermore, it is very possible that the comparably lower barriers to entry into the ICT and clean tech sectors require less specialised knowledge and resource exchange than in the life science sector. Therefore, the follow-on commercial and business development through collaboration with large corporations (during the expansion and growth stages of the portfolio company) is less significant. This explanation is further bolstered when the importance for VC firms of collaboration with large corporations in obtaining and using corporate expertise in science and technology is considered.

6.6.3. The Value-Adding Motive: Science and Technology

The third type of value adding explored here as a motive for collaboration with large corporations is the importance that VC firms attribute to corporate knowledge and expertise associated with science and technology. As previously explained (see Chapters 2 and 4), it is posited that VC firms investing in early stage high-tech enterprises seek out corporate knowledge and expertise in science and technology through collaboration with large corporations and use or direct this knowledge and expertise to assist their portfolio companies in the R&D of science and technology intensive products and processes. Findings for the value-adding motive associated with expertise in science and technology are shown in Table 21.

Table 21: Relative Significance of Value Adding: Science and Technology

	ICT	**LIFE SCIENCE**	**CLEAN TECH**	
NO	11	0	0	**7**
YES WEAK	72	0	60	**53**
YES STRONG	17	100	40	**40**
	100% (N=18)	**100% (N=7)**	**100% (N=5)**	**100% (N=30)**

The findings show that expertise in science and technology is the weakest type of value adding coded for overall, although wide variation was evident among the three sectors. Unsurprisingly, VC firms investing specifically in life science attributed a very high level of importance to this motive (coded 100% Yes Strong). For ICT and clean tech-focused VC firms the importance of collaboration with large corporations for obtaining corporate expertise in science and technology is weaker in some ways than was expected. Those firms engaged heavily in ICT were coded significantly weaker, with 11% coded No, 72% coded Yes Weak, and 17% coded Yes Strong. Compared to ICT, the clean tech-specific VC firms attributed greater importance to the science and technology value added accrued through collaboration with large corporations, coded 60% Yes Weak and 40% Yes Strong.

Again, the expectation was that all three sectors would show a propensity for seeking out and using corporate knowledge and expertise in science and technology through collaboration with large corporations. Portfolio companies

engaged in life science were expected to necessitate higher level inputs of science and technology than those in the ICT and clean tech sectors. However, inputs for technology for all three sectors were expected to be considerable, though science inputs might be less. Importantly, the findings themselves should not be viewed as directly indicative of lower science and technology input requirements for the ICT and clean tech sectors, although that may be a large part of the explanation. What the findings demonstrate is that UK VC firms investing in life science view collaboration with large corporations as being substantially more important for obtaining inputs of science and technology than do those engaged in ICT and clean tech. These findings may not be indicative of the sectors as a whole, but rather only of the firms in which UK VC firms are investing.

Looking more closely at the life science-focused VC firms, the importance of collaboration with large pharmaceutical companies as a source of expertise in science and technology is strongly evident, as one interviewee explained:

> We do have a number of deals where the corporate venture group via their link back to the corporate parent has specific sets of expertise that you can link to in the Big Pharma player. They certainly bring the Big Pharma technical expertise, they have access to experts in a particular therapeutic area, or in chemistry, or biology, or in whatever it might be. So that is one important area that they contribute in.

The comments of another interviewee at a life science-focused VC firm reiterated this emphasis on collaboration as an important source of specialized corporate expertise:

> Big Pharma provides a lot of expertise. I mean a Pharma generally has a fantastic investee of scientists and to be able to work with that is a great opportunity. And they may not be the fastest but they are very smart people. They also have extensive networks, not only the people internally but external contacts. For example, if you have a problem with manufacturing you can seek someone out who has seen this before and they can sort it out much faster than we can.

From the comments above, two points in particular resonate, reinforcing findings from the previous chapter that point to the very formal and interdependent ties between UK life science-specific VC firms and large pharmaceutical companies. First, the UK life science-specific VC firms interviewed here all spoke of readily

available access or open channels between themselves and large pharmaceutical companies; such access is not only welcome but also relied on for expertise in developing their portfolio companies. Second, access to and use of corporate expertise in science and technology through collaboration with Big Pharma for these firms — involving access to "extensive networks" — is inseparable from the commercial and business development of their portfolio companies. This appears obvious, but it is an important point to make for this sector more than others, because the combination of science and technology is at the core of what most life science portfolio companies do. It permeates most if not all of these firms' functions in commercialising new products or processes, particularly those firms engaged in drug discovery and therapeutics. This connection between science, technology, and business development is a significant driver of collaboration between life science-specific VC firms in the United Kingdom and large pharmaceutical companies**.**

Another instance in which collaboration leads to the exchange of expertise in science and technology is with corporate spin-outs. As established earlier (see Chapter 5), corporate spin-outs involving the VC firms interviewed here are not all that common, but they do occasionally occur, particularly in the life science sector. In such instances corporate expertise in science and technology is directly transferred from the corporation to the newly formed portfolio company. Typically, not only is the technology spun-out, but the corporate employees (scientists and technologists) are spun-out with it, becoming the core of the new portfolio company. An interviewee at a life science-specific VC firm explained:

> Spin-outs can be difficult for a variety of reasons. If done correctly, though, they provide some advantages. The main benefit being the corporate expertise — some science, some technology — which is spun-out with the corporate personnel; they spin these people out! And that works very well for the Pharma company, because then they aren't firing those people, and it works very well for us, because their expertise and background should help to develop the project [portfolio company].

The considerable importance placed on collaboration with large corporations by life science-focused VC firms for accessing and using corporate expertise in science and technology is not shared by VC firms investing primarily in ICT and

clean tech. These VC firms did not describe science and technology as unimportant inputs for their portfolio companies, but rather noted that that collaboration with large corporations is not a formal source of such inputs. Again, the lower resource intensities of these two sectors when compared to the life science sector undoubtedly play a significant role in these findings (findings for the value-adding motive more generally) and indicate lower barriers of entry into these sectors, making collaboration with large corporations less essential than in the life science sector. A related factor, as previously established, is the propensity for VC firms focused on ICT and clean tech to invest in later stage portfolio companies, which are more established and have more mature technologies and products

For VC firms focused on clean tech and ICT the factors mentioned above translate to a relationship between the VC firm and the large corporation which, although not unimportant, is much less direct and very much hands-off when compared to similar collaboration in the life science sector. When asked about the importance of collaboration with large energy and utility companies for accessing and using corporate knowledge and expertise in science and technology, an interviewee at a clean tech-focused VC firm commented:

> Yes, in terms of technology, our strategic partners [large corporations] do provide our companies [portfolio companies] with guidance, and a lot of partnerships [between large corporations and individual portfolio companies] involve this, but for us it is really the validation of the technology, the commercial validation, where the value of a corporation comes in … it builds confidence for our companies and helps [us] set strategy.

Comments similar to those above were shared by other clean tech-focused VC firms, as well as those VC firms heavily engaged in ICT. Two points in particular need mentioning. First, for VC firms in these two sectors most corporate knowledge and expertise in science and technology obtained through collaboration are identified with the corporate validation of a technology, that is, the selection motive. As such, value adding in these two sectors — as the findings indicate — corresponds more directly with the importance of industry and market knowledge; collaboration informs the development or direction of technology based products

and processes but does not generally act as a problem-solving mechanism by which technological challenges are overcome. Second, when the transfer of corporate expertise in science and technology might be considerable for these two sectors, the VC firm may play a more limited intermediary role. An interviewee at an ICT-focused VC firm commented:

> Some of that [exchange of technical expertise] does occur, but that isn't the role of these partnerships [with large corporations]. You need to understand that these corporate venture capitalists are looking for new firms to acquire and partner with. They play a scouting role for their parent. They don't want to get highly involved in any one particular venture; they are very hands-off. Now for spin-outs, you obviously get that corporate expertise, but this [a spin-out] is rare.

As will be discussed in Chapter 7, such informal partnerships appear to work best, both for the corporate venture capital programme and the VC firm. However, this does not mean that large corporations are not a source of scientific knowledge and technological expertise for portfolio companies. Echoing earlier comments, an interviewee at another ICT-focused VC firm stated:

> Our portfolio companies connect to corporate expertise through their own personnel; whether it is technologists, programmers, even management, many of them come from the big IT companies — all the big ones — bringing their expertise and experience with them.

For portfolio companies, therefore, past corporate ties appear to be the most prevalent means by which corporate knowledge and expertise are transferred and exchanged (see Chapter 5). But what this does imply, of course, is that formal collaboration between most VC firms and large corporations (the life science sector being the exception) is not the primary, direct bridge for the transfer of complex corporate knowledge and expertise in science and technology. Therefore, the overall findings regarding the value-adding motive speak to a UK venture capital model in which collaboration with large corporations does enhance the development of portfolio companies, particularly in terms of building business and commercial capacity. But the findings also show a model in which the capacity building or business development of portfolio companies may be more a function of the portfolio company's relationship with a corporate partner.

6.7. Conclusion

The previous chapter established the high propensity for VC firms to collaborate with large corporations and their corporate venturing divisions. This chapter explored the motivations for collaboration, gaining insight into whether VC firms use collaboration with large corporations to build the capacity of their portfolio companies. According to the findings, the most important motives for collaboration are the selection motive and the exit motive. Therefore, VC firms use collaboration with large corporations to validate technology and/or products proposed by potential portfolio companies, leading to a decision to invest. This process of corporate validation was described as continuing during the post-selection monitoring phase. The purpose of this corporate validation, both in selecting and monitoring portfolio companies, seems less about determining commercial potential and more about gauging and maintaining corporate interest for positioning portfolio companies for exit via corporate acquisition or merger, with the current weakness of the IPO market very much driving the importance of the exit motive.

The weaker importance attributed to the finance motive was expected, because it was assumed that only VC firms heavily engaged in syndication and co-investing would attribute much importance to this motive (syndication with large corporations being rare outside the life science sector). That aside, the relative importance attributed to the deal flow motive was surprising. VC firms described the deal flow as associated with the selection motive and the on-going validation of portfolio companies. Corporate validation raises the visibility and reputation of both the VC firm and portfolio company, driving additional funding and increasing the amount and quality of future portfolio companies, that is, the deal flow. In this way, the deal flow motive very much involves the exchange of information between the VC firm and the corporate partner.

Also surprising was the relative weakness of the value-adding motive, which went counter to expectation that the value-adding motive would be the most important motive sought and used through collaboration. Following the exit motive and the selection motive in importance, the value-adding motive was most associated

with industry and market knowledge, much more so overall than with commercial and business development or corporate expertise in science and technology. In this way, the value adding motive is very much connected to the selection motive and the on-going post-selection validation and monitoring of portfolio companies leading to adjustments in strategy, but rarely to hands-on intervention in the development of a product or process. Most surprising, though, was the relative weakness attributed to collaboration for commercial and business development, thought to be the essence of the active VC firm. Apart from those VC firms investing specifically in life science, commercial and business development appeared to be more a function of the relationship between large corporations and the portfolio companies themselves, rather than any substantial intermediary role played by the VC firm.

In comparing sectors further, collaboration with large corporations is more important for those VC firms investing in life science than it is for those investing in ICT and clean tech. This appears to confirm the assumption that higher resource intensities necessary in the life science sector, including inputs of science and technology, are probably driving life science VC firms to collaborate with large pharmaceutical companies. Therefore, the findings lend further support to hypotheses (H1) and to some extent (H2): for VC firms collaborating with large corporations the greater the science and technology inputs required by an investee company, the more important collaboration becomes for the use of value added in the post-selection monitoring and development of an individual portfolio company**.** More than just the need for specialised knowledge and expertise (i.e. value adding), however, is at play here. Controlled by a few dominant global pharmaceutical companies, positioning portfolio companies to successfully enter the life science sector necessitates that VC firms closely collaborate with Big Pharma. From selection and validation to monitoring and business development to eventual exit, the need for collaboration is pervasive.

That being said, it was expected that VC firms investing in ICT and clean tech would still seek out considerable external inputs of knowledge and expertise through collaboration with large corporations, including some inputs of science and technology. Overall weaker findings for these two sectors can probably be

attributed to several factors, including lower resource intensities, lower barriers to entry, more readily available investment capital due to hot markets, and fewer mature investment funds (a lack of exit stage investments). However, what appears to be driving the weaker findings for these two sectors is a shifting by VC firms of early stage funding to later stage funding. VC firms identified by this research as early stage investors are selecting and then allocating a greater share of their funds to later stage, more established portfolio companies. These later stage portfolio companies need less specialised value added inputs and probably have pre-existing partnerships with large corporations.

These concepts are further developed in Chapter 7, which looks at the circumstances under which VC firms collaborate with large corporations and the challenges and disincentives presented by this seemingly important form of investment collaboration.

7. The Circumstances and Location Dynamics of Collaboration: Patterns, Challenges, and Analysis

For effectively selecting and monitoring portfolio companies, and then successfully exiting investments in them, VC firms combine and leverage their own experience and expertise with the external knowledge and resource capacities of their local investment and industry networks, which include large corporations (Zook, 2004). This reliance on local networks is due in large part to the highly tacit and asymmetric knowledge flows and related agency costs that characterise the innovation process and the development of NHTCs more specifically. In this context, the previous two chapters have established how and why VC firms collaborate with large corporations and offered some insight into the degree of importance that geographic proximity plays in facilitating this collaboration. Findings suggest that this collaboration is increasingly common, but more formal collaborative structures are the exception. Driving this collaboration is the exchange of complementary knowledge for purposes of better investment selection and investment exits through corporate acquisition or merger. Initial findings place some importance on geographic proximity in facilitating collaboration but with an emphasis on the regional network capacities of the LMR rather than any significant co-location between actors.

This chapter combines the findings and analysis of the previous two chapters and provides further clarification and analysis regarding the circumstances under which collaboration is pursued and leveraged (i.e. the *when* of collaboration). Although the majority of VC firms interviewed downplayed the value-adding benefits of collaboration with large corporations, VC firms investing heavily in life science and biotech were the exception, supporting expectations that the more specialised the required inputs for investment, the more important collaboration becomes for developing portfolio companies. It follows that for investing in new life science companies, the propensity for VC firms to use collaboration with corporate partners as a source of value added inputs (e.g. science, technology, and business development) is directly connected to the relatively higher capital costs, longer development timeframes, and related barriers to market that new life science companies must face and navigate – factors that make aligning new

products with the pipeline needs of large pharmaceutical companies an imperative for both new life science companies and the VC firms investing in them.

For venture capital investment, value-adding activities are strongly associated with the post-investment monitoring phase and the subsequent development of portfolio companies (see Zook, 2008). Therefore, in exploring propensities for corporate collaboration at each phase of the venture capital cycle, this chapter assesses the expectation that

> *(H3) the greater the science and technology inputs required by portfolio companies, the more important collaboration between venture capital firms and large corporations becomes for investment monitoring and evaluation.*

In doing so, this chapter also looks to further refine the role that geographic proximity plays in facilitating this collaboration at each phase of the venture capital cycle. Research on venture capital (e.g. Zook, 2004) suggests that geographic proximity is particularly important during the post-selection monitoring phase of the venture capital cycle. Therefore, corresponding with H3, this chapter also assesses the expectation that

> *(H5) for collaboration between venture capital firms and large corporations, the importance of geographic proximity will be most prominent during the post-selection monitoring and evaluation of portfolio companies.*

Finally, in exploring the circumstances under which VC firms collaborate with large corporations, this chapter further clarifies the *challenges* to collaboration posed by the organisational constraints and opposing interests of these two seemingly different yet complementary actors.

The structure of this chapter corresponds to the various phases of the venture capital cycle, analysing varying propensities for collaboration exhibited during the investment selection phase (Sect. 7.1), the post-selection monitoring phase (Sect. 7.2), and the exit phase (Sect. 7.3). For each phase the connection between collaboration and geographic proximity is explored. This is followed by a

discussion of the main challenges this collaboration presents (Sect. 7.4), along with some concluding discussion and analysis (Sect. 7.5). An important aspect of this analysis is the triangulation of the findings through the perspective of several large corporations and their corporate venturing divisions that operate out of London based offices. This additional perspective, derived from in-depth semi-structured interviews, is used to verify and sharpen the main findings, adding a further dimension of credibility.

7.1. Collaboration During the Investment Selection Phase

The screening and investment selection phase of the venture capital cycle is characterised by high propensities for collaboration between VC firms and large corporations. As established in previous chapters, this collaboration is particularly important for VC firms as a mechanism for enhancing the investment selection process. The purpose of this collaboration for investment selection is twofold: (1) it provides insight into the commercial viability of a proposed technology or product, and (2) it determines a large corporation's degree of commercial interest in a proposed technology or product. These motivations are connected and occur in tandem, but findings position the latter as more relevant for VC firms when making a decision to invest in a new company. A large corporation's commercial interest in a particular technology or product signifies the potential market viability, but perhaps more important, it also suggests a potential investment exit through a corporate acquisition or merger. The findings suggest that establishing this corporate interest in a proposed technology or product is a main driver for VC firms' collaboration with large corporations.

However, the use of collaboration by VC firms for investment selection purposes is not as simple as just asking a large corporation for an opinion on a potential portfolio company. This early stage collaboration is a mutual and recursive exchange of information that may or may not lead to a decision to invest in a particular company. Information gained through this interaction is often used by VC firms to seek out potential portfolio companies that best match the pipeline needs of their corporate partners; these potential portfolio companies are then further screened through additional information exchange with a corporate partner,

leading to an investment decision. This exchange of information at the selection phase may also lead to greater and better quality deal flow for the VC firm (as described in Chapter 6) in that the VC firm may gain exposure and access to new investment opportunities, including corporate spin-outs – investment opportunities that carry with them possible corporate validation and the potential for corporate acquisition. Therefore, this interaction for investment selection purposes acts as the initial mechanism through which the majority of collaboration between VC firms and large corporations occurs and on which subsequent collaboration follows.

However, in most cases this exchange of information regarding investment selection does not lead to eventual co-investment arrangements. The more likely outcome is a strategic partnership in which information about potential investments is recursively exchanged and current portfolio companies are continuously evaluated. When asked about the timing of collaboration, a venture capitalist at a life science-focused VC firm commented:

> Well, I would say [collaboration] is more common at the selection phase. One of the roles of these corporate venture groups is to be out scouting out new technologies, and that involves the research groups of Big Pharma, and the research groups are very good at the mid- to late stage drug discovery stage, so they don't really spend their efforts looking around at that point of the value chain. They are much more interested in early and breakthrough technologies. So the corporate venture groups are often involved in seeding academics, companies being spun out by universities, these early stages. So in my experience, they are there early, and that is great for the spin-out entity, because they get some corporate and pharma expertise early on, and when the next round of investors comes in it is sort of validated.

This interpretation of the findings is verified through interviews with several corporate venturing divisions of large corporations, which described the interaction with VC firms as a fluid exchange of information regarding complementary needs, leading to investment decisions by both actors. The head of a *corporate venturing division* of large ICT oriented company explained:

> Our relationship with the VC [venture capital] community is extremely important. We take two perspectives: one is the inbound perspective where we have lots of products but we don't have everything. If there is good stuff out there which complements what we have or can plug holes, it is good to know the companies that have that, and to bring them in-house in terms of partnerships or any other commercial model where we can offer a broader

> global solution. The second area (perspective) where working with other innovative companies is important is where we want to expand our brand into the ICT community. The ICT industry is very "sticky," most people who begin in the ICT industry stay in the ICT industry: study computer science, begin in a start-up company, end up working for the ICT department at Merrill Lynch. It's very important that people in IT will want to continue to use our products – growing another generation of users.

This comment is informative because it highlights the use of this collaboration by large corporations to scan for companies that are complementary from a technology and product perspective. Therefore, VC firms clearly can be viewed as network intermediaries in that they act as information repositories for the network: they collect and hold comprehensive information on the makeup and competencies of network participants (i.e. current and former portfolio companies). The above comment also alludes to the significant interdependence and connections between sector-specific venture capital networks and broader industry networks. In this way, large corporations seem to recognise that venture capital networks are an important source of new innovations and new talent within an industry, and that participating and in some ways encouraging these venture capital networks has long-term benefits for both themselves as network incumbents and the broader industry. A representative at another corporate venturing division expanded on these themes:

> We are engaging with independent venture capital because they are a really good entry into networks of innovative firms. We don't know everyone out there. We are really good in working with large companies, but small companies — not as good. With individuals, small firms, and start-ups, we are lost, and just not equipped to handle them. VCs see 500 business plans a year, only invest in 5, have a portfolio of 50 — great way of engaging (the due diligence is done). We do that across the continent, we have a good chance of identifying good, interesting companies.

This notion of large corporations having difficulty in handling small firms can be interpreted in two ways. The first alludes to a lack of capability on the part of large corporations to integrate small firms organisationally into their operations, whether through acquisition or merger (i.e. internalising to a degree the acquired firm) or in working alongside a small firm in the form of a partnership. In this view, collaborating with a VC firm, with the VC firm acting as an intermediary, provides a degree of organisational learning for a large corporation. In this way,

collaboration assists large corporations in effectively *establishing* and then *developing* their partnerships with small entrepreneurial firms.

This leads to the second interpretation: that large corporations have difficulty in *identifying* which small firms are most appropriate for partnering and acquisition purposes, not just from a product or asset perspective but also organisationally. In this view, collaborating with VC firms is particularly valuable for large corporations in selecting small firms for partnerships and acquisition. The findings lend more support to the latter, particularly when describing collaboration at the early stage; identifying appropriate firms for acquisition or partnership seems to be the primary motivation for large corporations to seek out and engage in collaborative activity with VC firms, thus corresponding to the overarching motivations for collaboration as described by the VC firms interviewed. Building on the above, these comments further establish VC firms as not only investment intermediaries but also as *knowledge brokers* in that they identify complementarities between portfolio companies and large corporations and then facilitate in bringing them together, helping the two to overcome certain organisational barriers (e.g. strategic and cultural differences).

In sum, the comments above highlight the complementary nature of this collaboration between VC firms and large corporations. First, from the venture capital perspective, early stage collaboration with large corporations is engaged in to obtain both the commercial validation for potential portfolio companies and for beginning a long-term process of nurturing potential or current portfolio companies for corporate acquisition or merger. In other words, corporate commercial validation and corporate interest in a potential portfolio company are, in large part, driving a VC firm's decision to invest. This collaboration regarding investment selection also grants a VC firm access to additional investment opportunities (e.g. through a large corporation's investment portfolio, and raising a VC firm's reputation), leading to better quality deal flow. Second, from the corporate venture capital perspective early stage collaboration with independent VC firms provides a window on emerging technology and, more important, acts as a selection mechanism for identifying new firms for partnerships, investment, and acquisition. Large corporations will have a measure of confidence in potential

portfolio companies that are brought to their attention by a VC firm because of the extensive due diligence already performed by the VC firm.

In many respects, for both VC firms and large corporations this collaboration geared toward investment screening and selection is about obtaining and using complementary *market knowledge* for selecting commercially viable portfolio companies and complementary technologies and products through acquisition and partnering, thus reducing to some extent the substantial market uncertainty inherent in innovation (see Chapter 2). In contrast, the less prominent exchange of technical knowledge at the selection phase is not all that surprising. Technical knowledge is certainly necessary for evaluating potential portfolio companies, but it appears that in most instances the technical soundness of the proposed technology or product has been vetted through other means prior to any formal corporate collaboration. Again, from the venture capital perspective it is market viability and corporate interest (i.e. the market test) that are sought through early stage collaboration. The exception is with those VC firms investing in life science and biotech, where a considerable amount of technical know-how appears to be exchanged between the VC firm and large corporation (see Chapter 6). The explanation is that requirements for science and technology and subsequent development costs are higher here compared to other sectors (see Chapter 3). These requirements necessitate greater collaboration and knowledge exchange between the two parties at the selection phase. The aim here is to better align and integrate the portfolio companies with the corporate product pipeline needs and to establish this early on in what will likely be a long investment or partnering commitment by both parties.

Regarding further sector propensities, the complementarities concerning selection benefits and the propensity to seek these out through early stage collaboration were felt across sectors. VC firms investing in life science, ICT, and clean tech all engaged with large corporations for investment selection purposes. Again, VC firms engaged in life science exhibited a higher degree of interaction between themselves and their corporate partners in the pharmaceutical industry. This interaction was not so much formalised as it is systemised to a degree that these VC firms had procedures in place for facilitating collaboration for investment

selection and other purposes going beyond the selection phase. This level of systemisation was not as evident for VC firms investing in ICT and clean tech, indicating venture capital's more developed intermediary role in the life science sector, where the relationship between large pharmaceutical companies and smaller biotech firms is more co-dependent and long-established (see Chapter 3).

However, as the findings in Chapter 5 suggest, early stage collaboration between VC firms and large corporations is characterised by informal interaction, which may or may not lead to more formal collaborative structures. As one venture capitalist commented:

> These relationships are "relationships." We don't have many formal agreements with anybody; nobody has rights to any information whatsoever. It is an ongoing dialogue, and at a certain time they may say that they are interested in a certain company, we make an introduction, and away it goes.

This emphasis on informal collaboration was shared by a representative at a corporate venturing division:

> There is not much interaction at a formal level or structure, but there is definitely an interaction at an informal network level. We go to lengths to inform the VC community that this is what we do and this is what we are interested in, and we invite VCs to come to us with ideas. The most structured it becomes at this stage comes down to individual phone calls with fund managers. They say "we have a company [portfolio company] that we are raising money for, and we think you might be interested."

With considerable early stage collaboration occurring between VC firms and large corporations, pursued and engaged in by both parties for identifying and validating potential investments and partners and leading to decisions to invest, the question then becomes, what occurs after investment selection regarding this collaboration? Some comments from the interviews (e.g. "we make an introduction and away it goes") may characterise not only this early stage collaboration as it is experienced by most VC firms, but may also hint at a propensity for less direct interactions between VC firms and the large corporations as the relationship proceeds through the expansion stage. In other words, from the venture capital perspective, the process of investment selection may well introduce a large corporation to a

portfolio company, thus catalysing a relationship between them where the role of the VC firm as intermediary declines in importance.

7.1.1. Investment Selection, Collaboration, and Geographic Proximity

As discussed in Chapter 3, geographic proximity plays a very important facilitating and determining role in a VC firm's screening and selection of portfolio companies. The tacit and asymmetric nature of the information that characterises new ideas and technologies associated with NHTCs generally requires VC firms to select and invest in local portfolio companies where necessary face-to-face interaction and information exchange is less costly. For screening and selection purposes, geographic proximity also allows VC firms to leverage their local networks of other VC firms and industry contacts. Information exchange with these local actors is viewed as integral to enhancing due diligence and verifying the market and technical viability of a proposed product or technology. For this reason, it was expected that a VC firm's collaboration with corporate contacts and partners (e.g. large corporations) for investment selection purposes would be greatly facilitated by geographic proximity and related access to local industry networks.

Although the findings presented in Chapter 5 downplay the role of co-location as facilitating collaboration between VC firms and large corporations, the majority of interviewees stressed the importance of face-to-face interaction in meeting with corporate contacts and corporate partners, with much of this interaction based on the past industry ties of VCs and through local business and professional networks operating within the LMR. Coupled with the significance that almost all interviewees placed on this collaboration for investment selection purposes, it is almost certain that geographic proximity facilities this exchange of information between these two actors regarding potential portfolio companies and corporate pipeline needs, leading to investment selection decisions. Again, many interviewees claimed that they would not select a company for investment if the company did not have the interest or backing of their corporate contacts or partners. In this way, corporate validation of a portfolio company (product and technology) is almost overarching for determining market viability, and to some

extent, technical viability – this places large corporations firmly, and intimately, within the decision making process by which VC firms screen and select new companies for investment, a process dominated by interactions within local networks.

Furthermore, when taking into account comments made by interviewees, particularly those at life science focused VC firms, about the advantages of having pharmaceutical company R&D centres located in the LMR for meeting purposes and information exchange it is difficult not to connect some degree of importance to co-location for facilitating collaboration for investment selection purposes. Although a substantial number of interviewees stressed the global focus of their investments, investing not only in the United Kingdom but also in other venture capital markets around the world, a still sizable amount of their funds involved investments in portfolio companies located in the LMR. For selecting these local companies (i.e. screening and due-diligence), London based VC firms will undoubtedly leverage their local industry networks. In other words, if VC firms are basing much of their due-diligence on information from local actors (e.g. other VC firms and entrepreneurs), why would they not engage large corporations that have a local presence in the LMR for these purposes, particularly given how important collaboration with corporate partners is for selecting portfolio companies, as described by interviewees? In this way, a strong argument can be made that geographic proximity, including some degree of co-location, plays a significant role in facilitating collaboration between VC firms and large corporations during the investment selection phase of the venture capital cycle.

7.2. Collaboration During the Post-selection Monitoring Phase

In considering the venture capital investment process with its emphasis on staged funding rounds, and the active monitoring of portfolio companies involving the provision of nonfinancial value added toward the development of these companies, it was thought that the benefits of collaboration between VC firms and large corporations would be felt most during the post-selection monitoring phase, from the early stages of investment up through the expansion stage. Furthermore, it was expected that the importance of collaboration for monitoring and value added

purposes would be greater for those portfolio companies requiring substantial inputs of science and technology (H3). Whereas the investment selection phase emphasises the reduction of market uncertainty through corporate validation and interest, it was thought that corporate collaboration during the investment monitoring phase, particularly during the early investment stages, would emphasise the reduction of technical uncertainty and, during the expansion stage, focus on the building of business and commercial capacity of portfolio companies.

Based on the findings discussed in Chapter 6, collaboration with large corporations does hold some importance for the post-investment monitoring phase, but the significance or intensity of this collaboration decreases somewhat from that experienced at the investment selection phase. As established in Chapter 6, motivations for accessing and using knowledge and expertise for value-adding purposes, while evident, were not identified by the majority of VC firms interviewed as primary motivations for collaboration and were less important than motivations for enhancing investment selection and investment exit. The findings suggest that for the majority of VC firms, collaboration with large corporations during the post-investment monitoring phase covering both the early and expansion stages of the investment is a more informal continuation of the collaboration that occurs during the selection phase; whereas on-going collaboration is used to enhance the monitoring and evaluation of portfolio companies, this continuing evaluation is focused on ensuring the market viability (industry and market knowledge) of a portfolio company while maintaining the acquisition or merger interest of a large corporation. In some instances, this ongoing evaluation might lead to decisions regarding product development and necessary technical adjustments, but the more likely outcome are changes to business and marketing strategy.

As established in Chapters 5 and 6, collaboration during the investment monitoring phase, similar to collaboration during the selection phase, is characterised by informal interaction between individual venture capitalists and their corporate contacts. This informality continued even when strategic partnerships were held between a VC firm and a large corporation. In such arrangements, placing corporate representatives on the boards of portfolio companies was common, but

their involvement in the monitoring of those portfolio companies was described by the majority of interviewees as limited and "very hands off." In this way, the monitoring of portfolio companies seems to be the responsibility of the VC firms themselves and their syndicate partners, generally other VC firms. The role of the corporate partner seems to be to provide guidance to the VC firm when required, but this is only periodic and generally aligns with changes to investment strategy, such as when moving from what would be considered early stage investment to expansion or later stages. Again, the need for flexibility by both parties keeps formal or contractual agreements between them to a minimum, making instances of syndication and co-investing between VC firms and large corporations less probable.

This does not mean that substantive exchange of information and knowledge, beyond the exchange of industry and market knowledge, is not occurring through this collaboration during the monitoring phase. A number of interviewees from across sectors spoke of the technical and commercial benefits of corporate partnering to their portfolio companies. For the most part, though, this was either not widespread or the value added was the result of partnerships between large corporations and portfolio companies with little coordination required by the VC firm. The exception to this was VC firms investing specifically in life science and biotech, for which propensities for syndication and co-investing with corporate partners was significantly higher compared to other sectors. The degree of formal collaboration exhibited in this sector corresponds to more substantive exchanges of knowledge and expertise between VC firms and large corporations regarding science and technology during the monitoring phase. An interviewee at life science-focused VC firm commented:

> We also find that collaborating with corporate venture groups where the group sits firmly within the parent company has advantages, because those groups measure more on what they deliver back to the corporate and not necessarily on return. In such cases, we collaborate for a very particular reason in that this corporate has unique expertise which aligns with a company we are investing in. And it is very often the case that these are very early stage companies, where we are talking very high risk, breakthrough science.

This comment is interesting in that it points to some advantages of collaborating with a corporate venturing division that resides firmly within the parent company. This runs counter to what most VC firms interviewed described; their preference was to collaborate with a corporate venture capital division that worked more independently from its parent company, because these are more investment return focused (see Section 7.4.2). For VC firms focused on investments in life science, however, the complementary knowledge and market validation obtained through collaboration with large pharmaceutical companies seems to matter most. The combination of such knowledge is used not only to overcome technical challenges, but also to aid the business and commercial development of portfolio companies. An interviewee at a life science-focused VC firm elaborated:

> If you can get comfortable with their agenda, a corporate partner can bring a lot in terms of knowing the commercial market. Although you do hear often about a gap in that many biotech firms believe they know more about the market than the pharma companies, or that the pharma CVC are run by pharma execs that don't understand the biotech culture – you can debate it in different directions. But, in many "spaces" the corporate partner can bring a lot in terms of industry knowledge, commercial capabilities, and connections. They can be a good partner in that respect.

Comments such as these, and there were several, hint at the complementarities that can be realised through this collaboration, both between VC firms and large corporations and between large corporations and small entrepreneurial companies. From this perspective, VC firms can be viewed as effective intermediaries and knowledge brokers in helping to bring together the complementary asset of NHTCs and large corporations, thus connecting NHTCs to valuable enabling infrastructure (see Chapter 2). In summarising and verifying the complementary benefits of this collaboration, an interviewee at a *corporate venturing division* commented:

> The real positive thing about investing with VC firms and other partners is that you get different capabilities. What we bring is a real good understanding of the commercial and consumer markets, marketing, and certain technologies, and we like to invest in funds with a really good track record in successful commercialization and exit in particular technology sectors. For example, one of our companies is a chemical catalyst company which has made very good commercial progress. However, we don't know much about catalysts. Therefore, we work with a VC co-investor who has a

> lot of experience in the chemical industry. For us, it is worth potentially not going for the highest valuation and bringing in a real capable investor that can add a lot of value. So there is a spectrum of motivations from the real cynical risk management, to the practical utilitarian stretching of funds, to the real upside of enhancing capabilities.

Again, the strong propensity for life science focused VC firms to use collaboration with large corporations during the monitoring phase for value adding purposes was not shared to the same extent by VC firms investing in ICT and clean tech, although corporate knowledge in science and technology was significant for clean tech focused VC firms. Several interrelated explanations for these differences were offered in Chapter 6, from a lack of value-adding activity on the part of VC firms to the view that large corporations are not a significant source of value-adding capacity for use by VC firms, value-added being derived from other sources. Neither of these explanations satisfies. Rather, it seems more probable that the downplay of the value-adding benefits from collaboration with large corporations is the confluence of several factors involving sector differences in the degree and substance of the factor inputs required to develop and commercialise new technology based products and processes and the corresponding barriers to market (see Chapter 3). Compared to the life science sector, factor inputs and barriers to market are less in the ICT and clean tech sectors, resulting in less demand in these sectors for value added inputs through corporate collaboration.

Furthermore, although the effects of the severe economic downturn (2007–2010), particularly the contraction of the IPO market occurring during the time of this study, appear to be driving VC firms to collaborate more frequently with their corporate partners, these effects may also be diminishing the value-adding potential of this collaboration. Under these conditions, the aim of most VC firms is to select portfolio companies that align with the product pipeline needs and strategic objectives of large corporations and to then better position portfolio companies for an exit via corporate acquisition or merger. To make this outcome more likely, VC firms are selecting portfolio companies that are more established (i.e. not early stage), and therefore require less initial capacity building (value-added) and thus less corporate input and participation in the monitoring of the companies. This shift away from early stage companies was confirmed by a

number of interviewees, particularly those at ICT focused VC firms. Clean tech focused VC firms were also investing heavily in more established companies, but this was not considered a shift in investment strategy, but rather a standard investment practice for these VC firms. Subsequently, these more established portfolio companies are likely to have pre-existing collaborative partnerships with large corporations, thus lessening the need for the VC firm to connect these portfolio companies to corporate contacts. Thus, the confluence of these factors results in weaker than expected findings for the value-adding motive.

7.2.1. Monitoring, Collaboration, and Geographic Proximity

According to the literature, although geographic proximity and local investment networks greatly facilitate VC firms in the selection of portfolio companies, the reliance on local actors and capacities becomes even greater during the post-selection monitoring phase, when asymmetric information persists, agency costs potentially increase, and technical uncertainty associated with product development is at its highest, particularly at the early investment stages (Mason, 2007). Active monitoring, however, is very time-consuming. Being in close geographic proximity to the portfolio companies they invest in reduces the costs of monitoring by allowing VC firms to meet regularly not only with portfolio companies, but also with other VC firms and partners participating in the on-going monitoring process. This collective monitoring effort contributes to the continual evaluation of portfolio companies – determining potential adjustments in strategy, personnel, and funding amounts from one investment round to the next (Zook, 2004). For this reason, it was thought that collaboration between VC firms and large corporations for investment monitoring purposes would be greatly facilitated by geographic proximity, with the importance of co-location increasing for the monitoring of portfolio companies with substantial science and technology input requirements (H3).

In considering the findings, particularly the decreased importance that a majority of the interviewees placed on the value adding contributions that collaboration with large corporations generates, coupled with the largely informal and somewhat periodic interaction with corporate partners described by interviewees during the

post-selection monitoring phase, the overall significance of geographic proximity during the monitoring phase is, surprisingly, markedly less than during the investment selection phase. It seems that for most VC firms, regular face-to-face access to corporate partners is not particularly advantageous for the monitoring of portfolio companies, further suggesting that for most VC firms, corporate contacts and partners are not intimate participants in the investment monitoring process. Similar to the investment selection phase, the industry and market knowledge that corporate contacts and partners provide is deemed most beneficial during the monitoring phase (assisting the VC firm in adjusting business and marketing strategy). Such information only periodically sought and described as easily communicated over the phone.

For life science focused VC firms, however, the importance of corporate partners for obtaining knowledge and expertise regarding science and technology, as well as for business and commercial development, indicates a more substantive and coordinated relationship during the post-selection monitoring phase. Furthermore, the propensity for life science VC firms to engage in syndication with corporate partners probably, in such instances, increases the interaction and knowledge exchange between the two for investment monitoring purposes. Such knowledge exchange, even if not particularly frequent, probably requires face-to-face interaction, making geographic proximity and some degree of co-location a likelihood, if not a necessity. In this way, the findings lend some support to (H3).

Finally, this research does not adequately capture the relationship and location dynamics between venture capital-backed portfolio companies and the large corporations that, it is assumed, are often initially brought together by an intermediary VC firm. It is very possible that such relationships are facilitated by geographic proximity and, to a certain extent, the co-location of portfolio companies and large corporations. In this way, the overall importance of geographic proximity in regard to corporate partnerships may well be more significant than the interviewees admit. In other words, for VC firms, the importance of geographic proximity in facilitating collaboration with corporate contacts and partners might very well decrease following the investment selection phase, whereas geographic proximity becomes more significant for facilitating

relationships between portfolio companies and large corporations, these geographically proximate relationships contributing to the post-selection monitoring phase.

7.3. Propensities for Collaboration during the Exit Phase

Corresponding to the exit aims of most VC firms, collaboration between VC firms and large corporations culminates in the later stages of the investment cycle leading to an investment exit, with the interaction between the VC firm and corporate partner(s) intensifying somewhat from that experienced during the investment monitoring phase. Aligned with the exit motive, VC firms reengage their corporate contacts and corporate strategic partners to facilitate a successful investment exit. The general aim is a successful exit by corporate acquisition or merger. Importantly, the actual process of collaboration for investment exit was not articulated at length by interviewees, making it difficult to fully characterise the interaction between VC firms and large corporations during the exit phase. Some of this might be due to VC firms' sensitivities in discussing both exit strategies and details regarding exit negotiations with corporate partners. Also, it was unclear from the interviews the extent to which portfolio companies were acquired by large corporations that were actual collaborative partners of the respective VC firms, either as strategic or syndicate partners. In other words, collaboration with corporate partners may be used to position portfolio companies for exits by acquisition, but those corporate partners may not always be the acquiring companies.

Furthermore, in positioning portfolio companies for exit, the facilitating role of collaboration appears to take two forms, one of which is not entirely connected to an exit by acquisition or merger. First, VC firms may seek out large corporations to obtain additional investment funding (as demonstrated in Chapter 6), which may be crucial in getting a portfolio company to the exit stage and may also increase investment awareness about a particular portfolio company, raising the visibility of the portfolio company and perhaps the reputation of the VC firm (see Neus & Walz, 2005). When the IPO market is more robust, such a strategy probably will still be employed. This strategy takes on further resonance during an economic

downturn, the aim being to drive additional funding for the portfolio company and attract additional corporate interest, setting up a potentially lucrative bidding race for the acquisition of the portfolio company. Even when corporate funding is not sought, corporate partners will still be approached by the VC firm to assess their interest in an acquisition or merger with the respective portfolio company.

Therefore, it is the exit phase of the venture capital cycle that informs and characterises much of the cycle's preceding phases and stages (as discussed in Chapter 3). As previously discussed (see Chapter 6) collaboration with corporate partners is aimed, in large part, at selecting portfolio companies that have corporate backing or validation, and then positioning these companies for corporate partnerships or exits by corporate acquisition or merger – the only real viable venture capital exit in an environment of limited exit options (see Schwienbacher, 2008). It is also apparent that diminishing exit options have coincided with a shift by venture capital investors from early stage funding to later stage funding in more established portfolio companies. These later stage portfolio companies may be better aligned with the more immediate technology and product pipeline needs of large corporations than early stage companies.

7.3.1. Investment Exit, Collaboration and Geographic Proximity

Given the relative lack of detail provided by interviewees concerning the processes by which collaboration with large corporations facilitate the investment exit phase, it is somewhat difficult to assess the importance of geographic proximity in this regard. As discussed in Chapter 3, the literature on the connections between venture capital investment and geographic location focus primarily on the significance of geographic proximity as it relates to the investment selection phase and post-selection monitoring phase; discussion regarding geographic proximity and the exit phase is mainly absent. That being said, both the findings and the literature lend themselves to two possible interpretations. First, given the importance of the exit motive as described by interviewees, it can be assumed that a substantial amount of face-to-face interaction will occur in the lead-up to an exit between a VC firm and their corporate partners. It can also be assumed that face-to-face meetings will occur between respective corporate partners and the portfolio

companies they are hoping to acquire. Therefore, some degree of geographic proximity should be advantageous, if not necessary. Again, however, the extent to which portfolio companies are being acquired by large corporations that have a strong presence (i.e. a headquarters or R&D division) in the LMR is unclear, bringing some doubt over the significance of co-location for investment exit.

Second, VC firms and large corporations engaged in an exit by acquisition or merger involving a London based portfolio company will probably rely on the financial and legal services found in London, particularly investment banks, corporate law offices, and patent attorneys. In other words, whether or not co-location is significant, the processes through which a London based VC firm and a large corporation pursue and finalise an exit by acquisition are predominantly local. Finally, these local processes and subsequent interactions between London based VC firms and large corporations for investment exit purposes, are, as suggested by interviewees, facilitated by the London region's international transport links, thus allowing substantive interaction in the absence of significant co-location.

7.4. Challenges to Collaboration

An understanding of when VC firms collaborate with large corporations gives not only knowledge of the complementarities of this collaboration, but also illuminates the inherent challenges in bringing these complementary actors together, thus demonstrating the advantages of informal collaborative structures and the limitations of more formal co-investing arrangements. These challenges often are grounded in different organisational interests and strategic objectives that, in some respects, highlight not only the potential barriers to integrating the needs and functions of NHTCs with those of large firms as discussed in Chapter 2, but also the different investment approaches and aims between independent venture capital and corporate venturing activities. In the most basic sense, this is about reconciling two competing interests: the relatively long-term development and investment return objectives of independent venture capital and the short-term technology and acquisition objectives of large corporations. These challenges manifest themselves in two ways: (1) challenges associated with different strategic interests and

expectations and (2) challenges associated competitive confusion, particularly as it relates to the investment exit phase.

7.4.1. Different Strategic Interests and Expectations

First, challenges to collaboration associated with different strategic interests and expectations are most apparent when moving from less formal interaction to more formal collaborative arrangements such as formal strategic partnerships and syndication partnerships. As discussed previously, one of the main objectives of most corporate venturing programs is to gain access to emerging technology, that is, identifying complementary technology or products and scouting the market for potential partners to secure it. This constitutes rather a "wait and see" strategy, which seems to typify the collaborative approach of most large corporations toward independent venture capital partners. This is also an approach that seems to align with the interests of most VC firms. For collaboration to evolve to more formal co-investing arrangements, VC firms expect corporate partners to treat the portfolio company as a true venture capital investment in which the focus is on the development and successful exit of the portfolio company, with an emphasis on optimal investment return. As one interviewee venture capitalist bluntly articulated regarding such co-investing:

> We want corporate syndicate partners who align with our interests — that is making money! If their major interest is something else, they may do things that may not be right for the investors in a specific small company, because their goal is to access technology.

This comment is similar to those of other interviewees whose firms engaged in syndication partnerships with large corporations. Such comments by VCs were acknowledgments of a sort that even as co-investors, the primary aim of these corporate partners is to enhance their access to new products and technology. Such aims have obvious benefits for VCs and portfolio companies regarding potential value added and investment exit opportunities. However, in addition to these benefits not always being realized, these aims do not always coincide with the aim of developing portfolio companies to their upmost potential as companies or valuation as investments. In other words, VC firms want both the capital and the value added that corporate partners can provide toward the development of

portfolio companies, and they want potential exits by corporate acquisition, but not at the expense of investment returns. As one interviewee venture capitalist explained:

> The way we interact with these corporate groups is very much determined on their modus operandi, what their real goals are. So, when we are building a syndicate, we are just as careful with choosing our investment partners as we are with the science and technology aspects of the investment. It needs to be handled carefully. Overall it is a very positive contribution, but you just have to be cautious, particularly in handling the confidentiality. I mean, if you were to go to a corporate player and exchange confidential information, that confidential information can't find its way back, even if they say there are Chinese walls and it's not going to get through, you still have to be cautious.

In this way, collaboration can be both a channel for knowledge gain as well as a conduit through which VC firms and portfolio companies can lose proprietary knowledge and know-how (see Chapter 2). Another interviewee at a life science VC firm commented:

> I have another company where we have a corporate venture group alongside us, well we came in on the B round, they were in on the A round, and we were nervous – how do you keep things confidential? So in that circumstance, we made it very clear to that corporate partner and that they did not have a preferential access from a deal perspective. And in fact, we are in the process with that company, in working on a corporate relationship, and we have a number of players; and the individual who represents the actual corporate on the board is not allowed to be part of the board discussions on anything to do with partnering. So, you can handle it, but it does cause issues.

Besides issues of confidentiality, the quote above raises challenges in dealing with propensities for competitive confusion. The majority of VC firms interviewed engaged in collaboration with multiple corporate partners, generally the leading industry players in their respective industries. Competitive confusion may arise when one corporate partner is viewed by other corporate partners or potential partners as having gained preferential access to a portfolio company and the technology or product it holds. A result may be the erosion of trust between a VC firm and its current and potential corporate partners – partners they very much want available for future collaboration and as bidding suitors for an exit by acquisition. A venture capitalist at a life science-focused VC firm elaborated:

> It can also be a quite tricky thing. The problem is that there are different forms of corporate venturing groups. There are some that are embedded in the pharma company, and their role is really to be out scouting for opportunities and making their investments. They keep their network open and linked into interesting companies. That is actually quite tricky for us to deal with because we don't want to be constrained with pharma companies that we might want to sell to. Another pharma company would be very nervous if there was a pharma corporate investor on the board who knows everything about the company and the negotiations.

This issue of competitive confusion is probably most apparent in the life science sector, where to develop a new life science company VC firms need relationships or even formal partnerships with a select number of large pharmaceutical companies. Due to consolidation in the pharmaceutical industry, however, the number of pharmaceutical companies with which a VC firm can partner is actually quite small (see Chapter 3), making it increasingly likely that such corporate partners will be competitors for the same products and technologies, thus increasing the potential for competitive confusion.

7.4.2. Exit Complications and Other Challenges

This notion of potential competitive confusion appears again during the later stages of the venture capital cycle, when portfolio companies are being positioned for an investment exit through a corporate acquisition or merger. In such an exit the objective of the VC firm is to sell the portfolio company at the highest possible price. This generally requires having multiple bidders for acquisition. The potential problem is that strong ties to a strategic corporate partner or corporate co-investor can lead that corporate partner to believe it has preferential access to a particular portfolio company and that it is the preferred or expected acquirer of that firm on exit. Such a situation can dissuade other potential bidders from becoming involved in the exit (thus lowering the bidding price) or lead to friction between the VC firm and the corporate partner, potentially causing damage to the collaborative relationship. An interviewee at an ICT focused VC firm commented:

> In terms of collaboration, too much collaboration can be damaging to exit. You need some optimal number [of bidders for acquisition]. Getting that optimal number to get that deal tension in an acquisition where they all understand what the value drivers and capabilities are, but where there are not so much that it becomes too complicated — we spend a lot of time

> debating this issue. So in some ways it creates an encumbrance, making exit more difficult. We do have lots of discussions with corporations about our businesses, but they just have to be done carefully.

The potential for complications surrounding exits involving a corporate partner highlights the obvious tension in the interests of the two investment actors. The VC firm wants the highest possible bid, whereas the corporate partner wants to buy a portfolio company at the lowest possible price. These opposing interests can result in different investment expectations and objectives, as well as outcomes. An interviewee at a life science-focused VC firm elaborated:

> I was involved in a situation where a pharmaceutical fund [venture capital fund investing in life science] had pharma people [corporate representatives] on the board. These board members were very much beholden to their parent company and thus were constrained in raising additional funds for a particular company [portfolio company]. Pharma [parent company] ended up buying the company [portfolio company] when the negotiating level was very low and the venture capital fund lost out. So you have to be very careful. They [corporate partner] can just sort of get in the way. They can stall you, and then pick you up on the cheap. You want to avoid this kind of situation.

Another related challenge in aligning interests for portfolio company firm selection and exit, particularly in more formal co-investing situations, is reconciling the VC firm's long investment horizon (5 to 10 years) to the pipeline needs of a corporate partner, which are often more immediate. As an interviewee venture capitalist commented:

> The challenge is to get them to think about whether they might be interested in a particular company 5 years from now. They want technologies and products now! This is the tricky part.

Exactly how VC firms better align the expectations of corporate partners to the long-term emphasis of the venture capital investment process is not entirely clear from the findings, but the process of repeat interaction seems to build trust that facilitates mutually recognized benefits between the parties, with some degree of organizational learning occurring on both sides. In many ways, collaboration itself can be seen as a mechanism for learning and for better aligning complementary interests. The overarching objective of the VC firm is to achieve a profitable exit; the overarching objective of the large corporation is to acquire new technology that

matches its R&D and strategic objectives. Through sustained collaboration with each other, both objectives can be met.

That being said, in approaching these challenges a common sentiment among the VC firms interviewed that engaged in syndication or co-investment with large corporations was that it was preferable to collaborate with those corporations that operated external corporate venturing or corporate venture capital divisions. Such operations align more closely with the objectives of independent venture capital, where the emphasis is on investment return through the development of portfolio companies and not access to technology or products that can then be brought back to the parent company. An interviewee at a large ICT focused VC firm that had engaged in several syndications involving a large corporation, explained:

> There is another group of corporate investors who are linked to a corporate parent but who actually sit separate from it. Of course, it has links back to the parent company, but it is generally very loose, and the goal is to make returns for the parent. So they look much more like a regular venture capital partnership, and we prefer this. They are return focused, unlike most internal corporate venturing arms.

An interviewee at a life science-focused VC firm commented:

> With those companies that have specific venture capital arms, it is very straightforward, they know the process. I think it would be almost impossible to bring in a pharma company that didn't have a venture capital arm. I don't really see how they could invest; the complexities are too complicated. If you have a pharma just come in, it could potentially look like they were trying to buy a specific portfolio firm. This is not what would happen with a corporate venture arm. So bringing in a pharma on its own could frighten off other pharma companies, or it could panic them into buying it. It could work both ways.

From the venture capital perspective, collaboration with large corporations *offers* considerable opportunities for knowledge exchange that, if appropriately accessed and used, can be applied to the development and capacity building of entrepreneurial firms, for example, as the majority of life science-focused VC firms interviewed for this study suggest. However, outside of life science, it may be that the full use of this value-adding opportunity is curtailed somewhat by the less intensive input needs of portfolio companies and the return-driven imperative of most VC firms, which results in collaborative relationships with large corporations

that emphasise flexibility over *deep* knowledge exchange. As a result, the focus of collaboration for most VCs interviewed is placed on the selection phase and the exit phase of the venture capital investment process, rather than on the post-selection monitoring phase.

Finally, another challenge to making collaboration between VC firms and large corporations work is in the actual process of developing the relationships, particularly from an individual VC perspective. For VCs, engaging in repeat interaction with corporate contacts and partners to build substantive relationships takes time at the expense of other functions and activities (e.g. monitoring of portfolio companies). An interviewee at an ICT focused VC firm commented at length:

> I've struggled a bit on the actual value of corporate relationships and the struggle involved in maintaining them. I meet corporate people at networking events, they might be good connections for my businesses, but going out and making these connections work is very time-consuming. It would have to be an extremely thorough job on my part for that to pay off. I think there are better ways in which we can add value. Many times the kind of companies that we get involved with have experienced management that already have those connections (they are going from company to company selling those businesses, it already is a more equal relationship). The other thing is that I am relatively new to this (investing in the sector for only 2 years), so over time these relationships might grow.

The interviewee continued:

> In general, I think the collaborative process is very time-consuming. It is non-structured and is network based. It is inherently inefficient, so I wouldn't want to have to devote any more time to it. Would I like a better quality of collaboration? Yes. We are about to raise money for a new business, and we are about to go around and talk to all the funds that invest in businesses like that. The process of finding those funds, finding the right person at those funds, and bringing the company in for a good hearing is a long, involved, and detailed process, and there is a whole industry built up around it, lots of intermediaries who handle that process, make money out of that process.

Comments such as this, although not pervasive, were expressed by several interviewees. Two points in particular should be made. First, although this research points to growing collaboration between VC firms and large corporations, such collaboration is not automatic. As in most collaborative relationships, there is a

cumulative learning process in which experience and familiarity weighs heavily in the substance of the exchange and the benefits of the outcome. Furthermore, although collaboration between VC firms and large corporations plays a significant role in the venture capital investment process, it is still an activity that is evolving. Finally, the above comments, similar to those made by interviewees, identify collaborative relationships between large corporations and portfolio companies that are established without the assistance of the VC firm as an intermediary. Again, what this may imply is that collaboration between VCs and large corporations is in fact a significant source of value added for venture capital backed portfolio companies, but that the value adding comes about through subsequent partnerships and direct interaction between large corporations and portfolio companies.

7.5. Discussion and Conclusions

When looking at the various stages that comprise the venture capital investment cycle, it is clear the collaboration with large corporations holds tremendous benefits for VC firms in that it enhances investment selection, has value for investment monitoring activities, and improves investment exit options. As shown in Figure 20, however, the benefits of this collaboration are felt most prominently and are thus pursued during (a) the investment selection phase, aligning with the selection motive, and (b) the later stages of the investment process culminating in the investment exit, corresponding to the exit motive as established in Chapter 6. Collaboration during the post-selection monitoring phase, from the early stages of investment up through the expansion stage, was surprisingly less significant. For most VC firms interviewed, the investment monitoring phase was characterised by informal and periodic interaction aimed at obtaining a variety of corporate knowledge and expertise, particularly industry and market knowledge for evaluating the developing market potential of portfolio companies so as to better position them for an exit by corporate acquisition or merger.

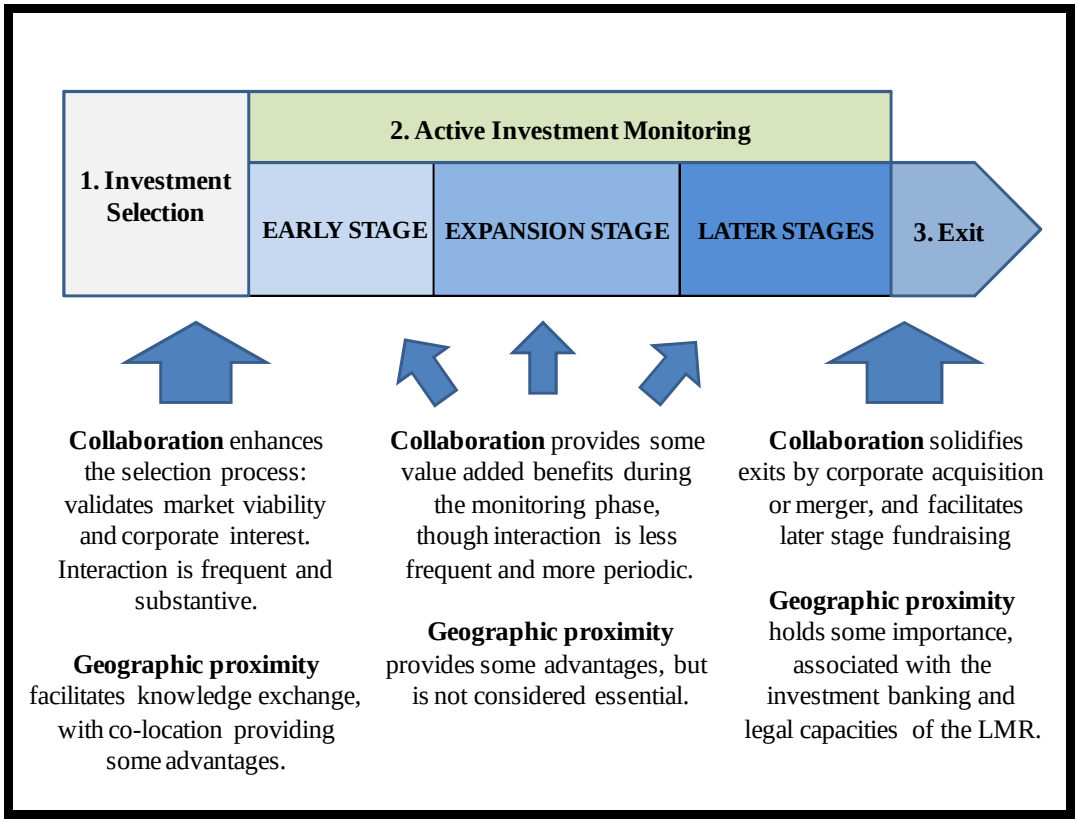
Using this collaboration for enhancing investment selection and improving investment exit options may be driven, in part, by a significant contraction in the IPO market during the most recent economic downturn, which is pushing VC

firms away from early stage investments that require substantial value added inputs and moving them toward investing in more established companies. At the same time, VC firms are placing more emphasis on investing in companies that align with the commercial and strategic interests of their corporate partners, thus facilitating exits by corporate acquisition and merger. The exception to this investment approach appears to be those VC firms investing heavily in life science and biotech. In these industries early stage investment is somewhat more prominent and the factor inputs required by portfolio companies and high barriers to market necessitate close collaboration with large pharmaceutical companies. These circumstances lead to the use of value-adding opportunities to build the capacity of portfolio companies and thus an emphasis on collaboration during the investment monitoring phase. That being said, the exit by acquisition and merger objective still holds for many of the life science-focused VC firms interviewed.

More specifically, however, the findings speak to collaborative relationships between VC firms and large corporations where less formal collaboration provides a more flexible and advantageous relationship in which the complementarities of the parties are potentially offset by different strategic interests and organisational constraints. Such a relationship is particularly advantageous for the selection of portfolio companies and for profitably exiting those investments. Yet this flexibility may lessen opportunities for value-adding during the investment monitoring phase.

Prominent among the challenges to collaboration is aligning organisational interests: aligning venture capital's long-term investment approach, which is based on investment return, with the short-term corporate objectives that emphasise more immediate technology and product pipeline needs. Furthermore, corporate partnerships, if not structured and approached carefully, can lead to complications during the investment exit stage involving competitive confusion, which can drive down the bidding price for an acquisition or merger. Additionally, developing collaborative relationships with large corporation takes time and resources, placing less experienced VC firms at a distinct disadvantage when compared to larger, more experienced VC firms.

Figure 20: Propensities for Collaboration & the Role of Geographic Proximity



Source: Own interpretation

Also shown in Figure 20, the importance of geographic proximity for this collaboration seems to follow the propensities for collaboration as they relate to the venture capital investment cycle, with geographic proximity greatly facilitating collaboration at the investment selection phase and to some extent collaboration at the investment exit phase. For the selection phase, geographic proximity allows VC firms to regularly meet face-to-face with corporate contacts and partners to discuss how potential portfolio firms might align with corporate pipeline needs. This exchange of industry and market knowledge as well as specialised and possibly proprietary information may well be facilitated by the co-location of the actors. Interviews with several London based corporate venturing divisions supported this co-location significance; the interviewees stated that their scouting of new technology brought them into frequent contact with London based VC firms.

For collaboration during the post-selection monitoring phase, the significance of geographic proximity appears to decrease from that of the selection phase.

Although substantive knowledge exchange involving science and technology and business and commercial development between VC firms and corporate partners occurred across sectors, it was described prominently only by those VC firms investing in life science and biotech. For the investment monitoring phase, most VC firms emphasised the access to industry and market knowledge that their corporate contacts and partners could provide – information that can be easily communicated by phone. Therefore, the need for close geographic proximity and the co-location of VC firms and their corporate partners during the monitoring phase was downplayed by the majority of VC firms interviewed. The significance of geographic proximity for collaboration during the exit phase is a bit less clear. Collaboration building up to an exit by acquisition or merger probably involves considerable face-to-face contact between VC firms and corporate partners, but there may be more of an emphasis on interactions with investment banks and legal services based in London for facilitating the acquisition or merger.

In considering the overall findings, it can be argued that geographic proximity plays a more significant role in facilitating collaboration between London based VC firms and large corporations than most interviewees admit or realise. Although much of the investment by London based VC firms may well go to portfolio companies abroad, a still significant number of investments are local. In selecting, monitoring, and exiting investments in local portfolio companies, London based VC firms collaborate with large corporations, many of whom have strong local presences in the LMR. This includes corporate HQs, R&D centres, and corporate venturing divisions – many of these described by interviewees as scouting London based portfolio companies for new technology and potential acquisitions, placing them in substantive contact with local VC firms. Furthermore, for initiating and building relationships with corporate contacts and partners and for exchanging complementary information, much of it specialised, tacit, and proprietary, some degree of face-to-face interaction is essential, even in the supposed absence of significant co-location. Therefore, geographic proximity is still important, with the LMR facilitating opportunities for profitable interactions between VC firms and large corporations through an abundance of social and professional network activities and tremendous capacity for international knowledge exchange.

8. Conclusion: Venture Capital and Corporate Partnering: Opportunities, Constraints, and Implications

Venture capital investment is one of the most effective funding mechanisms for developing NHTCs, thus playing a significant role in the support and facilitation of both entrepreneurship, and the commercialisation of new innovations. In doing so, VC firms contribute not only finance, but also considerable value added in the form of specialised knowledge, expertise, and connections to external funding, knowledge, and enabling infrastructure (De Clercq & Fried, 2005; Auerswald & Branscomb, 2003). Furthermore, the highly tacit information and asymmetric knowledge flows that characterise the innovation process, and NHTCs more generally, require VC firms to meet regularly, face-to-face with potential and current portfolio companies, both for investment selection purposes and ongoing investment evaluation and monitoring (Zook, 2004). For VC firms, this active monitoring is crucial for both managing asymmetric knowledge and related agency costs, and for developing the technological and commercial capacities of their portfolio companies (Gompers & Lerner, 2004). In order to lessen the selection and monitoring costs, VC firms will invest predominately in local companies, and rely on the knowledge and resource capacities of their local investment networks (Gompers & Lerner, 2001).

This study has proposed that a significant source of value adding inputs for venture capital backed companies are large corporations and their corporate venturing divisions and that these potential corporate partners hold central positions within local venture capital networks; leading to substantive interaction and collaboration between these large corporations and VC firms (Maula, Autio, & Murray, 2005). That being said, how this collaboration is coordinated and the various motivations for doing so have not been well substantiated empirically.

This study, therefore, has sought to capture and understand *how, why and under what circumstances do independent venture capital firms collaborate with large corporations and their corporate venturing divisions.* In doing so, this study has inquired to the frequency of collaboration, the structures and mechanisms through which this collaboration occurs, and the primary motivations for which this

collaboration is pursued. Furthermore, this study aimed to identify when collaboration is most beneficial in regard to the venture capital investment process, and to understand the challenges to bringing together these two complementary actors with often conflicting organisational cultures and different strategic interests. Furthermore, this study has sought to understand not only how venture capital, as active investors, provide substantial value added to their portfolio companies, but to also illuminate VC firms as important network intermediaries and knowledge brokers — bringing together complementary actors, competencies, and resources for bringing new innovations to market (see Chapter 2).

Because geographic proximity is viewed as facilitating much of the venture capital investment process (Mason, 2007), particularly venture capital's reliance on local networks and knowledge capacities for investment selection and investment monitoring — contributing to the concentration of venture capital activity in a select number of large metropolitan regions — the secondary objective of this study has been to explore and assess the role that *geographic proximity plays in facilitating collaboration between venture capital firms and large corporations.* For this reason, this study has focused on potential collaboration between VC firms and large corporations occurring in the London metropolitan region (LMR). The LMR being home to the largest concentration of UK based VC firms and the majority of venture capital investment in the UK, as well as growing number of corporate venturing offices and activities (BVCA, 2010).

8.1. Main Theoretical Constructs and Hypotheses

In answering these questions, Chapter 2 laid out the main theoretical constructs for which this study is based. First, while innovation offers opportunities for great profit to motivated individuals and firms, innovation's inherent uncertainty makes it significantly challenging for entrepreneurs and NHTCs, lacking sufficient experience and resources, to commercialise their new ideas (Auerswald & Branscomb, 2003). As such, this study is based on the notion that innovation requires both the motivation and flexibility to generate new ideas, as embodied by entrepreneurs and NHTCs, and the experience and resources to pursue them, as offered by large established companies. Such a perspective is based on a

complementary asset model of firm-based innovation developed through the work of Teece (1992), Christensen (1996), Rothwell and Dodgson (1991), Chesbrough, Vanhaverbeke, and West (2008), and others. As these and other studies demonstrate, innovation, in most high tech sectors, comes about through a variety of inter-firm relationships between NHTCs and large established companies, ranging from producer-customer partnerships and spin-out/offs, to strategic alliances and joint R&D ventures (Rothwell, 1991).

Second, although such inter-firm relationships offer tremendous complementary benefits, obstacles to such collaboration include organisational and cultural barriers, and different strategic interests and objectives. In such instances, Lee and colleagues (2010) suggest that bringing together appropriate firms for collaboration often requires an intermediary actor whose network position and expertise can effectively recognise complementarities between firms. Therefore, this study views VC firms as investment and knowledge intermediaries that are uniquely positioned, within local investment networks, to identify and facilitate complementary partnerships between their portfolio companies (i.e. NHTCs) and their corporate partners.

Finally, the local emphasis of venture capital investment and related networks corresponds to the geographic concentration of entrepreneurial activity and innovation more generally within a select number of large metropolitan regions such as London. Viewed as regional innovation system, the LMR, and other regions like it, offer individuals and firms a seemingly unlimited number of opportunities for collaboration and profitable knowledge exchange (see Gordon & McCann, 2000), often between system incumbents (e.g. large corporations) and new system entrants (e.g. entrepreneurs, NHTCs). This interaction and subsequent collaboration is coordinated through networks which promote norms of interaction and embedded behaviour and processes (e.g. business and professional networks, venture capital syndication networks) (see Lawton Smith and Waters, 2011). In doing so, these networks develop and contribute to regional institutional capacities which support and govern the selection, development and diffusion of new ideas and technologies in the region (Cooke, 2005). This process is facilitated and sustained through interactions between the region and global knowledge flows,

often facilitated by knowledge brokers (e.g. VC firms) who can collect and effectively match and integrate external ideas with regional competencies and needs (see Amin & Thrift, 1992 & Zook, 2004). Such interaction infuses regions with new ideas, enhances capacities, and prevents lock-in (Maskell, Bathelt & Malmberg, 2005).

Chapter 3 looked more closely at how and why VC firms leverage local networks to more effectively manage tacit and asymmetric information and related agency costs, and to add value at each phase of the venture capital cycle, particularly the investment selection phase, and the post-selection monitoring phase (Gompers & Lerner, 2004). The investment selection phase is characterised by frequent face-to-face interaction between VC firms and entrepreneurs. This intense screening and due diligence is aided by a VC firm's relationships to other local VC firms and connections to local actors such as universities, successful entrepreneurs, and large corporations, all of whom can assist the VC firms in determining the managerial, technical, and market viability of a proposed technology or product (Gompers & Lerner, 2004; Zook, 2004).

A VC firm's reliance on local networks is thought to increase during the post-selection monitoring phase (Mason, 2007). VC firms limit agency costs and effectively develop portfolio companies by employing a staged investment structure involving multiple funding rounds and investment syndication with other VC firms and partners, many of these from a VC firm's local network (Sorenson, & Stuart, 2008). These co-investors and strategic partners participate in the monitoring of portfolio companies (e.g. sitting on the board of directors) and bring with them diverse and complementary expertise which can be used for better developing a portfolio company's technical and commercial capacities (Gompers & Lerner, 2001). During the exit phase, the importance of local networks is less clear, although VC firms may rely on local investment banks and legal services, as well as local corporate partners in instances when an exit is by acquisition or merger.

Three high-tech sectors were then considered from a venture capital investment perspective: ICT, life science, and clean tech. In comparing these three sectors, life

science was characterised by higher capital costs, longer investment timeframes, more specialised input requirements, and higher barriers to market. Therefore, it was thought that investing in life science companies would require significant value adding activities involving inputs of science and technology, and more formal and substantive collaborative relationships with large pharmaceutical companies (see Chapter 3, Sect. 3.4).

Based on these constructs, two sets of hypotheses were considered (see Chapter 3, Sect. 3.5). The first set was premised on the differing input requirements of portfolio companies, differences that were thought to be sector specific: *the greater the science and technology inputs required by portfolio* companies, (H1) the more important and formal collaboration between VC firms and large corporations becomes; (H2) the more important collaboration between VC firms and large corporations becomes for value adding purposes; (H3) the more important collaboration between VC firms and large corporations becomes for investment monitoring and evaluation. The second set of hypotheses considered collaboration between VC firms and large corporations and assesses the role of geographic proximity, proposing that (H4) collaboration between VC firms and large corporations will be facilitated through both geographic proximity and the capacities of the LMR, with (H5) the importance of geographic proximity is most prominent during the post-selection monitoring phase.

8.2. Research Approach

In capturing the existence of organisational constructs and to describe the processes and procedures for collaboration, this study employed a mainly qualitative approach based on in-depth semi-structured interviews with 30 technology oriented VC firms. All firms were engaged in some degree of early stage investing, and all were located in the LMR (see Chapter 4). The selection process for the interviewee firms was informative. The number of U.K. VC firms engaged in early stage technology investment is relatively small (60–80 firms total). Therefore, the 30 firms interviewed formed a representative sample. However, a number of interviewees spoke of their firms' declining early stage investments. To conduct a cross-sector comparison, interviewee firms were

identified as investing in one or a combination of three high-tech sectors: ICT, life science, and clean tech. This cross-sector comparison was used to explore how these three high-tech sectors, necessitating different factor input requirements and exhibiting varying barriers to market, would show different propensities for collaboration between VC firms and large corporations.

The interview questions were split into three sets of inquiry. The first set focused on the structures used and the various arrangements that VC firms engage in for collaborating with large corporations. The second set of questions inquired as to the motivations behind VC firms' collaboration with large corporations. A third set of questions examined the circumstances under which collaboration with large corporations is pursued, as well as the challenges and limitations toward more substantive relationships. A line of inquiry running through these question sets, particularly those regarding the structures and circumstances for collaboration, was the extent to which geographic proximity plays a role in the facilitation of this collaboration, looking particularly at co-location and the capacities of the LMR. Additional interviews were conducted with several corporate venturing divisions operating from offices in London. Their inclusion provided an important triangulation of sources to clarify and further validate the core empirical findings.

8.3. Findings: Summary and Analysis

The summation of the empirical findings (Chapters 5 and 6) suggests that collaboration between VC firms and large corporations is increasingly common, but that more formal collaborative structures, particularly syndication partnerships, are the exception. The primary mechanisms for establishing and maintaining these relationships are venture capitalists' past industry ties and subsequent corporate contacts. Driving this collaboration is the exchange of complementary knowledge, particularly industry and market knowledge, for purposes of better investment selection (the selection motive) and the positioning of portfolio companies for more optimal investment exits through corporate acquisition or merger (the exit motive). Such exits are the only viable outcome during a severely weakened IPO market as a result of the economic downturn and resulting credit crunch. Access to and use of specialised expertise for the development of portfolio companies (value

adding motive) was a somewhat secondary motivation for interviewee firms, with collaboration focused on investments in life science being the exception. When significant value-adding relationships exist, they are often established and maintained independently of an intermediary VC firm.

In further comparing the different sectors, life science focused VC firms showed stronger propensities for more formal collaborative structures and placed more importance on the value adding motive than did those investing in ICT and clean tech. This appears to confirm the expectations that the higher resource intensities necessary in the life science sector, including inputs of science and technology, are probably driving them to more formal and substantive collaboration with large pharmaceutical companies. Therefore, the findings lend support to hypotheses (H1) and (H2). More than just the need for specialised knowledge and expertise (i.e. value adding), however, is probably at play here. Due to consolidation in the pharmaceutical industry, positioning portfolio companies to successfully enter the market necessitates that VC firms closely collaborate with Big Pharma.

Combining the findings from Chapters 5 and 6 offered further insight concerning when collaboration between VC firms and large corporations is regarded as most beneficial, and illuminates this collaboration's opportunities, limitations, and challenges (see Chapter 7).

The *investment selection phase* of the venture capital process is characterised by high propensities for collaboration between VC firms and large corporations. Aligned with the selection motive, this phase is characterised by mutual and recursive exchanges of information that can lead to a decision to invest in a particular company. This involves the sharing of information regarding the R&D or product pipeline needs of a large corporation and the potential matches either residing in a VC firm's current portfolio or among those companies up for selection. For investment selection purposes, the information gained through this interaction is used by VC firms to validate the technical and market viability of a potential portfolio company, and to establish a large corporation's interest in it. Many interviewees claimed that they would not select a company for investment without some degree of corporate validation or interest. This interpretation was

verified by the corporate venturing divisions interviewed. For large corporations, collaborating with VC firms is particularly valuable in scouting for new technology and selecting small firms for partnerships and acquisition — making this collaboration highly complementary for both parties.

Collaboration during the *post-selection monitoring phase* was less prominent than in the investment selection phase. Aligned with the value-adding motive, motivations for accessing and using knowledge and expertise for value-adding purposes, while evident, were not identified as a primary motivation for collaboration by the majority of VC firms interviewed. Motivations for value-adding were secondary to both motivations for investment selection and investment exit. The findings suggest that for the majority of VC firms collaboration with large corporations during the post-investment selection phase is more a continuation of the collaboration that occurs during the selection phase, albeit less intense. On-going collaboration during the monitoring phase is used to enhance the monitoring and evaluation of portfolio companies (i.e. evaluate the continued market viability of a portfolio company) while maintaining the acquisition or merger interest of a large corporation. Therefore, the majority of VC firms are using collaboration with large corporations during the post-selection monitoring phase to access additional industry and market knowledge to reduce market uncertainty.

This collaboration culminates in the later stages of the investment cycle, as collaboration between VC firms and large corporations re-intensifies during the *investment exit phase*: VC firms reengage their corporate contacts and strategic partners to facilitate an investment exit, most likely in the form of an acquisition or merger; although an IPO may be sought under more robust market conditions. This facilitation takes on two forms. First, VC firms may seek out large corporations to obtain additional investment funding, which may be crucial in getting a portfolio company to the exit stage and may also raise investment awareness about a particular portfolio company. This can drive funding for the portfolio company while attracting additional corporate interest, setting up a potentially lucrative bidding race for an exit by acquisition or merger. Where corporate funding is not the primary aim, long standing corporate partners will likely be approached by the

VC firm to assess their interest in the acquisition or merger with a particular portfolio company. Importantly though, this interest will probably have been established long before the exit phase. The challenge for VC firms, therefore, is to encourage the interests of multiple bidders in a portfolio company — driving up the acquisition price — while avoiding a perception of preference for any one potential buyer (i.e. competitive confusion).

Besides exit challenges, another obstacle toward successful collaboration between VC firms and large corporations is the organisational constraints and the often divergent strategic interests of these two risk capital actors. Interviewees, whether VC firms or large corporations, spoke of the challenges of aligning interests, particularly the short-term technology interests of the large corporations and the long-term investment objectives embodied in the venture capital cycle, in which investment in a particular portfolio company can range from 5 to 10 years (Gompers & Lerner, 2004). These potential differences likely contribute to the relative lack of formal syndication and co-investing arrangement between these two parties.

This corresponds to the preference articulated by interviewee VC firms to collaborate with corporate venturing divisions that are more autonomous in their relationships with parent companies (i.e. true corporate venture capital operations). Such operations are usually set up to operate like a traditional VC firm, with a focus on investment return and long-term strategic objectives (see Dushnitsky, 2006). In either case, interviews with the VC firms and large corporations both emphasised that less formal collaboration provides a more flexible and advantageous collaborative arrangement for working with and investing in either NHTCs or more established firms, all of which are engaged in significantly uncertain enterprises.

8.3.1. The role of geographic proximity

In assessing (H4) and (H5), the findings presented in Chapters 5 and 7 demonstrate that collaboration between VC firms and large corporations is facilitated by geographic proximity, although most interviewees downplayed the importance of co-location. In this way, the role of geographic proximity is that of facilitating

face-to-face interaction between VCs and corporate representatives, with such interaction described as necessary for initiating relationships, and for exchanging specialised and often proprietary information, particularly during the investment selection phase. Surprisingly though, the importance of face-to-face interaction appears to decrease during the post-selection monitoring phase where interaction is described as less frequent and the knowledge exchanged less specialised. The exception again were those VC firms investing in life science who described frequent access to contacts at local corporate R&D centres as important for both investment selection purposes, and for value adding during the post-investment monitoring phase — lending some support to both (H5) and to the notion that co-location may play a more significant role in this collaboration than most interviewees realise.

When asked about the importance of co-location, most interviewees stressed the global focus of their investment activities, stating that “the local presence” of large corporations did not drive collaboration as such. That being said, the importance that interviewees placed in industry led meetings and conferences held in the LMR, coupled with both the importance assigned to the selection motive by most interviewees, along with the growing number of corporate venturing divisions operating in the LMR, would seem to counter such claims.

For the majority of interviewees, the LMR itself played a more significant, if not direct, role in facilitating collaboration between venture capital firms and large corporations. Interviewees described the LMR as having tremendous capacities for innovation (e.g. high tech industries, research universities, entrepreneurs, highly skilled labour) and both the network and transport infrastructure for facilitating international knowledge exchange (e.g. rich professional networks and robust international transport links), all of which create opportunities for face-to-face meetings, and networking, allowing VC firms to initiate and build collaborative partnerships with large corporations. Furthermore, the LMR is home to considerable international finance and legal capacities including investment banks, corporate law firms and patent attorneys. All of which are essential for facilitating substantive interaction between VC firms and large corporations, particular during

the investment exit phase when executing investment exits by corporate acquisition or merger. In this way, the findings lend substantial support to (H4).

8.4. Discussion and conclusion

Although collaboration between VC firms and large corporations appears to hold complementary benefits to both parties, questions remain as to the effect of this collaboration on portfolio companies and innovation more generally. The findings here support the idea that the goal of most VC firms is to invest and develop portfolio companies that will successfully fill a niche position within broader industries, becoming complementary partners or assets to the large corporations that typically dominate many of these high-tech sectors. The increasing frequency of collaboration between VC firms and large corporations in the high-tech industries of ICT, life science and clean tech — collaboration being advocated by both parties — speaks of a venture capital industry and market that may be tailoring both entrepreneurial ideas and motivations to the needs and interests of large established companies. This at the expense of investing and developing more radical ideas that might go counter to industry interests, thus leading to industries with less innovation and perhaps limiting the emergence of new industries.

The suggestions of potentially diminished innovative output coincides with the prominent trend of VC firms investing more in already established portfolio companies and devoting less of their funds to early stage companies, indicating that the capacity building potential of this collaboration is not being sufficiently leveraged. Such potential, however, might still be realised, as evidenced by the number of VC firms investing heavily in life science, particularly by public venture capital funds tasked with filling this persistent early stage equity gap (Nightingale et al., 2009). As alluded to in Chapter 1, some public venture capital programmes in the United Kingdom include large corporations in an advisory roll aimed at helping these programmes build the investee readiness and capacities of their early stage portfolio companies. On the one hand, although they may enhance the capacities and business development of participating portfolio companies, they may also succumb to investment selection and strategy that aligns closely with corporate interests and objectives, at the expense of more radical and game-

changing innovations. On the other hand, corporate involvement in early stage public venture funds may prove to be an effective means of organisational learning, both for the large corporations and the public venture funds, where both types of organisations learn how to be more effective early stage investors. This process also could create collaborative practices and ways of doing things that can be carried over to early stage investing both inside and outside the environs of the public venture capital fund.

For public venture funds, this research is more instructive in showing the importance described by interviewee firms regarding the capacities of the London metropolitan region and the global transport links and knowledge flows that characterise it. In many ways the findings point to the inherent disadvantages of less innovative regions in attracting venture capital activity when compared to high capacity regions such as London. Going back to ideas of agglomeration and entrepreneurial ecosystems, VC firms will generally invest where opportunities for profit reside (Zacharakis, Shepard & Coombs, 2003). In other words, they will invest where there is demand for venture capital investment. That being said, engaging in uncertain enterprises also depends in part on access to information regarding opportunities and access to knowledge and resources to make pursuing such opportunities possible. For regions that lack demand for venture capital and the public venture funds pushing to create that demand, knowledge and resource networks that stretch across regional boundaries, with large corporations as possible network nodes connecting underperforming regions to high capacity agglomerations such as London, may offer a more effective strategy for developing these venture capital markets (see Nightingale, et al., 2009).

The potential that collaboration between VC firms and large corporations has for both entrepreneurial and regional capacity building, coupled with the limitations of this study, offer considerable opportunities for future research. Such research should examine the value-adding implications of this collaboration for venture capital backed entrepreneurial firms. Although this study has captured the intent of VC firms concerning corporate collaboration — confirmed by the corporate venturing perspective — the outcome of this collaboration remains unexplored. To this end, broad-based survey work on U.K. based entrepreneurial firms regarding

the benefits and drawbacks of corporate investment participation, as well as quantitative studies that match corporate involvement in a venture capital investment with exit outcomes and post-exit performance, would go a long way towards establishing the effects of this collaboration and add considerably to our understanding of the value-adding 'black box' of venture capital behaviour.

Furthermore, a wealth of knowledge might arise from in-depth case studies that focus more on the organisational learning aspects of this collaboration. Such case studies might look at how a particular collaborative relationship has developed over time. Finally, the lack of conclusiveness that can be derived from this study concerning the location dynamics of this collaboration warrant additional research. In particular, research that seeks to identify the location imperatives of corporate venturing divisions would certainly expand understanding on the geography of risk capital and the interplay of regional and global knowledge flows.

This study presents a substantial first step in positioning future research by establishing the existence and frequency of particular organisational structures and offering answers regarding the processes and mechanisms employed, as well as the motivations for and the organisational constraints toward collaboration between two complementary yet distinct risk capital actors. These are findings on which future research can build.

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