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MASTER THESIS

# Innovation Risk and Human Capital in Seed and Early Stage Venture Capital Investments

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## Executive Summary

Venture Capital Firms (VCFs) function as an important intermediary for the funding of New Technology-Based Firms. Within the last decade there has been a significant change in the global landscape of seed and early stage investing. This research explored what has changed in the investment environment and analyzed how VCFs learn about technology to support their decision-making processes and deal with informational asymmetries and the high level of uncertainty inherent to technology-based businesses.

Primary data was collected from 17 interviews with VCFs active in Europe. Analytical procedures followed deductive – based on the framework of organizational learning proposed by Huber (1999) – and inductive approaches. VCFs from the sample acquire knowledge about technology mainly through the process of vicarious learning – by observing other funds' behaviors, and by grafting – acquiring knowledge from personal networks and from their portfolio companies. *Technology strategists* are VCFs that possess a high level of specialized internal knowledge base within their funds. For these firms learning about technology has only marginal effects on informational asymmetry but can help reduce the level of innovation risk. *Technology opportunists* are VCFs not heavily affected by IA because they bridge their knowledge gap through a network of trusted peers.



**Keywords:** *Venture Capital, seed and early stage investing, technology and innovation funding, innovation risk, human capital*

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## List of abbreviations

| | |
|---|---|
| AI | Artificial intelligence |
| BA | Business Angels |
| CEO | Chief executive officer |
| CTO | Chief technology officer |
| EU | European union |
| GP | General partner |
| IA | Informational asymmetry |
| ICO | Initial coin offering |
| IPO | Initial public offering |
| IR | Innovation risk |
| IT | Information technology |
| KA | Knowledge acquisition |
| LP | Limited partner |
| NTBFs | New technology-based firms |
| R&D | Research and development |
| ROI | Return on investment |
| SBB | Science-based businesses |
| UK | United Kingdom |
| USA | United States of America |
| VC | Venture Capital |
| VCs | Venture capitalists |
| VCF | Venture Capital Firm |
| VCFs | Venture Capital Firms |

# 1. Introduction

## 1.1 Context of the study

Venture Capital (VC) is a specific intermediary financial activity that addresses funding needs of young ventures (see Fig. 1). The standard *venture capital investment cycle* (P. A. Gompers & Lerner, 2004) starts when independent managers (i.e., general partners – GPs) raise capital from outside investors – institutional or private organizations (i.e., limited partners – LPs) – in search of asset diversification (i.e., uncorrelated with public markets) and ROIs higher than risk-free rates. GPs allocate capital that has been raised from LPs into funds that are the instruments that coordinate the exchange of financial resources for equity (or debt-equity hybrids) of selected companies (i.e., portfolio firms).

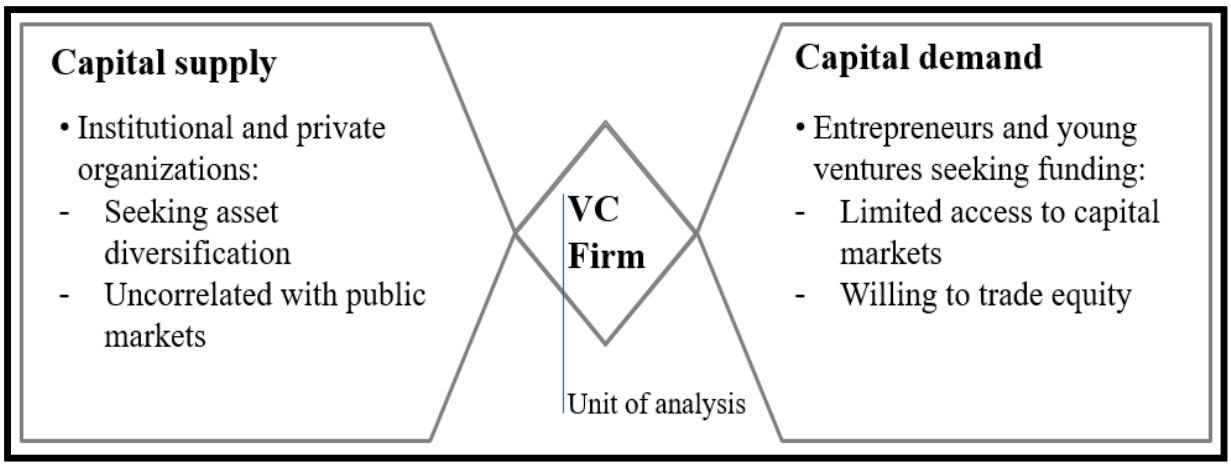


***Figure 1. The intermediary function of Venture Capital***
*Source: own depiction. Based on Rin, Hellman and Puri (2003)*

After investments are made, portfolio companies are monitored and coached by investment managers of the VC firms (henceforth – VCFs). The investment cycle ends when a portfolio company undergoes a liquidity event (i.e., exit from the investment). This type of contractual arrangement has played an important role in providing external funds to entrepreneurs and

organizations with limited access to funding from capital markets (P. A. Gompers & Lerner, 2004; P. Gompers & Lerner, 2001; Rin, Hellmann, & Puri, 2013).

Recent annual VC investment activity illustrates the significance of this relatively young industry. In 2015, global VC investments surpassed the $100 billion threshold (see Fig. 2), with an approximate worldwide distribution of North America (60%), Asia (30%) and Europe (10%). The annual volume of transactions surpassed the 10,000 mark and there were around 1,000 exit deals, collectively valued at more than $70 billion. In the same year, Insight Ventures Partners broke the record for capital raised by a single fund by raising $3.4 billion for their 9th fund. New Enterprise Associates (NEA) held the earlier record of $2.8 billion. Moreover, Japanese telecommunications firm Softbank and Saudi Arabia's government-owned Public Investment Fund announced a plan to structure a technology-focused fund – the Vision Fund - with the target to manage $100 billion, primarily invested in emerging technology driven companies.

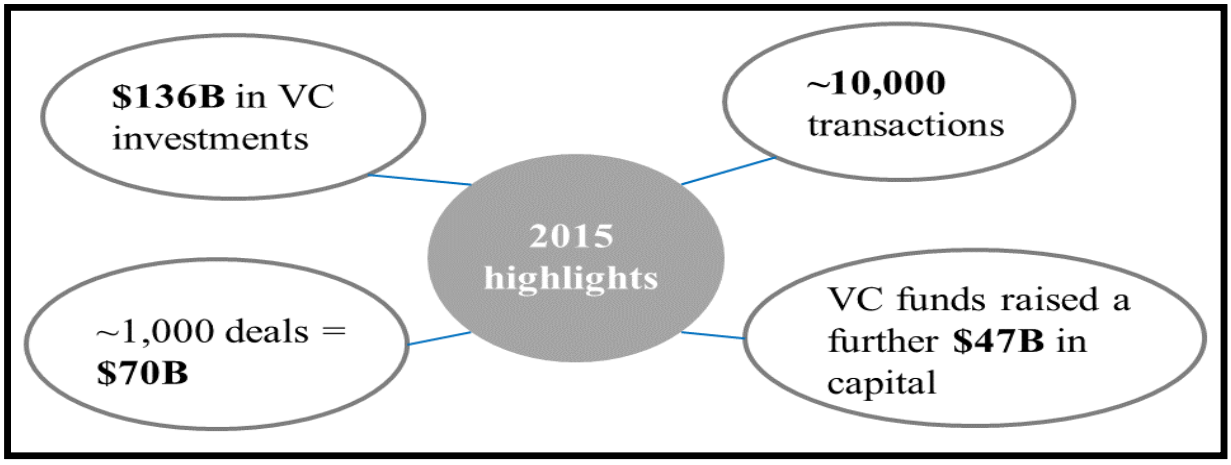


***Figure 2. Highlights of global Venture Capital activity***
*Source: based on data from: Preqin Global Private Equity & Venture Capital Report and KPMG/CB insights (2016)*

In spite of these impressive totals, VC activity remains cyclical and dependent on macro and micro economic trends (P. Gompers & Kovner, 2008; Nanda & Rhodes-kropf, 2013; Nanda & Rhodes-

Kropf, 2016). The following chart (Fig. 3) illustrates global VC activity in financial volume and number of deals over the last five years, reported on a quarterly basis.

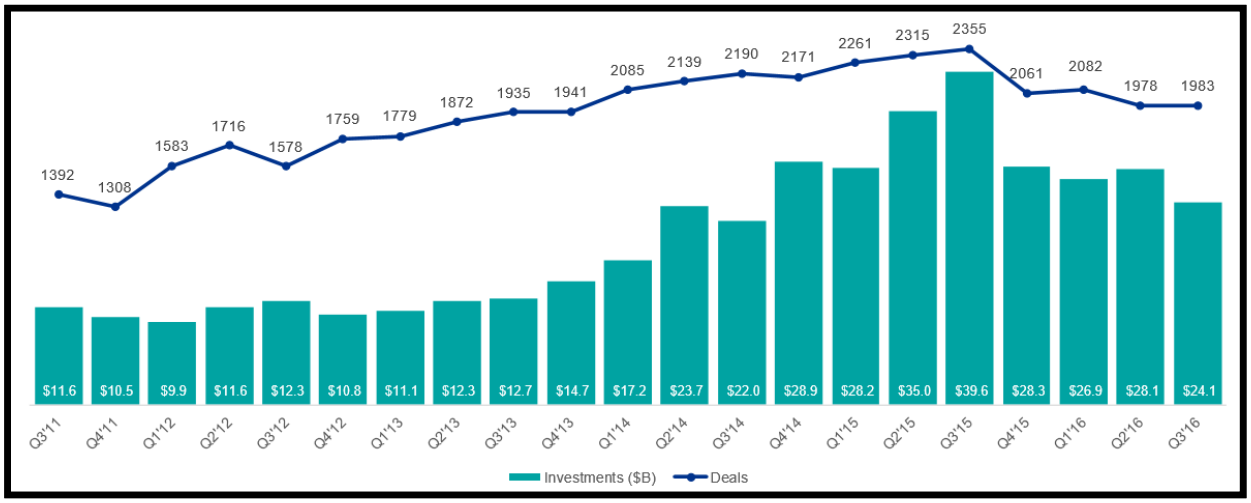


***Figure 3. Quarterly global financing trends to VC-backed companies***
*Source: Venture Pulse Q3 2016, KPMG / CB insights*

Technology investing is linked to the origins of the VC industry (Hsu & Kenney, 2005). The Technology sector (e.g., telecommunications, semiconductors, hardware, software, internet and mobile devices) and the health care sector or more broadly "life sciences" (e.g., pharmaceuticals, biotech, medical devices) are the typical recipients of VC funds. Historically, in the USA these sectors have accounted for 75-80% of VC investments (Metrick, 2007). Zider (1998) was one of the first to make the point that VCFs invest in "good" industries as opposed to (good) people or (good) ideas. Technology and life sciences industries also are known to attract VC funding due to their large addressable markets where rapid growth can be achieved by young innovative ventures, as they enter the market, grow and attain economies of scale with development of a new technology or business model. The preference of VCFs for technology-related businesses has been studied by various researchers, and *informational asymmetries* appear as a recurrent explanation: "*Venture capitalists operate in environments where their relative efficiency in selecting and monitoring investments gives them a comparative advantage over other investors. This suggests strong*

*industry effects in venture capital investments. Venture capitalists should be prominent in industries where informational concerns are important, such as biotechnology, computer software, etc.*"(Amit, Brander, & Zott, 1998, p. 444).

A recent report on VC funding shows that the high percentage of technology-related investments remains highly significant, even on a global scale (see Fig. 4).

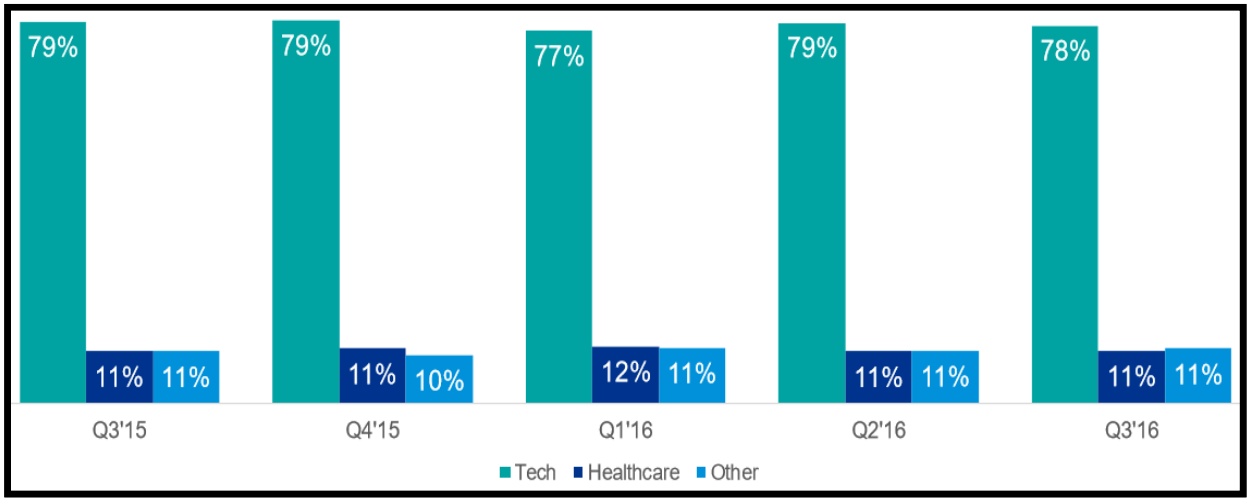


***Figure 4. Quarterly global tech investments versus other industries***
*Source: Venture Pulse Q3 2016, KPMG / CB insights*

In the USA context, among the largest publicly-listed companies in terms of market capitalization, there is a concentration of technology-related VC-backed businesses. And it is significant that VC-backed public companies currently account for 44% of all research and development (R&D) expenditures among publicly-listed US companies (Gornall & Strebulaev, 2015). However, in spite of these impressive numbers and results, it is important to note that VC is not the primary source of funding for start-ups and innovative activities (Branscomb & Auerswald, 2002; Elston & Audretsch, 2009; Puri & Zarutskie, 2012).

Branscomb and Auerswald (2002) question why VCFs do not dominate the funding of early-stage technology ventures. A simple answer is that such companies are in the financing business – not

in the R&D business. The authors further their argument by recalling the relationship that VCFs have with their capital providers and the responsibility to deliver significant returns to their investors. A consequence of such a mindset is the preference of VCFs' investment managers for *later stage* companies, those that have advanced their businesses past initial product development and by doing so have gotten past some of the *uncertainty* inherent in any venture. The process by which VCFs extract valuable information prior to the investment (i.e., due diligence) is costly and time consuming and so are the post-investment monitoring activities, all of which are connected to the level of *agency risks* (D. Dimov & Murray, 2008). This constraint encourages VCs to take a general "wait-and-see" attitude to determine which businesses will emerge successfully from a new technology development rather than to engage in uncertain bets on early stage start-ups. This logic has pushed traditional VCFs to seek investments in companies in later stages of venture maturity.

Within the last decade there has been a change in the profile of VC investments. From a macro viewpoint in annual terms, the average amount of capital raised in each fund is higher, the total number of new funds created has increased, and the total amount of money invested in VC funds has grown. Not surprisingly, the significant increase in the scale of the industry in terms of capital made available, new companies being created and employment of specialized human capital had an impact on its dynamics. This has affected the whole spectrum of VC venture funding. For example: earlier stages became highly competitive; mid-stages have been squeezed between higher initial financing rounds and larger investors; and late stage investors, capable of providing bigger financing rounds, have increased the valuations of late stage companies. This has delayed exits (i.e., IPOs) and has held back the liquidity of the entire system. It can be argued that the traditional segmentation of players by their stage of investment may have lost its significance for large VCFs

that have become verticalized – "from seed to exit". Additionally, an increase in deal flow from both formal investors (independent funds that manage third party capital) – and informal investors (who control their own capital) – into seed and early stage companies challenges the notion that such investments have *limited scale* and only belong in the realm of specialized *niche investors*.

Data on VC activity shows that earlier stages are indeed relevant. There is consistent activity on a global scale. Recent figures show that seed and early-stage (Series A) investments account for a substantial proportion of deals (see Fig. 5).

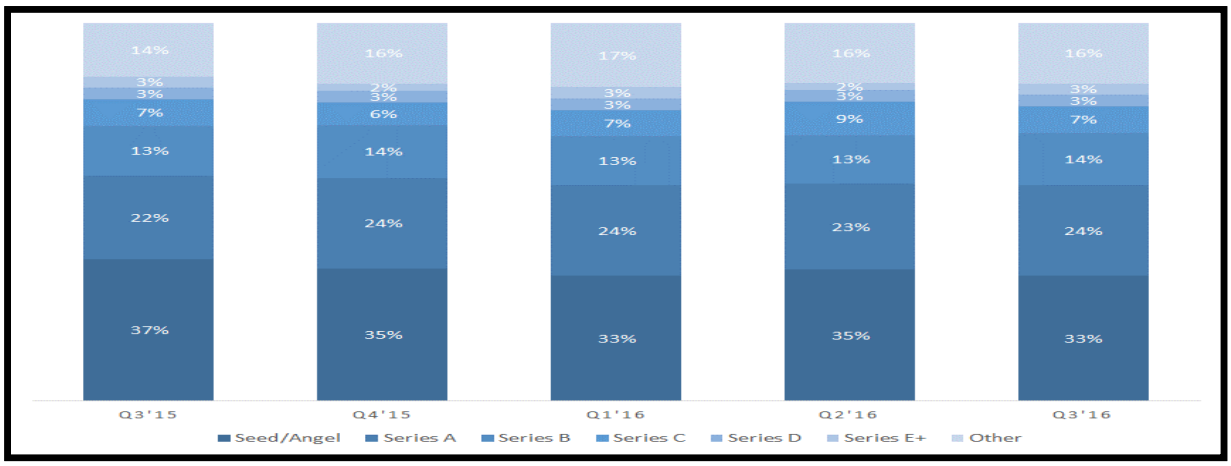


***Figure 5. Quarterly global deal share by stage***
*Source: Venture Pulse Q3 2016, KPMG / CB insights*

More specifically, in Europe, seed investments currently average nearly 50% of all deals. And combined with early-stage (series A) they total over 70% (see Fig. 6). This is a *significant change* in a context where these type investments were historically low (Lockett, Murray, & Wright, 2002; G. Murray, 1999; Gordon C. Murray & Lott, 1995; Gordon C Murray & Marriott, 1998).

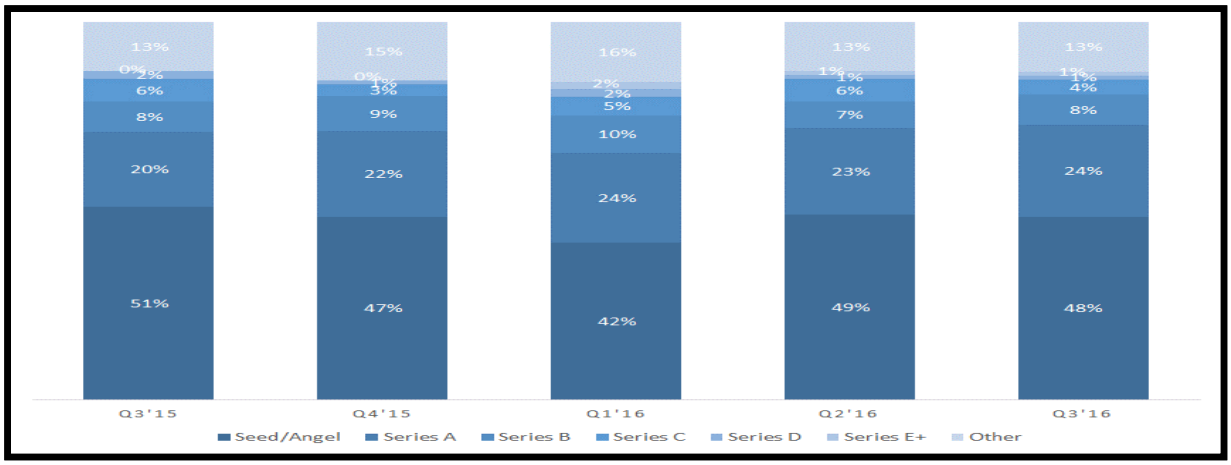


***Figure 6. Quarterly European deal share by stage***
*Source: Venture Pulse Q3 2016, KPMG / CB insights*

Sill focusing on the European context, it is interesting to highlight that the sub-category of "deep" technology is developing. According to Atomico (2016) "since 2011, the number of deep tech startups founded in Europe has grown by a factor of 3.5. Nearly $2.3 billion has been invested in deep tech in Europe since 2015 compared to the $1.7 billion that was invested over the four-year period between 2011 and 2014. The year 2016 was a bumper year with $88 billion in deep tech M&A".

The average deal size of early-stages is still much lower than the averages of later stages, but the fact that collectively they account for most deals is the interesting part. It is intriguing that in a short time-frame there has been a quantitative and qualitative change in the seed stage investment landscape. This raises the question of what drove investors back into investing in earlier stage companies and how these VCFs deal with informational asymmetry and uncertainty to assess their investments prospects.

An example from practice offers a good illustration of the above argument. Hunter Walk is a US seed VC:

> *We're again in a period where the most exciting investment opportunities possess real technology risk. When we started Homebrew in 2013, our industry was, in retrospect, probably midway through a cycle where innovations were in business model rather than underlying technology […] When I look at our deal-flow (and investments) over the past 18 months, I see an interesting shift back towards more technology risk than business model emulation. Think of what venture investors have been pursuing lately: AI, autonomy, VR, computer vision, bioscience, agriculture, material sciences. There's real possibility that the company's technology doesn't pan out – or at least not at the level of sophistication where it can become a durable competitive advantage. Some investors believe it's going to be difficult to invest in these areas without an advanced degree in the discipline. Satya and I disagree, and to date, have made several investments in very talented teams*. (Walk, 2016).

This passage is key to the core elements of this research. It shows a growing trend of change in the landscape of technology funding and highlights the importance of human capital as a form of risk mitigation.

## 1.2 Research goal and research questions

The aim of the previous pages of this study was to describe the essential elements of the VC industry and to explore the nature of the relationship between VC and technology investing. A deeper analysis on the specifics of VC activity shows that investors adjusted their investment behavior and began embracing companies in earlier stages of development. Previous VC research indicates that "antipathy" towards seed and early-stage investments is justified by (a) *informational asymmetry* and (b) *higher uncertainty* when compared to later stage alternatives. However, recent data on VC shows constant investors' engagement with seed and early-stage

companies on a global scale, indicating a different posture towards these types of deals. To understand the change in the investors' perception about these type investments, this research focuses on how VCFs acquire technology-related knowledge and if it helps them to reduce the effects of informational asymmetry and uncertainty in their decision-making process.

The research goal of the study is to identify how VCFs address their needs of knowledge about technology to support their investment decision making processes. This research will be guided by the following **central research question**:

***How do Venture Capital firms acquire knowledge about technology to better support their decision-making process?***

To further structure the research, a set of sub-questions are linked to the main question to address specific topics in separate parts.

**Sub-question 1**: *How do VC firms acquire technology-related knowledge?*

**Sub-question 2**: *Do technology VC firms acquire knowledge differently?*

**Sub-question 3**: *Can the acquisition of technology-related knowledge help reduce the effect of information asymmetry in VC firms' decision-making processes?*

**Sub-question 4**: *Can the acquisition of technology-related knowledge help reduce the level of innovation risk in technology-related investments?*

## 1.3 Significance of the research

### 1.3.1 Academic relevance

This research contributes to academic literature by: (i) identifying and addressing a specific knowledge gap in relation to VC research; (ii) integrating adjacent fields of academic study; and (iii) testing a theoretical framework from organizational studies on a new set of primary data.

(i) Previous research on VC funding suggests that investment in early stages of venture development (including seed-stage) is neglected by professional VC investors due to the presence of high levels of information asymmetry and uncertainty (D. Dimov & Murray, 2008). However, recent data show that the relationship between VCFs and this category of investment has changed considerably. This research aims to contribute directly to reduce the gap in the availability of literature that addresses this phenomenon.

(ii) Building on the extensive review of Da Rin, Hellmann & Puri, (2011) on VC research and on multiple works on the characteristics of VC (De Clercq, Fried, Lehtonen, & Sapienza, 2006; D. Dimov & Murray, 2008; P. Gompers & Lerner, 2001; Hellmann & Puri, 2000), the second contribution comes from the review and integration of literature related to the funding of young innovative ventures. Namely, *innovation and technology funding* from financial and policy perspectives (Branscomb & Auerswald, 2002; Cumming, 2007; B. H. Hall, 2002; Kortum & Lerner, 2000b; Lockett et al., 2002; Gordon C. Murray, 1999; Gordon C. Murray & Lott, 1995; Gordon C Murray & Marriott, 1998; G. Pisano, 2006; G. P. Pisano, 2010); *the influence of human capital* (Bottazzi, Da Rin, & Hellmann, 2004; D. P. Dimov & Shepherd, 2005; M Knockaert, Clarysse, & Wright, 2010; M Knockaert & Lockett, 2006; Mirjam Knockaert, Clarysse, & Lockett, 2010) ; *decision-making* (P. Gompers, Gornall, Kaplan, & Strebulaev, 2016; Hudson & Evans, 2005); *risk profiles and*

*management* (Amit et al., 1998; Cumming, Fleming, & Schwienbacher, 2005; Fiet, 1995; Reid & Smith, 2007) and *learning and knowledge* from an organizational perspective (Bingham & Davis, 2012; Bingham, Furr, & Eisenhardt, 2014).

(iii) Finally, the third contribution comes from applying the theoretical framework developed by Huber (1991) on organizational learning. More specifically, the process of knowledge acquisition (KA) and the related typology proposed are tested against new primary qualitative data collected from 17 semi-structured interviews with active European investors.

### 1.3.2 Practical relevance

The main contributions to practice produced by this study are: (i) the documentation and analysis of the learning processes of early-stage technology-focused VC; (ii) the identification of key practices related to information and knowledge acquisition from an organizational point-of-view; (iii) an analysis regarding how investors differ considering their knowledge acquisition processes; (iv) and an assessment of whether acquiring technology-related knowledge can help reduce the effects of information asymmetry and uncertainty in the relationships between the investors and their investment prospects.

## 1.4 Thesis structure

This research contains six Chapters. The *introductory Chapter* provides information on the basic function of VC and the changing landscape in early stage VC funding. Furthermore, it presents the main argument for the justification of this research. The objective of *Chapter Two* is to position this work in the context of the existing literature. This Chapter can be skipped if the reader has knowledge on background information on VC, innovation and technology funding. A gap in the knowledge about VC funding of early-stage ventures is addressed in Chapter 2.2.5. *Chapter Three*

develops the argument that *learning processes* can be studied in a VC context and presents a theoretical framework (Chapter 3.3) used to test primary qualitative data collected in a new setting. The *fourth Chapter* contains the design of the research as well as a detailed description of the methods applied in the collection and analysis of the qualitative data. *Chapter Five* provides the results of deductive and inductive data analysis. In *Chapter six* findings are discussed, research questions are addressed and a conclusion is presented. These are followed by the limitations of the current study, theoretical and practical implications and finally by suggestions for future research.

# 2. Background information

## 2.1 Methodology of literature review

The relationship between VC and technology can be explored from multiple perspectives. With the goal to provide relevant results, a set of parameters delineated the scope of this study. The first was related to the overlap amongst different fields of study interconnected to the topic of VC, resulting in a greater focus on key topics of research (see Fig. 7). Secondly, the unit of analysis – concentrated on VCFs investment perspectives. The last parameter relates to internal aspects of VCFs, more specifically to the characteristics of early-stage, technology-focused investment companies.

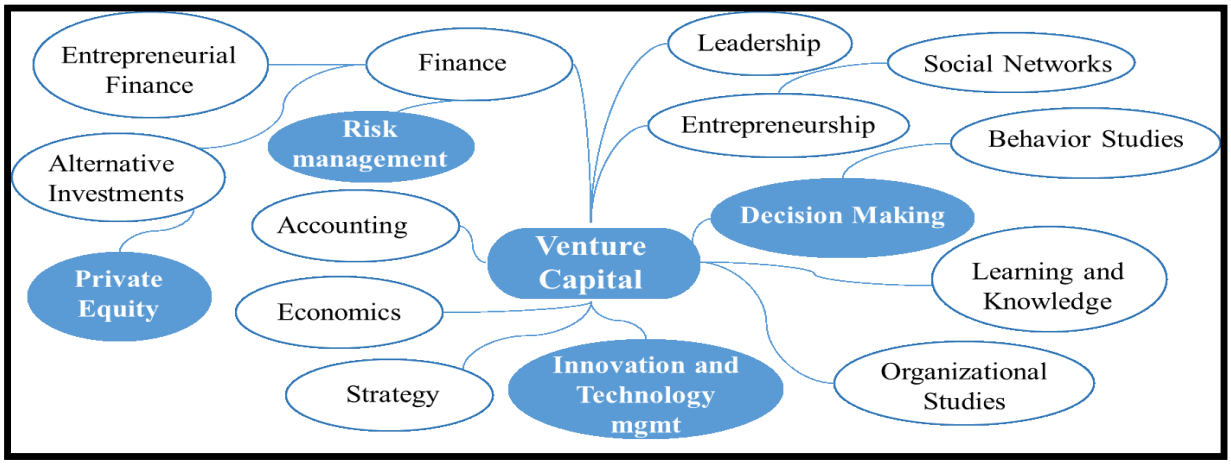


***Figure 7. Fields of study closely related to Venture Capital***
*Source: own depiction*

Once the initial filter was applied, the process of literature review followed the steps proposed by (Saunders, Lewis, & Thornhill, 2009). Their recommendations are: (a) begin with the definition of key parameters of the research questions and objectives; (b) conduct a first search based on keywords to generate a list of references to authors; (c) read and evaluate the initial findings and develop new parameters to redefine further searches; and (d) do this process iteratively until a mature, relevant set of material is developed.

Based on this process, the most frequent keywords were: *venture capital*, *venture-backed firms*, *equity gap*, *seed-stage*, *early-stage*, *portfolio management*, *risk management*, *decision-making*, *evaluation criteria*, *informal investors, match-making*, *technology funding and innovation funding*. Multiple combinations of these words were used to conduct searches in electronic portals such as Google Scholar, Social Science Research Network (SSRN), National Bureau of Economic Research, Journal Storage (JSTOR) and Informs, among others. Results from searches in these portals typically pointed to content aggregators (e.g., Science Direct, Elsevier) or directly to the academic journals or online libraries where these works were originally published.

The literature review produced two important findings. The first was an identifiable gap in the existing knowledge concerning VC activity, specifically in the subset of studies that analyze investor's behavior towards companies in earlier stages of venture development. This gap is the motivation for this research but also delineates the whole study. The second outcome was the identification of a theoretical framework on organizational learning that was applied deductively to analyze data from interviews with investors.

## 2.2 Analysis of existing literature on VC

### 2.2.1 Innovation funding, equity gap and challenges for science-based businesses

*Equity gap* is manifested when there is imbalance between supply and demand of capital. In an innovation context, the gap is manifested as a *shortage of capital* available for innovative projects due to the nature of such initiatives (G. Murray, 1999; G C Murray, 1998). Investments in high technology firms carry a considerable amount of complexity and uncertainty (Gordon C Murray & Marriott, 1998). Brascomb and Auerswald (2002, p.5) state that "*efficient markets do not exist for allocating risk capital to early-stage technology ventures*". To support this claim, they recall the inability of investors to fully benefit from the returns of R&D. Hall (2002, p.35) provide a

similar statement, *"…it is a widely-held view that research and development (R&D) activities are difficult to finance in a freely competitive market place*". The author supports his argument by recalling classic works of Nelson (1959) and Arrow (1962) but maintains that the general idea was previously suggested by Schumpeter (1942) with the concept of non-rival knowledge. Since knowledge is the primary output of R&D activities, and because it can't be permanently and fully appropriated by a single entity, there is less incentive for economic agents. Moreover, Hall (2002) states that investment in R&D differs from other types of investments due to its essential characteristics. Firstly, the asset generated by R&D – the firm's knowledge base – is intangible and partly embedded in the firm's employees' human capital. Hence it is dependent on an employer-employee relationship that is subject to change. Secondly, uncertainty in R&D outputs is higher in the early stages of a project, with an amplified effect for new-entrants or start-ups.

Pisano (2006; 2010) refers to *science-based businesses* (SBBs) as entities that simultaneously pursue both scientific advancement and financial returns from their R&D efforts. The author's enquiry on the relationships between science and business touch upon critical issues concerning any innovative efforts. "*Engaging in science means that science-based businesses confront an unusually higher risk profile and longer-term time horizon than in other contexts, including high technology*" (Pisano, 2010, p. 472).

Branscomb and Auerswald (2002) provide a simplified model – based on previous works from the innovation literature. Their model illustrates the concept of a "technical bridge – from invention to innovation" (see Fig. 8). It is a visual representation of five major steps that a research effort follows until it becomes a successful innovation. The first two stages are in the knowledge or idea phase where basic research is conducted and a proof of concept might arise: here is where they position the invention. In the authors' view, the third stage is key for the transition from a proof of

concept phase to a potentially viable business. From a funding perspective, this is the first point where independent investors may be attracted by market growth potential. It is in the final two stages where innovation occurs and business issues such as product development, production and marketing become key concerns.

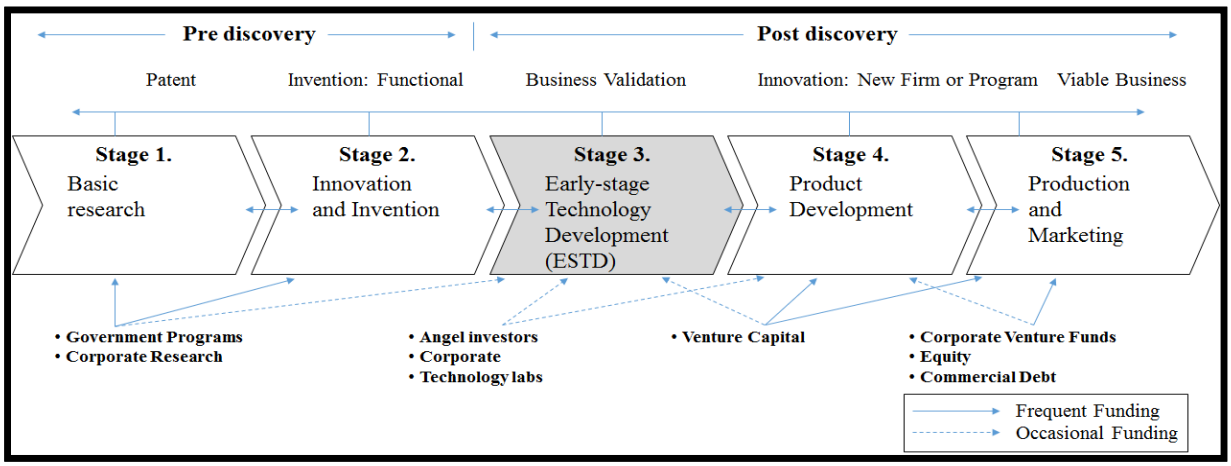


***Figure 8. The sequential model of innovation and commercialization***
*Source: Adapted from Branscomb and Auerswald (2002)*

In Pisano (2010), the author highlights three major challenges for science-based businesses: (i) reward for a sustained risk exposure – "the risk management problem"; (ii) the combination of multiple bodies of knowledge – "the integration problem"; and (iii) the need for cumulative learning – "the learning problem".

*The risk management problem* captures the basic technological feasibility issue – in other words, will the technology work. As the author argues, this is especially relevant for SBBs as opposed to other R&D initiatives that build upon mature science that is proven and well known. This argument relates to the link between mature science, prediction ability and ultimately risk reduction. To reach maturity and eliminate uncertainty in terms of basic feasibility, R&D efforts require multiple iterations and time – a combination that necessarily translates into higher costs.

*The integration problem* relates to the nature of SBBs that typically rely on different bodies of knowledge to generate their own outputs. Here, once again, the notion of mature science reappears from a different perspective. The author's argument is that a deeper understanding of the underlying knowledge base of a science allows for the modularity of its fundamental building blocks. The issue that SBBs face is that in less mature science the rules of the game are yet to be fully discovered and so are its main modules or blocks. The less clearly that these boundaries are defined, the harder it is to break "the problem" into modules and appropriately direct resources and effort.

*The learning problem* derives from the first two problems. It is presented as the trial-and-error process of new knowledge creation. Learning from failure is critical to making advances in a process where judgment, intuition and other subjective components of decision-making play a part. Sharing knowledge and the learning process are essential to leverage collective work to move in the direction of solving complex issues.

The problems mentioned above contribute to the previously mentioned funding gap of innovation. It is an international cross-border challenge, that is partly addressed by government support (Giacomo, 2004; Lerner, 1999) and partly by the private sector through the VC industry (Hellmann & Puri, 2000; Kortum & Lerner, 2000a). Governments and policy makers have developed or adopted instruments to stimulate innovative market activity. These include the creation of public funds, offering government financing for private funds, providing financial and fiscal incentives and through the development of incubation labs and university collaboration (Cumming, 2007; Phan, Siegel, & Wright, 2005; Wright, Lockett, Clarysse, & Binks, 2006).

In his work on SBBs, Pisano (2010) assesses the general sources of R&D funding: *public equity*; *monetization of intellectual property*; and *venture capital* (private equity). Public equity, or raising

funds through a fragmented public sale, has the advantage of potentially achieving high volumes of capital from a single coordinated effort. Nevertheless, the nature of R&D projects differs from typical assets with which public investors are familiar. The valuation logic does not fit into the traditional earnings-based calculations from known products or markets. Instead it is based on a portfolio of projects in a context of market and financial performance uncertainty. Limited or restricted information on R&D projects add complexity and may discourage a generalist public investor.

Monetization of intellectual property is an option or alternative for R&D centers. Instead of developing businesses (e.g., with products, earnings) out of their research outcomes, owners of R&D can sell, license or pursue some other non-equity related arrangement for a third party to engage in such activities. The benefit of this strategy is that it allows for the original intellectual property holder to manage the total risk of its portfolio. The disadvantage is that resources from this type of funding come *ex-post* and that intellectual property assets are not necessarily liquid, in the sense that it is hard to precisely isolate a *module* and sell it or license to a third party (Pisano, 2010).

VC stands out as an important channel of funding for young ventures with R&D aspirations. This category of investor brings industry expertise, capital and close monitoring of its portfolio companies. What constrains VC funding of R&D-related investments, is the long-time frame typically required for these initiatives and the capital allocation of the VC business. VC funds have a defined horizon to yield profits from investments and a fund distribution logic that, purposely, limits the amount of capital dedicated to each prospect. These are two considerable restrictions for SBBs where exploration requires relevant amounts of capital and time. VC financing of innovation has limitations (Hall, 2002). It is worth remembering that a VC decision to invest is an option,

meaning that there needs to be a proper match between demand and supply, which is not always the case (Murray, 1999; Wright et al., 2006). Moreover, there is a tendency of concentrating on a few industries, limiting the scale, and it requires easy access to a mature stock market that reliably provides exits for investors (Jeng & Wells, 2000; Ritter, 2011). The next section will go into more depth regarding the specifics of VC.

### 2.2.2 The maturity of the VC industry leads to specialization

The VC industry has grown radically in size and sophistication (De Clercq et al., 2006). This phenomenon stimulated the emergence of a wide and growing body of academic research (see Fig. 9). Industry-level aspects constitute a large block. Investigations cover the industry itself – how it is structured, how entities interact and what governance issues are important (Sahlman, 1990); outcomes for society, regional development, innovation outputs; and the public policies to address them (Florida & Kenney, 1988; Ueda & Hirukawa, 2008). Going deeper into analysis of the VC industry, a group of works discuss the validity of VC (Gomez-Mejia, Balkin, & Welbourne, 1990; Manigart et al., 2002; Steier & Greenwood, 1995), whether this form of equity-based financing adds value (de Bettignies & Brander, 2007) to nascent entrepreneurs and whether fund managers contribute to the portfolio firms, and to their managerial teams or business model. Furthermore, principal-agency issues (Amit et al., 1998) receive considerable attention along with how contracts are structured (Kaplan & Stromberg, 2003; Kaplan & Strömberg, 2001) and variations on the business model (i.e., Corporate and Government VC). Finally, industry performance is tested by its attractiveness and sustainability (Cochrane, 2005).

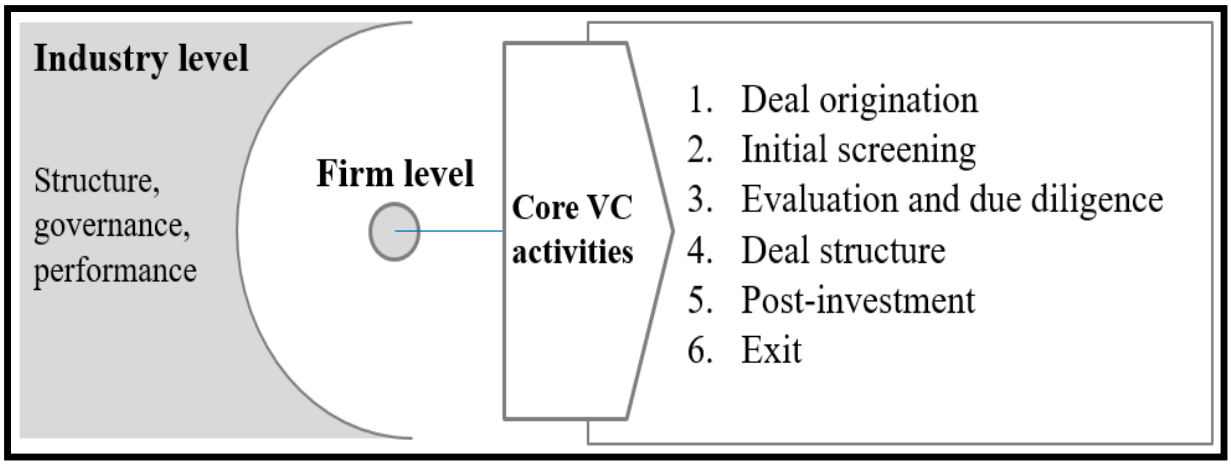


***Figure 9. Industry and firm level approaches on Venture Capital***
*Source: own depiction. Based on Based on Fried et al (1994), Gompers & Lerner (2001), Hall & Hoffer (1993), Hudson & Evans (2005), Da Rin et al (2013), Tyebjee & Bruno (1984)*

On a more refined level of analysis, VC investment is typically referred to as a multi-staged process that encapsulates the chain of events inherent to fund a deal from its origin to conclusion (Fried, Vance; Hisrich, 1994; P. A. Gompers & Lerner, 2004; J. Hall & Hofer, 1993; Tyebjee & Bruno, 1984). From this micro perspective, studies concentrate on one or more stages of the VC cycle, pre- or post-investment activities and liquidity events.

As the VC industry matured, it was natural that similarities and distinctions among investors emerged. Literature has established that VCFs differ in many aspects and that unique human capital shape their actions. It is possible to assume that different configurations affect decision-making processes as well as the attitude towards uncertainty and risk, resulting in different portfolio strategies (D. P. Dimov & Shepherd, 2005; Elango, Fried, Hisrich, & Polonchek, 1995; Ruhnka & Young, 1991).

This study is concerned with a specific type of VC. As was developed in the introduction, technology-based or technology-enabled businesses represent a considerable proportion of all VC-backed firms. This subset of investments requires certain skills (Lockett et al., 2002) and knowledge from investors, emphasizing the differences between high-tech and non-high-tech VCs

(Baum & Silverman, 2004; Lockett et al., 2002; Gordon C. Murray & Lott, 1995). The earlier the stage of a prospect, the higher is its uncertainty (Manigart et al., 2002; Sapienza, Amanson, & Manigart, 1994) and the longer is the time-frame required for expected returns (Cochrane, 2005). In summary, familiarity with technology, uncertainty-bearing and a long-term orientation on expected investment returns define the general profile of a specialized, technology-focused VCF – the focus of this work.

In the literature of the field of economic and public policy, the equivalents to the start-ups in the VC arena are the *New Technology-Based Firms* (NTBFs). Because these ventures overlap in several ways, important insights from previous studies on NTBFs fit well with the central question of this research and thus are worth noting. NTBFs have evolved in recent years due to their active role and impact on the economic system and their multiple interfaces with the innovation ecosystem (Mustar et al., 2006). Knockaert, Clarysse and Lockett (2010) find that specific human capital of investment managers play a role in their selection process. More importantly, the emphasis that these managers give to the ability to protect technologies appears to be one of the key differences between technology-oriented investors when compared to traditional investors. In a closely-related article, Knockaert, Clarysse and Wright (2010) analyze the investment selection behavior of early-stage high-tech VCs to expose the heterogeneity needed to properly assess projects from NTBFs. The central concept of heterogeneity is extrapolated to (i) *heterogeneity of selection behavior*, (ii) *heterogeneity of VC funds characteristics*, and (iii) *heterogeneity of human capital*. They gather an overall perception, among all types of investors, that the most important selection criteria were the potential return on investment and people characteristics (e.g., abilities of the entrepreneur and team). Specifically, on the selection behavior of VCs they point to three major clusters of investors: financial investors, people investors and technology investors.

*Financial investors* are rational and logic-driven, focused on return metrics of proposed business plans, market growth and team complementarity. *People investors* primarily look for subjective human factors of the team (i.e., leadership, experience) followed by financial criteria. These first two types of investors tend to invest in later stages of ventures and mostly recruit people with financial experience and business education when compared with technological knowledge. *Technology investors* have a broader, more balanced assessment criteria. Nevertheless, they focus on the characteristics of the product (e.g., uniqueness and protectability) and on the personal contact with the entrepreneur or "academic founder". This type investor generally has a strong link with academics and tends to recruit managers with high levels of scientific education. They invest in pre-seed and seed stage in a context where management is still in the organizational development phase, and the business model and financial performance still needs to be proven (Knockaert et al., 2010). Combining these findings on NTBFs with those of start-ups at the beginning of this section, it is possible to assume that investors have developed their expertise and preferences over time – thus, indicating specialization.

### 2.2.3 The process of Venture Capital investment behavior and decision-making

Hall & Hofer (1993) summarize early findings on VC activity and point to a multi-staged decision process, typically consisting of five or six stages: (1) *deal generation*; (2) *initial screening of proposals*; (3) *project evaluation and due diligence*; (4) *deal structuring*; (5) *post-investment activities*; and (6) *cashing out or exit activities*.

De Clercq et al. (2006) in their "guide" for aspiring entrepreneurs, map similar stages but also include the entrepreneurs' perspective, suggesting a more interactive process (see Fig. 10).

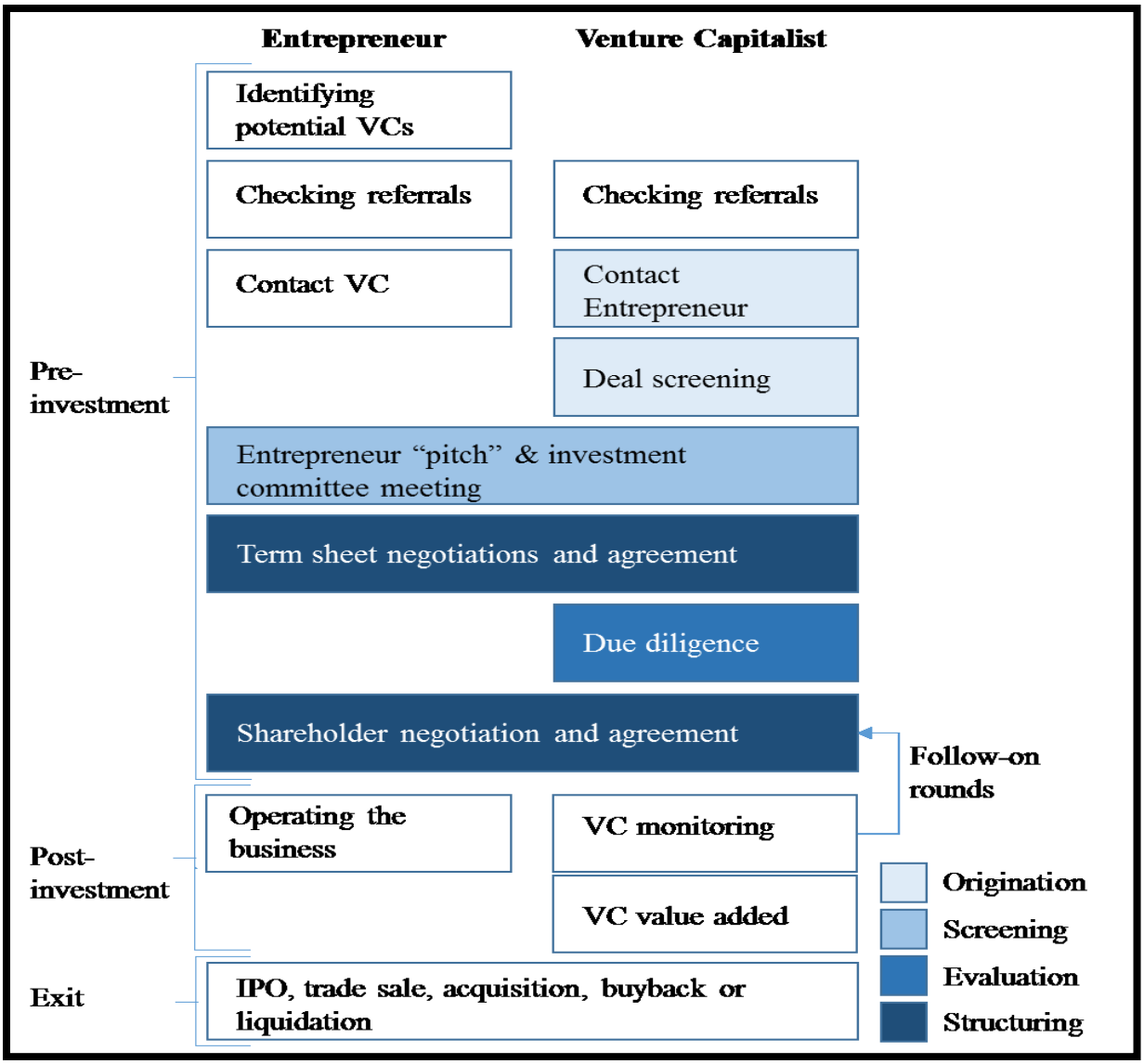


*Figure 10. Steps in the investment cycle*
*Source: adapted from De Clercq et al. (2006)*

The investment behavior of VCs and how they choose to allocate their capital – why, where, how and how much – is linked to their decision-making processes, and ultimately, to the evaluation criteria used to assess and select prospective investments. In a review of VC decision making, Hudson and Evans (2005) find that VCs' evaluation criteria are not straightforward, and there is no consensus on the most relevant issues considered by VCs. Previous research suggested that the "execution team" (Franke, Gruber, Harhoff, & Henkel, 2008; P. Gompers et al., 2016; Macmillan, Siegel, & Narasimha, 1985; Macmillan, Zemann, & Subbanarasimha, 1987; Shepherd &

Zacharakis, 1999; Tyebjee & Bruno, 1984), characteristics of the market environment (Hisrich & Jankowicz, 1990; Muzyka, Birley, & Leleux, 1996; Ruhnka & Young, 1991), characteristics of the product (Macmillan et al., 1987), financial criteria and exit opportunities (Macmillan et al., 1987) emerged as key drivers in the investment decision process. Because VCs share equity with their portfolio companies, it is natural that the *growth potential of the entrepreneurial ventures* and the *capability of the management team* to achieve this growth are of paramount importance (De Clercq et al., 2006, p.92). This may explain why there is little variation among the main investment criteria that has emerged from studies in different geographies and time-frames.

Investment behavior, decision-making and evaluation criteria relate to the development stages of ventures (see Fig. 11) in which investors choose to interact with and invest. In the VC context, stages refer to the maturity of such companies but are also used to classify investment funds by the type of prospects they typically explore. The practice of attaching labels (e.g., seed, early, late stage) to funds simplifies the communication of objectives and facilitates the matchmaking process between investors and investees. A clear separation in stages depicts the general perception about key characteristics in each stage. Essentially, as a simplification, the label of each stage indicates the approximate level of uncertainty, the potential amount of capital needed, and the degree of challenges faced by the founders or managers (e.g., proof of concept, production, marketing, distribution).

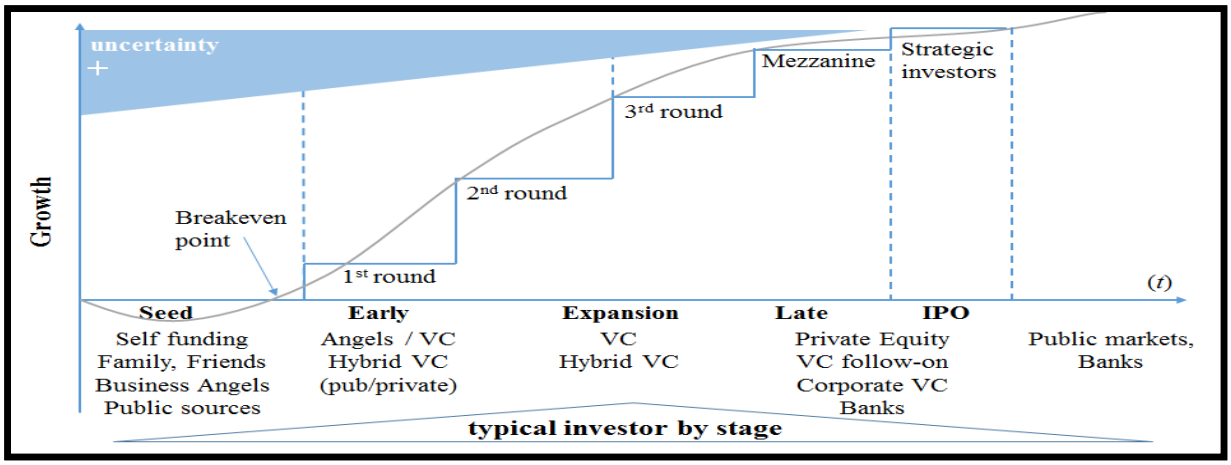


***Figure 11. Typical investor by growth stage***
*Source: adapted from* Duening, Hisrich & Lechter (2015)

Informational asymmetry and uncertainty are amplified in seed-stage companies. This has historically driven formal VCFs away from investing. One common explanation is that as the industry matured, VC funds got bigger and the allocation of capital in seed stages became suboptimal due to the smaller average size of deals and the expected returns within the relatively short lifetime of VC funds. Moreover, opportunity and governance costs of allocating financial and human capital to a large pool of smaller investments instead of to a few later stage companies with a clearer route towards exit, were discouraging to VCFs. Furthermore, the availability of specialized *human capital* (i.e., those with appropriate background and expertise) able to understand and assess earlier stages uncertainties and risks is (or was) relatively scarce. Specifically, this meant that start-up, seed stage investments were made primarily by informal investors (i.e., Business Angels) that invested their own capital. These factors contributed to making seed stage investing become a specialized activity, with fewer firms engaging in fewer deals (Dimov and Murray, 2008).

De Clercq et al. (2006) provide an overview by interlinking the main characteristic and issues present in each development stage (see Table. 1).

*Table 1. Issues related to VC investing by Venture Stage (De Clercq et al. 2006, p. 93)*

| | Seed Financing | Start-up Financing | Expansion Financing | Buy-out Financing |
|---|---|---|---|---|
| Characteristics of the venture | • 1–2 entrepreneurs<br>• Undeveloped technology and business concept<br>• Business plan is not validated | • Management team in place<br>• Product ready for marketing<br>• A pilot and other information about the product are available | • Marketing has been started<br>• Venture is ready to start growing and expanding | • Established company |
| Main purpose of the funding | • Enabling research and development<br>• Developing business concept | • Establishing the marketing and sales activities | • Launching full scale marketing activities | • MBO<br>• LBO<br>• Delisting |
| Typical venture capital investor | • Business angel (BA)<br>• Sometimes corporate venture capitalist (CVC) | • VC<br>• CVC<br>• Sometimes BA | • VC<br>• CVC | • VC |
| Main expertise or benefit beyond money provided by the venture capitalists | • Structure, discipline, sounding board and attraction of additional (external) funding (BA, VC, CVC)<br>• Insights how to establish the venture's legal form (VC)<br>• Technological insights (CVC) | • Marketing experience, recruiting help, contacts, help with follow-on financing (VC)<br>• Technological insights, test marketing and piloting possibilities (CVC)<br>• Reputation benefits (VC, CVC) | • Marketing experience, recruiting help, contacts, help with follow-on financing, help to plan and execute the exit (VC)<br>• Technological insights, test marketing and piloting possibilities (CVC)<br>• Reputation benefits (VC, CVC) | • Legal and other expertise how to execute a buy-out deal (VC) |
| Major trouble spots of venture capital funding from entrepreneurs' point of view | • Time consuming to locate, negotiate and close the deal<br>• Involvement (e.g. reporting requirements and governance) with a VC requires a lot of time<br>• Early stage company does not have very much to back up the valuation of the venture and the valuation might be very low | • Time consuming to locate, negotiate and close the deal<br>• Involvement (e.g. reporting requirements and governance) with a VC requires a lot of time<br>• CVC might want to direct the strategy of the venture | • Time consuming to locate, negotiate and close the deal<br>• Involvement (e.g. reporting requirements and governance) with a VC requires a lot of time<br>• CVC might want to direct the strategy of the venture | • Time consuming to locate, negotiate and close the deal,<br>• Involvement (e.g. reporting requirements and governance) with a VC requires a lot of time |

Despite their valuable overview on the main aspects of VC functioning, the authors do not provide an assessment within development stages that explains preferences and motivations that drive investors' behavior. This analysis is provided by Dimov and Murray (2008) in an in-depth examination of VC interest in seed stage. They build upon analysis of decision making, agency theories and human capital to explore how expertise shapes VCs' relationships with uncertainty. They argue that information asymmetry costs in pre- and post-investment phases are amplified in a seed and early-stage context. And consequently, this leads to investors' specialization either in terms of stage, industry or geography (or some combination) with the intent to reduce agency risks.

### 2.2.4 Risk management in Venture Capital

Amit et al. (1998) explore the link between VC and agency risk and highlight that information asymmetry (IA) is key in understanding VC activity. They maintain that the environment (e.g., industries) where these firms operate favors their ability to select and monitor investments, giving VCFs a comparative advantage over other investors. Moreover, the authors state that in a pool of similar opportunities VCs tend to favor those with relatively less costly IA. This leads to a preference for mature firms instead of start-ups. Per the authors, "*hidden information*" and "*hidden action*" are the major forms of IA. These two factors can lead to adverse selection of opportunities and increased chances for moral hazard due to unpredictable behavior of agents – creating market failure in entrepreneurial financing. These sources of market failure are especially pronounced for young ventures, influencing the decision of VCFs to focus on later stage firms.

Agency risk and informational asymmetry are not the only concerns among investors. The evolution of the VC industry changed the relationships between investors and investees. VCFs expanded from solely allocating capital and began playing a more complex active role. Additional resources and added-value services complement managerial and business skills of portfolio companies (Gorman & Sahlman, 1989; Kaplan & Stromberg, 2001; Sapienza, 1992; Sapienza, Manigart, & Vermeir, 1996). Coaching and monitoring of portfolio companies by the investment managers have a twofold objective. Efforts to define priorities and to rationalize the portfolio companies' decision making by influencing their business development and growth strategies, aim at increasing the likelihood that there will be a successful liquidity event. Secondly, a strong motivation for such control and monitoring is to manage the risk of the investments.

Risk management in a VC context covers the identification and assessment of risks and preparation of adequate responses when funding a new venture with the goal of carrying the investment to a

successful liquidation. Fiet (1995) provides one of the first comprehensive works that acknowledges and classifies risk-related issues in VC activity. Risk is separated into two major components – market risk and agency risk. The former encompasses the challenges and uncertainties of starting a new business and the latter concerns the issues involved in the partnership between investor and investee (i.e., principal-agent).

Since risk is omnipresent during the lifetime of any investment, it is important to understand its sources and characteristics. Multiple authors have identified and classified the primary risk-related issues in VC (Cumming et al., 2005; Fiet, 1995; Reid & Smith, 2003). Reid & Smith (2007) refer to total risk as the combination of all possible sources and natures of quantitative and qualitative risks associated with VC activities. They emphasize that *business risk*, *agency risk*, and *innovation risk* are crucial categories in high-technology contexts. Business risk relates to competitive and market dynamics. Agency risk is an outcome of information asymmetry and conflicts of interest between principals (e.g., LPs or GPs) and agents (e.g., GPs or portfolio firms). Innovation risk addresses the unpredictability (e.g., time involved, cost and outcome) of the deployment of a new technology. A finding of their work, focused on the UK context, is that investors are primarily concerned with agency risk while investees are more concerned with business risk. But there is not much consensus among investors and investees regarding innovative risk across the industry. This lack of consensus might be explained by the heterogeneity of VCs, even in the specialized high-technology niche.

Where to invest, under which conditions, how frequently, with whom, how much and for how long – all are questions that arise for the GPs soon after securing capital from institutional investors. When building a portfolio of VC investments, uncertainty and risk are recurrent issues that call for implementation of strategies to address them.

A group of works analyzes different strategies to deal with risk in a VC context and common instruments (or strategies) to mitigate against them. Low levels of commitment to unfamiliar industries, syndication (i.e., co-investment), diversification (e.g., by industry, geography), staging (e.g., investing in rounds) and portfolio size are among the frequently cited strategies (Ruhnka and Young, 1991).

Syndication network of investors (or the practice to co-invest) is a popularly-applied strategy to mitigate against risk. Brander et al. (2002) find that syndication and performance are influenced by complementary VC skills and an improved selection process. Casamatta & Haritchabalet (2007) highlight the need for balance between screening skills and value-adding to offset conflicting interests among co-investors. And Cestone, Lerner & White (2006) study the concentration of similar VCs in the syndication process as an outcome of asymmetric information.

On portfolio size and scope, Kanniainen & Keuschnigg (2003, 2004) study VC portfolio interactions and suggest that the optimal size is a trade-off between the size of the portfolio and the level of interaction that each portfolio company receives, suggesting marginal returns of VC advice. Fulghieri & Sevilir (2009) add that a larger portfolio enables the potential reallocation of human capital across companies in the case of venture fail, if technologies are related.

Regarding the staging of venture capital investments, Sahlman (1990) argues that staging is an important instrument for controlling VC risk, allowing the investor to create option-like returns.

Most of these instruments are technology- and industry-agnostic. In a more specific context, Mason & Harrison (2004) challenged the general perception that investing in high technology businesses necessarily involves higher risks than investing in non-technology-based businesses. Their study was based on analysis of informal investors in the UK. Their assessment is that

investments in technology-based firms are perceived as unattractive from a risk-reward perspective by (formal) investors and they compile specific sources of risk that concern these investors. The authors incorporated previous findings from Storey & Tether (1998), Murray and Marriot (1998) and Locket et al. (2002):

- *Management risk*: inexperience in commercial exploitation of technological innovations;
- *Agency risk*: efforts to overcome information asymmetry;
- *Market risk*: assessing the market potential that may not yet exist or creating a new market;
- *Technological risk*: technology may be unproven; its development may take longer; and it may cost more than originally expected;
- *Valuation risk*: traditional investments tend to be valued on earnings-base. Knowledge-based assets (i.e., R&D projects) are valued on the potential of future applications;
- *Project risk*: the need for rapid commercial exploitation requires large amounts of capital to beat competitive products;
- *Growth risk*: the new business is required to grow at rapid rates;
- *Timing risk:* entering the market too early or too late.

An important finding of their work is that, contrary to the general perception, technology investing does not involve higher prospects of loss (i.e., higher risk) when compared to non-technology investments. The authors suggested three possible explanations: (i) *that it is related to the characteristics of the investments*; (ii) *that it is related to the size of the deals and investor's profile*; and (iii) *that it is a specific trait of the informal venture capital market that emerges from business angels' investment appraisal practices and value-added contributions*. In further developing the last argument, the authors indicated that this type of (informal) investor is inclined to control

*agency, market and technology risks due to previous experience in the technology sector*, thus reducing the effects of adverse selection.

Their conclusion is in line with previous works on informal investors that find Business Angels better at handling agency risk than formal investors. These investors have an active involvement in key areas of their portfolio companies and are different from formal investors in their relationships and investment behaviors (Erikson & Sørheim, 2005; Fiet, 1995; Landström, 1998; Sætre, 2003).

### 2.2.5 A change in investors behavior

Prior to the seed and early-stage "boom" explained in the introduction, seed investments were typically associated with informal investors. This is mirrored in the available literature on seed stage investing (Dimov and Murray, 2008). However, as traditional VCs expanded investments in the seed stage and extended deals in early-stage, new studies emerged that analyzed these changes.

Notably, two interesting works approach the topic from different perspectives. The first is an extensive survey conducted by Bottazzi, Da Rin and Hellmann (2004). In the research, they focused on: "*the changing face of the European venture capital industry*". The researchers gathered descriptive data on VCFs profiles and investments, and they also examined the human capital factor within the industry. In their words: "*Our first and most important finding is that human capital is a key driver of the investment activities of venture capital firms*" (Bottazzi et al., 2004, p.27). In summary, they attributed the change in investors' behavior to a change in European VC human capital. They argued that "new entrants" – either new VCFs or investment managers – have a different profile when compared to the "old guard" of investors – both in terms of educational background/achievement and professional background. They highlighted that new

entrants tend to have a higher proportion of Master's degrees and emphasis on business education. Moreover, these new players invest more in early-stages – especially seed – and closely monitor their investments. The researchers suggested that these differences shaped changes in the European VC industry where they found evidence of a more integrated ecosystem, with higher uncertainty-bearing and closer interaction between investors and investees.

The second contribution comes from Klingler-Vidra's (2016) work on the parallel between seed funding and *patient capital* – a type of funding where the providers "evaluate the long-term potential of high-risk firms rather than assess short-term performance" (Klingler-Vidra, 2016, p.3). The author builds the argument that in a VC context, seed stage funding shares similar characteristics with patient capital as investors have a long-term orientation, a high involvement and tend to hold or be "loyal" to their investments despite the lack of short-term performance. An additional outcome of his work is an assessment of the potential factors that explain the increase of seed and early-stage funding: *lower entry barriers for start-ups* (*costs*); *increased capital inflows into the VC sector*; and *public policies supportive of entrepreneurship and incentives for entrepreneurial finance* (Klingler-Vidra, 2016).

*Table 2. VC seed funding in patient capital terms (Klingler-Vidra, 2016, p.9)*

| Patient capital attributes | VC seed funding characteristics |
|---|---|
| Intended investment horizon | • Typically 5–9 years.<br>• 'Fail fast' and unicorn trends forcing downward pressure on expected timeframe. |
| Engagement for short- or long-term objectives | • Actively involved in company management and strategy decisions through institutionalized means, such as board membership, as well as informal channels.<br>• Optimizing the long-term corporate value of the company at the time of exit through IPO or trade sale.<br>• Seed investors who provide follow-on funding to a start-up are incentivized to invest more time, expertise and access to networks. |
| Loyalty | • Strong ability to influence management, so instances of management not acting in accordance with venture capitalists' preferences relatively low.<br>• When discrepancies do occur, the venture capitalist does not exit due to patience by default (lack of exit options).<br>• The rise of secondary markets inhibits the patience by default; when venture capitalists lose confidence in a management team's ability to execute its long-term vision they may pursue exit via secondary market. |

Moreover, the author cites recent significant quantitative changes in investment behavior. He points out that seed stage deals grew by a factor of 10 – or greater in some countries, between 2000 and 2015. For instance, in the USA, institutional investors engaged in 80 seed deals in 2000; 468 in 2009; and 1,952 in 2015 (Klingler-Vidra, 2016).

Among VC practitioners this change in the landscape was noted earlier. Mark Suster, a former entrepreneur turned VC stated in his blog: "*A few years ago it became fashionable for large VCs to do seed funding. With open source software … and cloud computing infrastructure it just wasn't that expensive to get your company going, and founders just wanted to raise less money. Some larger VCs felt they were being "scooped" by some younger, nimbler and smaller VCs. So they set up seed programs that allowed for rapid decisions for $500k or less, often done as convertible debt for both speed and cost reasons. There are multiple firms that did this.*" (Suster, 2009).

More recently, Suster posted an article titled "Changes in the Venture Capital Funding Environment" (Suster, 2016) where he discussed again the rise of *seed and angels* and the "boom" of start-ups. The difference from his prior article is that now he approached the subject not as a trend but as *given new configuration of the industry*.

Another example from practice came from Daniel Blomquist, a principal at Creandum (a Swedish VCF). In his article, he develops a similar argument, based on the lower capital requirements for (internet) start-ups, and provides an illustration of the shift towards non-linear capital needs of ventures (see Fig. 12).

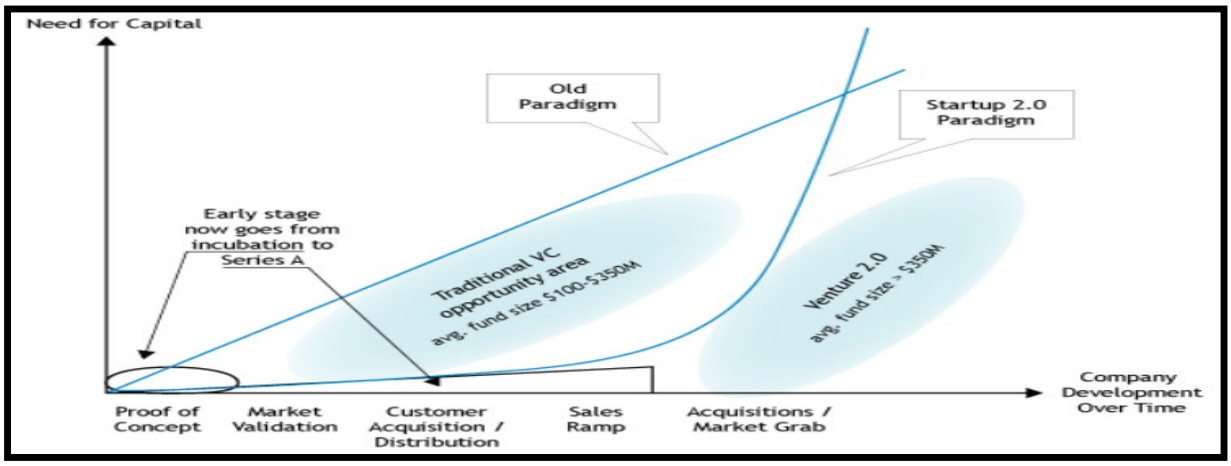


***Figure 12. The shift in capital needs for internet start-ups***
*Source: Blomquist (2014)*

This "new paradigm" has shifted the balance in the supply and demand of VC. From the demand side – due to a lower entry barrier – a higher inflow of new start-ups increases the pool of prospects, driving up supply of capital (Blomquist, 2014). This new configuration triggered a reaction from traditional VCs, altering their investment behavior but also raised questions on overfunding or premature funding of seed stage businesses.

Despite the important findings from the abovementioned articles there are not many other academic works that thoroughly investigate the change of investment behaviors in the seed and

early stage arena. It is especially significant that there is not much research with a focus on how increased learning about technology affects VCFs in their decision-making process. This is part of the *knowledge gap* that this research attempts to help reduce.

# 3. Theoretical perspective

Building on the arguments presented that human capital directly affects investors' behavior (Bottazzi et al., 2004, Dimov and Shepherd, 2005, Knockaert et al., 2010a, 2010b) this research attempts to integrate elements of the learning processes in organizational contexts with existing literature on VC. In the following topics, background information on how learning affects organizations is provided as well as how learning manifests itself in decision-making processes of entrepreneurs and investors. Finally, the theoretical framework used for the deductive analysis from data collected is presented, together with an explanation regarding why it fits with the central question of this research.

## 3.1 General perspective on learning

When individuals conduct research about learning and knowledge, there is a high chance that Kolb's (1984) work will appear as a recurrent theme. For this current research, Kolb's study is used mainly as background information, but it is important to note the relationship between learning and experience and the transformative aspect of knowledge provided by him. Kolb states, "*Learning is the process whereby knowledge is created through the transformation of experience*" (Kolb, 1994, p. 38). Corbett (2007) provides a concise explanation "*Kolb argues that the process of experiential learning consists of three distinct elements: (1) the existing knowledge, (2) the process through which individuals transform new information and experiences, and (3) the manner in which individuals transform new information and experiences into new knowledge*" (Corbett, 2007, p. 100).

Closer to the topic of how organizations learn is the concept of Absorptive Capacity (Cohen & Levinthal, 1990). In their work, the authors argue that to benefit from outside knowledge, firms need to possess some previous level of related knowledge. Furthermore, they explain that learning

is a cumulative effort inversely related to the level of existing knowledge-base on the object of learning – suggesting a more difficult process of learning in domains where there is no previous understanding (Cohen and Levinthal, 1990). Another aspect derived from the same work is how a diverse background facilitates learning. In a context where information comes from multiple knowledge domains, the likelihood of novel associations and linkages is higher due to the presence of a diverse existing knowledge base. These elements of learning have been explored in an entrepreneurial context.

## 3.2 Learning and knowledge in an entrepreneurial context

Bingham and Davis (2012) explore learning sequences in organizations and distinguish between direct learning (e.g., trial-and-error, experimental, improvisational) and indirect learning (e.g., vicarious – learning from others). Their focus is to determine if *learning sequences* exist, if they matter and if they evolve over time. The conclusion is that there are two basic learning sequences: (i) *seeding* is where indirect learning (seeds) direct learning, and (ii) *soloing* means that learning stays in the direct learning context (either in the original format or switches to another direct learning form).

Bingham, Furr and Eisenhardt (2014) coined "the opportunity paradox" where they examined the interplay of *flexibility* and *focus* in capturing new business opportunities. *Opportunity selection* (i.e., which problem to solve) and *opportunity execution* (i.e., solving the chosen problem) are equally relevant and have an important connection. They reach their conclusion by understanding two profiles: *opportunists* versus *strategists*. *Opportunists* tend to have a more flexible approach to opportunity selection, less scripted. On the other hand, *strategists* employ a more disciplined study of the nature of opportunities. Their focus is on capitalizing successfully on a sequence of opportunities rather than focusing on isolated efforts. The authors further compare and contrast

the two profiles in regards to selection of and execution of opportunities. Opportunists appear to be more flexible in the selection phase but more rigid in opportunity execution. This contrasts with the increased focus of strategists that offers increased flexibility in opportunity execution.

A key takeaway from their work is the importance of experience (i.e., learning) in successful opportunity capture. Furthermore, more focused opportunity selection appears to lead to more flexible opportunity execution. However, more flexibility in opportunity selection often leads to less flexibility in opportunity execution (see Fig. 13). They also suggest that long-term success partly depends on sequencing opportunities for learning and development. To manage the opportunity paradox, the recommendation is to combine a thorough selection of opportunities with speedy and flexible execution.

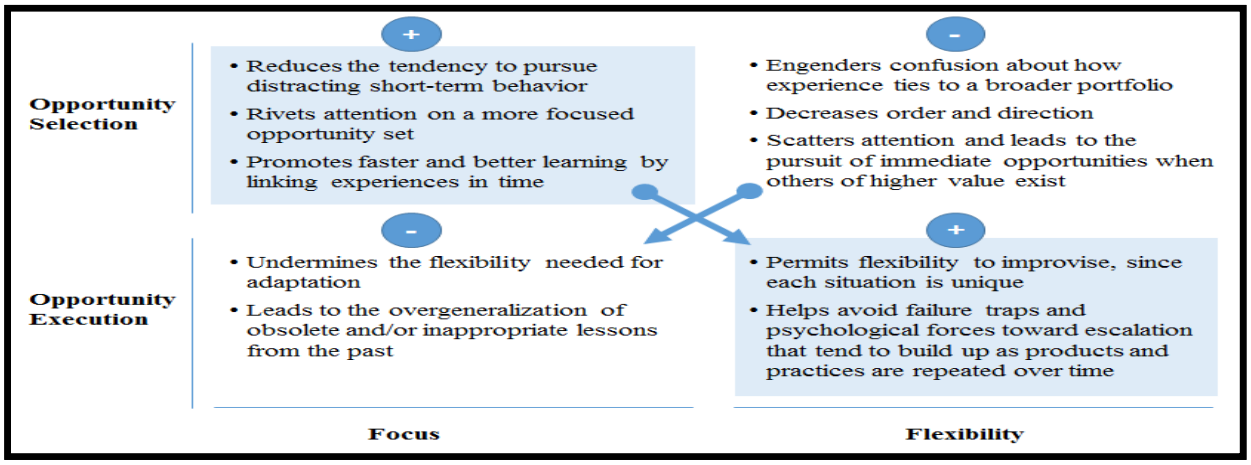


*Figure 13. Focus and flexibility in opportunity capture*
*Source: Bingham, Furr and Eisenhardt (2014)*

### 3.2.1 Learning from the entrepreneur's perspective

Ravasi & Turati (2005) point out that learning in entrepreneurial ventures typically occurs under adverse circumstances where entrepreneurs face high degree of ambiguity (exploratory nature); need complementary knowledge and skills; and suffer from scarcity of resources. Learning in entrepreneurial innovation contributes to (i) preserving the leading role of the entrepreneur in

collective contributions, (ii) improving the entrepreneur's control of the process, (iii) facilitating the assessment of potential risks, (iv) preventing loss of confidence and (v) helping to capture and integrate newly created knowledge.

Learning in an entrepreneurial setting is evidenced by the presence of *serial entrepreneurship.* Studies on serial entrepreneurs provide insights on the relationship between learning and investing and the impact on the investor-investee dynamic.

*Serial entrepreneurs* differ from novice or first-time entrepreneurs due to their previous venture experiences. *Habitual entrepreneurs* engage in a sequential (start-close-start) pattern while *portfolio entrepreneurs* run parallel (simultaneous) businesses. In terms of occurrence, previous research show that the relative participation of serial entrepreneurs in the overall entrepreneurial activity varies among countries, with Europe showing a higher average when compared to the USA (Hyytinen & Ilmakunnas, 2007; Westhead, Ucbasaran, Wright, & Binks, 2005). When compared to novice entrepreneurs, Gompers, Kovner, Lerner & Scharfstein (2010) provide evidence that a successful track record impacts future ventures. Hsu (2007) explores funding performance of serial entrepreneurs, suggesting higher probability and better valuations. These previous works confirm the general intuition that experience plays a part in running multiple businesses – thus making an inevitable link between experience and learning.

Bringing the serial entrepreneur topic closer to central question of this research, Bengtsson (2013) finds that only a minority of such entrepreneurs return to previous VCF when raising capital for new ventures. He suggests that one of the reasons for this behavior is a mismatch between the (current) expertise of the VCF with the required expertise (knowledge) to assess and support the entrepreneur's new venture. An additional insight from Bengtsson's work comes from the discussion of the relevant role of private information acquired from the entrepreneurs during the

investment process. Building on previous works, Bengtsson notes that the processes of due diligence, monitoring and coaching of founders leads to the accumulation of valuable information (knowledge) on the human capital of the entrepreneur and his or her early stage venture. Such information is key to building long lasting or repeated relationships between the VC and the serial entrepreneur. Furthermore, the author provides evidence that VCs refer companies to peer investors in their network, suggesting that the private information acquired from entrepreneurs can be transmitted and explored by a syndicated network.

De Clercq & Dimov (2008) analyze the trade-offs between developing internal knowledge or accessing external knowledge. Internal knowledge development is relevant when either there are no partners involved or available, or they are unfamiliar. As would be expected, the importance of internal knowledge declines as external knowledge plays a more significant role. Furthermore, accessing external knowledge positively impacts performance as more possible solutions arise to address specific problems. Building on the works of Lerner (1994) and Branders et al. (2002), the authors find that VC investments involving multiple partners in a syndication network were more likely to succeed, emphasizing the knowledge-sharing rationale in co-investments and inter-firm relationships. A similar finding came from Sullivan & Marvel (2011) in their analysis of venture development and knowledge acquisition in a network context. Their results suggest a positive relationship between product innovativeness and technology knowledge acquisition when accessed through network interactions.

### 3.2.2 Learning from the investor perspective

Sørensen (2007) provides one of the first empirical evidence that learning has an intrinsic value in the process of investing in the form of an *option value of future learning*. The author maintains that to understand how uncertainties are reduced in investment decisions, there is a need to

understand how VCFs learn. The outcome of his study is that decision to invest is affected by a combination of the expected return of the investment itself and the learning potential for future use. This is an important finding as it brings a different perspective on investment selection.

Other than maximizing and comparing each investment individually, he suggests that learning has an additional, indirect effect (option value of learning) for future decisions. This option generates a trade-off between exploiting investments with foreseeable payoffs and exploring investments with more uncertain payoffs. Exploitative behavior is present when VCFs change their investments due to the outcomes of previous experiences. Explorative behavior appears when these investors allocate capital in unproven investments, thus, "exercising" the option value gained from these investments. Sorensen concludes that VCs with exploratory strategies benefit from higher success rates.

De Clercq & Sapienza (2005) explored investors' learning from interactions with their portfolio companies. They analyzed the effects on each investment of VCs' experience, knowledge overlap among investors and investees, trust and the performance of portfolio companies on learning achieved by VCs on each investment. The outcome of their analysis supported a positive relationship between higher learning by VCFs from high performance portfolio companies. Additionally, they noted that less experienced VCFs learned more from these interactions, and limited learning occurred where extensive knowledge overlap was present.

## 3.3 Theoretical framework on organizational learning

Huber (1991) provided a framework (see Fig. 14) containing four constructs and processes associated with organizational learning: (i) *knowledge acquisition* – the process by which knowledge is obtained; (ii) *information distribution* – how information from different sources is shared and leads to new information and understanding; (iii) *information interpretation* – how

distributed information takes one or more commonly understood interpretations; and (iv) *organizational memory* – the means by which knowledge is stored for later use.

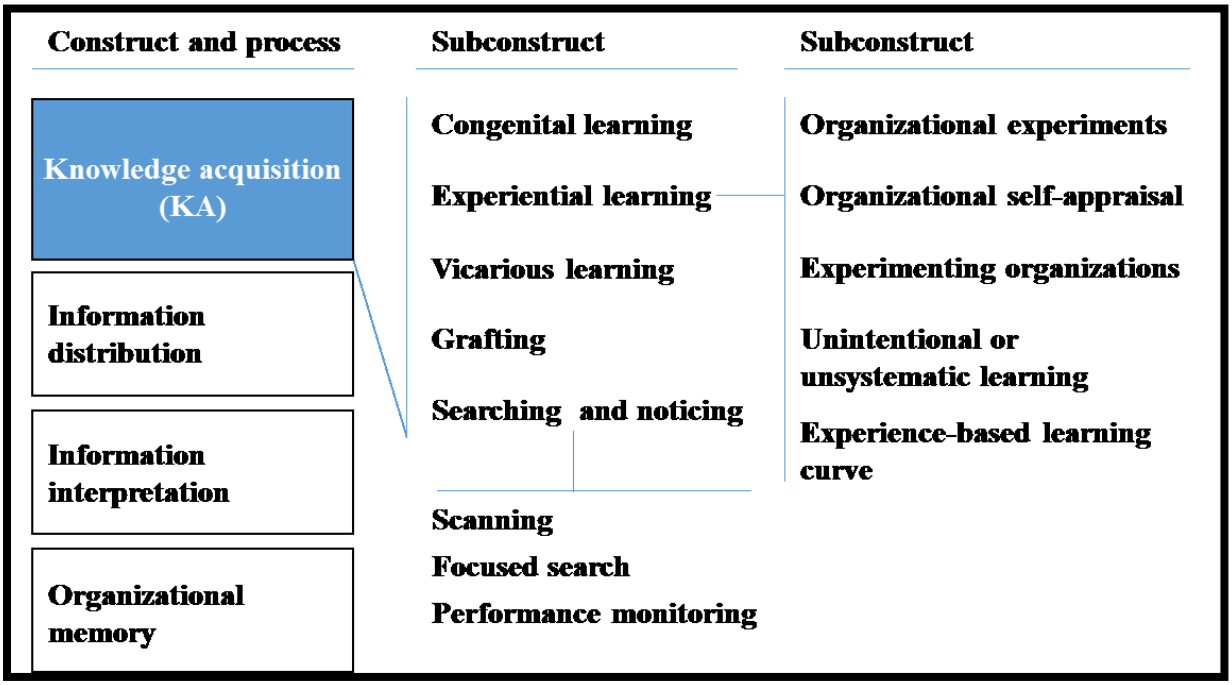


***Figure 14. Constructs and processes associated with organizational learning***
*Source: adapted from Huber (1991)*

The central question of this research is how VCFs acquire technology-related knowledge to support their decision-making process. Furthermore, it was argued (Chapter 2.2.4) that IA may lead to adverse selection of opportunities in a scenario where entrepreneurs 'hold' more information about their businesses than the investors. An additional component relevant in the context of VC funding of early-stage ventures is the uncertainty level inherent to these investments.

With the objective to explore if technology-related knowledge can help reduce the effects of IA and uncertainty in the VCFs' context, this research focuses on *knowledge acquisition* (KA) – the first process presented by Huber (1999).

The framework proposes five sub-processes related to KA: (i) congenital learning; (ii) experiential learning; (iii) vicarious learning; (iv) grafting; and (v) searching (or noticing).

(i) *Congenital learning* is associated with the knowledge available at the time of the organization's establishment – the knowledge and experiences of the founders or personnel, gained from their prior activities.

(ii) *Experiential learning* is knowledge acquired through direct experiences. This sub-process is further segmented. *Organizational experiments* facilitate organizational learning by providing elements for the analysis of cause-effect relationships between the organizations' intentional actions and their outcomes. *Organizational self-appraisal* relates to critical learning. Its objective is to assess and implement actions to correct problems. *Experimenting organizations* operate in a mode where the whole organization adapts to dynamic and unpredictable environments. *Unintended* or *unsystematic* learning derives from non-deliberate experiments. Lastly, *experience-based learning curves* correlate organizations' improved performance with their accumulated first-hand experiences.

(iii) *Vicarious learning* is learning by observing the actions of other organizations.

(iv) *Grafting* is a construct related to adding on components that possess knowledge required but not held by the organization.

(v) *Searching (or noticing)* refers to acquiring information from the organization's environment. This sub-process is also further segmented. *Scanning* is mainly associated with changes in the external environment to the organization. *Focused search* is an active effort, directed at a fragment of the organization's environment either internal or external. *Performance monitoring* is related to the organization's effectiveness in moving towards achieving its own established goals or meeting the expectations of stakeholders. Lastly, *noticing* is unintended acquisition of information either on the organization's external environment, internal conditions or performance.

# 4. Methodology

## 4.1 Research approach and research strategy

This study is mainly of *exploratory* nature and combines *deductive* and *inductive* research approaches. This is justified by the existence of a well-known theoretical framework suited to deductively analyze data collected to answer the central research question; and an induction approach able to generate new insights to help answer sub-questions related to the object of study. This methodology follows the suggestion of Saunders et al. (2009, p. 127), *"...not only is it perfectly possible to combine deduction and induction within the same piece of research, but also in our experience it is often advantageous to do so".*

The research strategy is a *case study* as it respects all the elements present in Robson & McCartan's (2015, p. 150) definition: "*a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real-life context using multiple sources of evidence*." More specifically, it is a *cross-sectional*, *holistic*, *multiple* case study, since the main concern of the study remains at the global level of more than one company in a specific time-frame (Saunders et al., 2009).

The research method is exclusively *qualitative* in the collection and analysis of data. Primary data was collected using a mono-method based on semi-structured interviews. The justification for this technique is its adequateness to explore reasons, decisions, attitudes and opinions of the respondents. Furthermore, the flexibility of the method allows the researcher to cover a range of themes without necessarily having to cover all of them in every interview. Furthermore, the informal setting allows interviewees to make connections, build on their responses and explore additional elements that may be unknown or neglected by the interviewer (Saunders et al., 2009).

Analytical procedures for this research needed to be compatible with deductive and inductive approaches. For the *deductive approach* the guidance for the choice of method comes from Saunders et., (2009, p. 505): "…*data display and analysis* is suited to an inductive strategy to analyze qualitative data, although it is also compatible with a more deductive strategy". The data display and analysis is based on the work of Miles & Huberman (1984). For the authors, the process of analysis involves three sub-processes: *data reduction*; *data display*; and *drawing and verifying conclusions*.

For the inductive approach the method of choice was *grounded theory.* "In the grounded theory of Strauss and Corbin (2008) the disaggregation of data into units is called *open coding*, the process of recognizing relationships between categories is referred to as *axial coding*, and the integration of categories to produce a theory is labelled *selective coding*" (Saunders et al., 2009, p.509).

## 4.2 Research design

The objective of this research is to understand *how VCFs acquire knowledge about technology to better support their decision-making processes.* The central question proposes a double challenge: (i) understand how VCFs acquire technology-related knowledge; and (ii) how a better understanding of technology can support VCFs' decision-making processes. A set of sub-questions needs to be addressed to provide a comprehensive answer.

The first two sub-questions were directly related to the process of *knowledge acquisition* of VCFs. They were answered based on deductive analytical procedures that tested collected data from semi-structured interviews conducted with the guidance from an existing framework of organizational learning.

The second two sub-questions were concerned with *informational asymmetry* (IA) and *innovation risk* (IR) in the context of the VCFs' decision-making processes. These questions were addresses from an inductive perspective. The key elements and processes required to achieve the research objective are addressed in the following topics.

### 4.2.1 Sample composition

Participants in this research were selected through the process of nonprobability (or non-random) purposive sampling (Saunders et al., 2009). The main parameters used to qualify potential interviewees were: (i) VCFs that engage in seed and early stage investments; (ii) VCFs interested in technology-related businesses; and (iii) VCFs that are active in Europe. Due to homogeneity in this population – all VCFs – a target for a minimum number of interviews was based on the guidance of Guest, Bunce & Johnson (2006) that suggested a minimum of 12 interviews. With the objective to maintain a balance in the profile of participants and to allow the comparison among them, an effort was made to provide enough diversification within the sample in terms of geography (within the EU), degree of industry specialization and exposure to technology-related investments. Overall, 56 companies were contacted, seven declined interest and 29 didn't provide feedback. As an outcome, 20 interviews were conducted (see Table 3).

*Table 3. Sample of VC Firms*

| VC Firm | Setting | Date | Country | Profile | Tech relevance | Industry | Stage |
|---|---|---|---|---|---|---|---|
| VC1 | Phone | 08/11/16 | Germany | Generalist | Low | Agnostic | Agnostic |
| VC2 | Person | 08/22/16 | UK | Specialist | Low | Cyber Security, Data Analytics, Cloud, Assistive Tech | Growth |
| VC3 | Email | 09/27/16 | Germany | Specialist | Low | SaaS, Marketplaces | Early |
| VC4 | Person | 09/29/16 | UK | Generalist | Low | Agnostic (except HW) | Early |
| VC5 | Phone | 10/04/16 | France | Specialist | Low | Internet | Seed to A |
| VC6 | Phone | 10/06/16 | Spain | Generalist | Low | Agnostic | Agnostic |
| VC7 | Person | 10/11/16 | UK | Generalist | Low | Agnostic | Series A |
| VC8 | Person | 10/12/16 | UK | Specialist | Low | Enterprise Software | Post-seed pre A |
| VC9 | Person | 10/12/16 | Belgium | Specialist | Low | Internet and Software | Seed and Early |
| VC10 | Phone | 10/12/16 | Netherlands | Generalist | Medium | ICT | Seed to A |
| VC11 | Phone | 10/13/16 | Netherlands | Specialist | Medium | Healthcare, ICT, New Media, Fintech | Series A |
| VC12 | Phone | 10/14/16 | UK | Specialist | High | Biotech, Healthcare, Software | Seed to A |
| VC13 | Phone | 10/15/16 | Sweden | Generalist | Low | Agnostic | Agnostic |
| VC14 | Phone | 10/18/16 | Netherlands | Specialist | Low | IT - B2B software | Early |
| VC15 | Email | 10/19/16 | Germany | Specialist | High | Chemistry, Hardware & Automation, ICT, Life Sciences | Seed |
| VC16 | Phone | 10/20/16 | UK | Specialist | High | Blockchain enabled businesses | Seed to A |
| VC17 | Person | 10/20/16 | UK | Generalist | Medium | Digital Tech, e-commerce, consumer fintech | Seed to A |
| VC18 | Phone | 10/21/16 | Spain | Specialist | High | Biotech | Early / Medium |
| VC19 | Phone | 11/09/16 | Netherlands | Specialist | Medium | Software | Seed |
| VC20 | Phone | 10/28/16 | US / NL | Specialist | High | Nano - Bio - Health - Clean / Tech, Energy, materials, optical, robotics | Pre-seed / Seed |

### 4.2.2 Data collection

The interview phase lasted approximately 75 days. All 20 interviews were conducted on a one-to-one basis. Six face-to-face meetings were held in London (UK) and 12 telephone interviews were done in the cases where either a telephone interview was preferred or a personal meeting was not possible. Additionally, two off-line email interviews were done with investors from Germany. Permission to record was requested in every session, and one interviewee requested not to be recorded. Furthermore, two recordings were corrupted, and data was lost. All interviews were conducted in English. Face-to-face and telephone interviews lasted on average 40 minutes.

The objective of the interviews was to collect two sets of qualitative data. The first set related to the learning process about technology from the VCF perspective. More specifically, how such knowledge is acquired and its relevance. The second set of data reflected the interviewees' perspectives on their decision-making process, specifically from a risk management point of view.

### 4.2.3 Data analysis

Data analysis was based on the outputs of successful audio recording of 17 interviews (see Table 4). Three interviews without recorded data were not considered. This is justified based on the benefits of working with audio recording: it allows the researcher to focus on the interview; there is no filter or selective collection; it makes clear who is the inquirer and who is the respondent; and provides fragments or quotes of the original data to be used in the final report (Boeije, 2010, p. 72).

Data was prepared for analysis by the means of transcription of the recorded interviews. Moreover, the data was made anonymous by assigning a pseudonym to each VCF using a simple code: combining the letters 'VC' with the order in which interviews were conducted: VC1, VC2, VC*n*.

*Table 4. Final list of VC firms interviewed*

| VC Firm | Setting | Date | Country | Profile | Tech relevance | Industry | Stage |
|---|---|---|---|---|---|---|---|
| VC1 | Phone | 08/11/16 | Germany | Generalist | Low | Agnostic | Agnostic |
| VC2 | Person | 08/22/16 | UK | Specialist | Medium | Cyber Security, Data Analytics, Cloud, Assistive Tech | Growth |
| VC3 | Email | 09/27/16 | Germany | Specialist | Low | SaaS, Marketplaces | Early |
| VC4 | Person | 09/29/16 | UK | Generalist | Low | Agnostic (except HW) | Early |
| VC5 | Phone | 10/04/16 | France | Generalist | Low | Internet | Seed to A |
| VC6 | Person | 10/11/16 | UK | Generalist | Medium | Agnostic | Series A |
| VC7 | Person | 10/12/16 | UK | Specialist | Low | Enterprise Software | Post-seed pre A |
| VC8 | Person | 10/12/16 | Belgium | Specialist | Low | Internet and Software | Seed and Early |
| VC9 | Phone | 10/13/16 | Netherlands | Specialist | Medium | Healthcare, ICT, New Media, Fintech | Series A |
| VC10 | Phone | 10/18/16 | Netherlands | Specialist | Low | IT - B2B software | Early |
| VC11 | Email | 10/19/16 | Germany | Specialist | High | Chemistry, Hardware & Automation, ICT, Life Sciences | Seed |
| VC12 | Phone | 10/14/16 | UK | Specialist | High | Biotech, Healthcare, Software | Seed to A |
| VC13 | Phone | 10/20/16 | UK | Specialist | High | Blockchain enabled businesses | Seed to A |
| VC14 | Person | 10/20/16 | UK | Generalist | Medium | Digital Tech, e-commerce, consumer fintech | Seed to A |
| VC15 | Phone | 10/21/16 | Spain | Specialist | High | Biotech | Early / Medium |
| VC16 | Phone | 11/09/16 | Netherlands | Specialist | Medium | Software | Seed |
| VC17 | Phone | 10/28/16 | US / NL | Specialist | High | Nano - Bio - Health - Clean / Tech, Energy, materials, optical, robotics | Pre-seed / Seed |

Qualitative data is "*based on meanings expressed through words; its collection results in non-standardized data requiring classification into categories; and analysis is conducted through the use of conceptualization*" (Saunders et al., 2009, p. 482). Boeije (2010) clarifies the second element: the outputs of qualitative collection techniques produce detailed and unstructured data. This means that in the analysis phase, the researcher will need to segment the data into parts and reassemble these parts again into a coherent whole (Boeije, 2010, p.76).

## 4.3 Deductive approach

Saunders et al. (2009, p. 124) recall Robson's (2002) useful set-by-step approach on how the deductive search unfolds by: (1) deducing a hypothesis from theory; (2) expressing the hypothesis in operational terms; (3) testing this operational hypothesis; (4) examining the specific outcome of the inquiry; and (5) if necessary, modifying the theory in the light of the findings.

Huber's (1991) framework of organizational learning offers a comprehensive and clearly defined set of *knowledge acquisition* activities (De Clercq et al., 2012, p. 145). Based on the author's proposed structure, the first two steps of Robson's (2002) methodology are expressed with a set of propositions:

*Proposition 1: congenital learning positively affects the acquisition of technology-related knowledge by VCFs;*

*Proposition 2: experiential learning positively affects the acquisition of technology-related knowledge by VCFs;*

*Proposition 3: vicarious learning positively affects the acquisition of technology-related knowledge by VCFs;*

*Proposition 4: grafting negatively impacts the development of internal technology-related knowledge by VCFs;*

*Proposition 5: searching positively affects the acquisition of technology-related knowledge by VCFs.*

The third step of the analysis was dedicated to test Huber's framework and typology of KA against primary collected data. Step four is presented in the results Chapter. The final step was not necessary.

## 4.4 Inductive approach

The inductive approach follows the opposite logic. There is no clearly defined theoretical framework. Data is analyzed with the objective to identify relationships that are then tested with the use of hypotheses or propositions. Ultimately, theory emerges as the output of data collection and analysis (Saunders et al., 2009).

In this research the general model of reference was provided by Boeije (2010) rooted in the grounded theory approach of Glaser and Strauss (1967). The author suggested a "spiral of analysis" as the process follows a sequential path of data collection and analysis. The starting point is *open*

*coding*, where data is segmented and classified using codes. Its output is referred to as coding scheme. Further data is collected to support the next level of analysis – *axial coding*, where the basic data is transformed into a more abstract framework. New data is iterated in the process and through *selective coding* the main categories of data are reassembled. The process should output the *core elements* that form the basis of a *conceptual model*.

### 4.4.1 Open coding

Open coding is the process of "breaking down, examining, comparing, conceptualizing and categorizing data" (Strauss & Corbin, 2007, p.61). All 17 interviews were individually analyzed and codified (see Appendix A). In this phase of data analysis, the objective was to gather a comprehensive list of codes to cover all aspects of data. The output of the individual open coding is the coding scheme (see Table 5).

*Table 5. Coding scheme*

| Codes | Codes | Codes | Codes |
|---|---|---|---|
| avoid direct competition | setting milestones | Technology should be internally owned, ideally IP protected | high knowledge barrier in life sciences |
| balance between technical and commercial skills | specialization and mitigation | confindece in internal/own analysis on technology/business | IP seen as important in life sciences |
| category leader | staging as risk mitigation | confortable with risk | life sciences is data driven |
| deal economics mindset | tangible deliverables | Founder seen as source of technical knowledge | In life sciences is hard to invest alone |
| deal-flow driven | team and execution risk | founders know the market better | in the US some big funds all the way through in life sciences |
| difficult problem to solve | risk as given in early and seed stage | network access and experice as valuable resources | Advantages of bigger funds is the option to balance a large |
| engament with first customers is key | high risk apetite | reputation | Micro VCs limit of funding can affect companies development |
| entrepreneur's industry expertise | keep track of competitors' investment behavior | self confidence | growth journey |
| entrepreneurs motivation | Recognize risk as part of the job | uncertainty bearing | support and valued added services |
| Entrepreneurs perceived as skillfull | type of risk associated to the profile of the portfolio co | analytical and communications skills | added value beyond capital |
| expensive valuation | risk assessment based on outputs of due diligence | entrepreneurs reputation | experiece journey |
| fast decision-making | reduce risk by getting in early at the best possible val | VC fills the gap of human capital or expertise | The added-value declines gradually until the next financing |
| growth potential | Low access to follow on capital is a higher risk for the | execution capabilities and resilance important for competition on | After the investment our value is limited to coaching and |
| growth rate | different profiles of techonlogy companies | analysis of the skill gaps and aligment btw fund/company | natural selection |
| innovative aspect not crucial | difference between tech and health care | Other skills sets (technical) are required other than the the current | ecosystem perceived as small |
| market fit | embedded technology | competition as a snowball effect | natural advantage of the local market/ecosystem |
| market maturity | emerging winner | competition grows the econsystem | ecosystem seen as key in VC business |
| market and technology developments in mature industries s | emerging fields are attrative due to lack of competition | competitions cycle | seed stage is also a branding game as startups can choose |
| network effects | extended funding | increased competition seen as heathy | interlinked ecosystem |
| product life cycles | fast decision-making | Other VCs seen as colleagues | late acknowledgment |
| product quality | incresed focus on the active fund | keep track of competitors' investment behavior | market forces |
| relationships between the key components of a new technol | lack of creativity (pivot) as reason do divest | Don't see other VCs stricly as competitors | market timing |
| significant market impact | organic growth | VCs alternate competition and collaboration | pace of technology development |
| solving a problem | Natural selection | competition good for the ecosystem | competition dictates market timing |
| Technology as source of competitive advantage | portfolio size diversification | competition opens markets | need to hit the market before others |
| market readiness | unsecurity of the team as a reason to divest | alternating negotiation power teams become attractive | when something emerges with benchmark the technology as |
| technology aspects and industry apetite done internaly | proactive portfolio balancing | collective thinking | track-record of raised capital |
| clear usp | Need to optimize capital allocation in other to compete | Fear of missing out | speed of development |
| good package of solution and solid data | financial reserve for unexpected funding needs | herd mentality | traction |
| no clear route to exit and long development timeline is a ban | avoid competition inside the portfolio | hot areas | credibility among peers gives you access to follow up rounds |
| position in the competite landscape is important | IP as differeciator | need to invest | technology readiness |
| access to deal flow is key | IP as market signal | over-hyped space | technologycal fesability |
| serial (previous) ventures | IP as valuable | importance of individual views on deals | technology is part of the solution |
| avoid direct competition | IP infringments | fashionable technology generate a hype | becoming confortable with technology is time consuming |
| accummulated learning can be applied to the new valuations | IP more relevant in life sciences | FOMO as investment driver | most opportunites are inbound |
| complex evolving system | IP not essential | FOMO has positive aspects, opens the mindset about opportunities | inability to exit a fund generates nich players such as close |
| control (board seat) | IP not relevant | divesting fails | inability to follow on next financing rounds generate mezzanine |
| diversitication | IP process seen as costly | double-down on winners | VC is also a game of network and connections |
| down side protection from tax schemes | IP protection or defense | exit pespective | divergent technology or potetial assesment |
| down-side scenario | IP providing competitive advantage | exit potential | information asymetry |
| due diligence | research restricted to academics, labs or big corporate | Financial responsibility | Entrepreneurs seen as more opportunistic |
| Financial responsibility | IP as a proof of capability | clear exit strategy | opportunistic behavior |
| limited risk limits outstanding returns | IP is a box to tick | cultivate relationship with larger funds for exit | funds cycles |
| product risk | Deep IP diligence in life sciences | existentence of a potential byer influences decision to invest | Complexity of managing a fund |
| risk tradeoff in amount invested and valuation | IP diligence key in life sciences | Dynamic between fund related to capital needs in investments | informality |
| | To add value IP must be owned by the company, not t | Very formal process of information generation, documentation and di | institutionalized fund |
| | | | indepence between LP and GP seen as important |
| | | | managing thrid party capital |

### 4.4.2 Axial coding

The primary purpose of axial coding is to determine which elements in the research are the dominant ones and which are the less important ones (Boeije, 2010, p. 109). Building on the coding scheme the main categories emerged (see Appendix B).

The main categories that emerged from axial coding were:

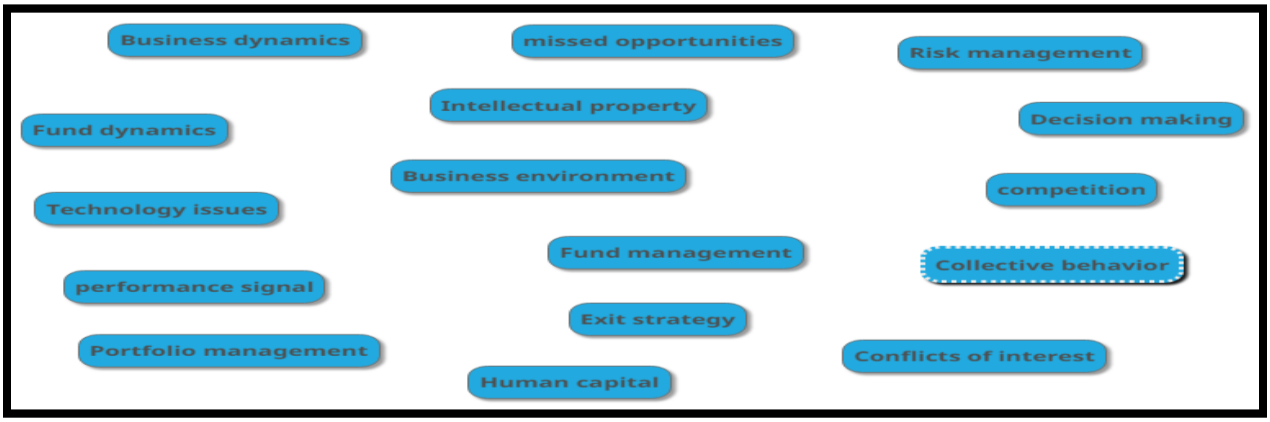


*Figure 15. Categories that emerged from axial coding*
*Source: own depiction*

(i) Decision-making: related to the evaluation and investment criteria

(ii) Risk management: acknowledgment and response to risk

(iii) Portfolio management: composition and main characteristics

(iv) Intellectual property: importance and concerns

(v) Human capital: specialized knowledge, personal skills, reputation

(vi) Industry competition: environment and fund-to-fund relations

(vii) Collective behavior: effect on decision-making and on the investments

(viii) Missed opportunities: assessment and causes

(ix) Performance signal: influence on investment

(x) Business dynamics: inner aspects of the VC business

(xi) Conflicts of interest: agency risks

(xii) Fund management: operational and practical aspects

(xiii) Exit strategy: influence on investments

(xiv) Fund dynamics: intra- and inter-fund

(xv) Value added: post investment activities

(xvi) Business environment: industry level aspects

### 4.4.3 Selective coding

Selective coding refers to looking for connections between the categories in order to make sense of what is happening in the field (Boeije, 2010, p. 114). In this stage the main categories derived from axial coding were analyzed from a cross-case integrative perspective (see Appendix C). The purpose of this relative analysis is to identify what are the key elements that will enable the formulation of a theoretical model.

Boeije (2000) provides guidance on what to consider when defining the final categories: link with the research questions and purpose of the research; sensitizing concepts from the literature review; and evidence from collected data.

The first result of the selective coding was to merge categories based on their linkage. Due to their proximity "added-value" was integrated into "portfolio management" that was subsequently merged with "risk management". Consequently, the most relevant categories that emerged from the data were: *decision-making*, *risk management* and *human capital*. The second result from selective coding was that human capital elements constantly appeared in decision-making and risk management categories evidenced by the importance that VCFs attribute to the founding team and their execution partners.

According to Boeije (2010, p.116) the core category possesses the following characteristics: (i) it is central, meaning that a lot of the other categories are linked to it; (ii) it is the heart of the analysis; (iii) it appears frequently in the data; (iv) it is not easily saturated; (v) it can be formulated in a more abstract way; (vi) it facilitates analysis – and makes the pieces of the puzzle fit together.

Based on these characteristics, it is possible to conclude that the *core category* is *human capital*. The derived *conceptual model* can be visually represented:

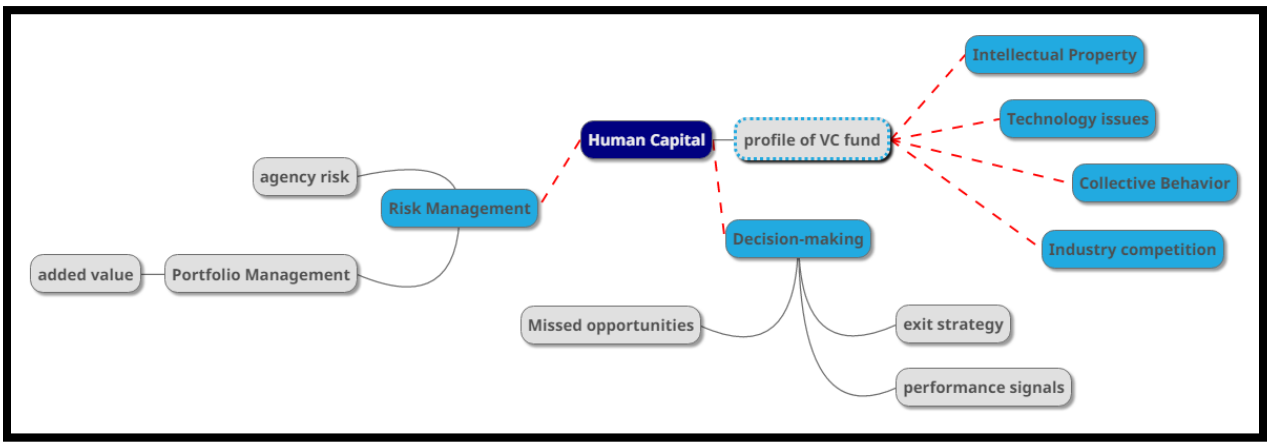


***Figure 16. Conceptual model based on inductive analysis***
*Source: own depiction*

### 4.4.4 Quality procedures

Saunders et al. (2009) recalled that data collected through semi-structured interviews are subject to quality issues. The main concerns are related to data reliability due to the non-standardized nature of such an instrument. Furthermore, a set of biases needs to be considered. The manner in which questions are formulated, the interviewers' "tone" and comments may bias responses. Similarly, the interviewees' behavior can influence the way answers are being interpreted. The authors also note that data validity may be affected if there is an imbalance in the level of trust among the participants, leading to omission of information. Lastly, findings based on data from

qualitative research collected with semi-structured interviews lack the fundamental characteristics of generalization since the sample is not a statistical representation of the whole population.

In this research, care was taken on the sample composition to enable consistent findings and data reliability. The process of contacting firms for potential interviews was long enough to provide a sample of 20 VCFs with diverse geographical (within the EU) and industry focus and degree of exposure to technology-intense businesses. In terms of data validity an effort was made to explore the interviewees' knowledge and expertise derived from their experience. Considering generalization, it was not the purpose of this research to provide statistically relevant findings.

# 5. Results

As it was explained in the previous Chapter, collected data from the interviews were aggregated into two major parts:

(a) The first part was related to knowledge-acquisition within VCFs. This fragment of the data was analyzed following a deductive approach based on a framework from organizational learning literature. The objective of this part is to address the *sub-questions one* and *two* (Chapter 1.3).

(b) The second cluster of data was concerned with decision-making processes, more specifically how risk is related to innovative or technological aspects of new ventures. It was analyzed following an inductive approach. The objective of this part is to address the remaining *sub-questions three* and *four* (Chapter 1.3).

## 5.1 Findings from the deductive approach

Huber's (1991) framework associated the learning process of organizations with a set of constructs and processes (see Fig. 14). As explained in the theoretical framework, this study is focused on the first process – *knowledge acquisition*. From a macro perspective, results from data analysis showed a consistent presence of the five sub-processes described by Huber in the acquisition of technology-related knowledge by VCFs. In all 17 interviews evidence was found for at least one sub-process of KA when presented in an aggregate manner (see Table 6).

*Table 6. Elements of subprocesses of Knowledge Acquistion present in interviews with VC firms*

| Process | Subprocess | Description | VC1 | VC2 | VC3 | VC4 | VC5 | VC6 | VC7 | VC8 | VC9 | VC10 | VC11 | VC12 | VC13 | VC14 | VC15 | VC16 | VC17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Knowledge Acquisition (KA) | Congenital Learning | Combination of the knowledge inherited at conception and additional knowledge acquired prior to its birth. Influenced by the nature of its founders | | + | + | + | | | | | | | | | + | + | | + | + |
| | Experiential Learning | Organizational experiments | | | | | | | | | | | | + | | | | | |
| | | Organizational self-appraisal | | | | + | | | | | | | | | | + | | | |
| | | Experimenting organizations | | | | | | | + | | | | | | + | + | | + | |
| | | Unintended learning | | | | | | | | | | | | | | | | | |
| | | Experience-based learning curves | | + | - | | - | + | + | - | + | - | | + | + | | + | + | + |
| | Vicarious Learning | Aquiring second-hand experience | + | + | + | + | + | + | + | + | + | | + | | | + | | + | + |
| | Grafting | Organizations frequently increase their store of knowledge by acquiring and grafting on new members who possess knowledge not previously available within the organization | + | + | | + | | + | + | + | | | + | + | + | + | + | + | |
| | Searching (or noticing) | Scanning | + | | | | | | | | | | | | | | | | |
| | | Focused search | + | | | + | | | | | + | + | | + | + | + | | | + |
| | | Performance monitoring | | | | + | | + | + | + | | | | + | | | | | |

On the following pages, all sub-processes will be analyzed individually.

### 5.1.1 Congenital learning

Congenital learning is associated with the characteristics and knowledge inherited at the organization's "birth" – influenced by the nature of its founders, their background and experience (Huber, 1999). All VCFs that were interviewed have a segment on their official communication channels (e.g., company's website) dedicated to introducing and describing the (nature of) founding partners, specifically detailing their professional experiences. This is related to the class of businesses heavily dependent on knowledge, experience and the personal networks of their key members (e.g., law firms, consultancies and specialized research firms).

Based on collected data, learning about technology from the founders of the VCF was *explicitly* stated by seven VCFs (see Table 7).

*Table 7. Detail on Congenintal Learning*

| Subprocess | Description | VC1 | VC2 | VC3 | VC4 | VC5 | VC6 | VC7 | VC8 | VC9 | VC10 | VC11 | VC12 | VC13 | VC14 | VC15 | VC16 | VC17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Congenital Learning | Combination of the knowledge inherited at conception and additional knowledge acquired prior to its birth. Influenced by the nature of its founders | | + | + | + | | | | | | | | | + | + | | + | + |

The following fragments from the interviews illustrate how technology-related knowledge is tied to the origin of the funds:

VC2 explained, "*We are specialized in cyber security and cloud computing. These two sectors we take them for given, basically. This is how the fund was set up, this is the mandate, so we don't look at anything else*".

When directly asked if there would be a loss of knowledge if a founding partner left the firm, VC2 replied, "*Yes, I think that is fair to say. Knowledge and relationships*".

VC13 shared similar characteristics, "*We were set up distinctly to leverage blockchain tech and so our investment thesis is a technology. From that perspective, the way in which we did it is to start a fund with a CTO. So we have someone that intimately knows the technology and the practicalities of it. To give a sense of what is possible now and what will be possible later on*".

When asked about the history of the fund, VC14 explained, "*We've been around since 1999, historically set up to make tech investments only on spin-out of Oxford University*".

VC16 detailed, "*Partners have their specific niche, where they are well known. For example, we have a partner focused primarily on Fintech. That would be the partner that dives deep into a technology and assesses all the market players in a given field and comes up with a brief summary for the rest of the partners to assess whether or not we should take the next step"*.

Lastly, VC17 contributed on the same topic, "*Yes, our partners typically have a tech background, also startup experience and big corporate experience. So, we all have a general grounding on technology capabilities that allows us to do a first analysis and take out the derivative information from the experts and translate that into an investment thesis*".

### 5.1.2 Experimental learning

Experimental learning is knowledge derived from direct experience, either from intentional (i.e., systematic) or unintentional (i.e., unsystematic) efforts (Huber, 1999). Evidence of this type of learning was found in 11 interviews (see Table 8). Furthermore, experience-based learning curves, a sub-process that was approached in terms of the relevance of specialized technology-knowledge was perceived as being negative in four interviews.

*Table 8. Detail on Experiential Learning*

| Subprocess | Description | VC1 | VC2 | VC3 | VC4 | VC5 | VC6 | VC7 | VC8 | VC9 | VC10 | VC11 | VC12 | VC13 | VC14 | VC15 | VC16 | VC17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Experiential Learning | Organizational experiments | | | | | | | | | | | | + | | | | | |
| | Organizational self-appraisal | | | | + | | | | | | | | | | + | | | |
| | Experimenting organizations | | | | | | | + | | | | | | + | + | | + | |
| | Unintended learning | | | | | | | | | | | | | | | | | |
| | Experience-based learning curves | | + | - | | - | + | + | - | + | - | | + | + | | + | + | + |

The sub-process of *organizational experiments* appeared in VC12, "*Part of this is because, in truth, there are so many things that can go wrong with a company that is intending to do something new with science and technology, that we and the company will do a lot of the learning after we have invested. Not all the answers are there, not all the questions are there. You discover those as you go. We are happy to keep discovering after we've made an earlier investment, which we acknowledge is high risk but then the tax schemes are there to help provide some downside protection"*.

The second sub-process within experimental learning – *organizational self-appraisal* emerged from the discussion with VC4 when talking about technology and market related issues that could affect their investments. "*We do something called the pre-mortem. We take a view, say six months from now and the company has failed. Why has it failed? So, we are looking from a Company level as well. Inherently VC is a high-risk investment strategy, from that perspective you have to be*

*comfortable with not knowing what you don't know and what kind of unknown variables will come into play", said VC4.*

In the context of missed opportunities, VC4 shared an assessment on potential reasons why lacking specific knowledge could affect the firm's operations: "*It is less to do with our understanding of the technology and more to do with the fact that the founders, the entrepreneurs, are looking for people with deep knowledge in that area. So, because of the fact that we are more generalists rather than deep specialists in specific areas, founders of much more technical companies lean towards Angel investors and VCs that have that kind of core level of knowledge that can relate and offer help*".

From the same angle, VC15 noted, "*Either we missed or decided not to invest. You can only learn from that and try not to miss an opportunity again.*"

*Experimenting organizations* could be related to VC7 who said, "*We used to operate under the name of x. We we're quite generalist. The early stage market became crowded due to tax schemes. We decided to become a thematic investment. We decided to shift our focus, instead of being a generalist. We rebranded – we now invest between 500K and 1.5M pounds. We call this post-seed and pre-series A. The companies that we are funding need more runway to reach Series A. In terms of picking a theme, we decided to go with Enterprise software".*

VC13 also provided evidence of adaptation, "*It comes from the structure that was in place when I joined – we have this technical team. And they can analyze the deals from a tech perspective. What we wanted to do is to make sure that the CTO and their team were able to validate the deals. It is a framework that I've come up with – it's an iterative model. At the moment, we are refining it; broadly we are looking at the deals from these 3 perspectives.*"

VC14 presents a similar case: "*We have been around since 1999. Historically set up to make tech investments only on spin-out of Oxford University. Over the last 4 years our fund size has grown and the fund's focus as well. In fact, now most of the focus of the fund is more on the application side rather than on deep tech*."

Finally, VC16 described the fund's new approach: "*We have a new model towards venture investing, which means that instead of up-front commitment from the LP, we've tried to create the fund structure into a deal-by-deal fund model. So the partners invest their own money up front after we've done the sourcing. This allows us to make quicker decisions. We can decide among the partners if we'll do the deal. We take a little bit more risk on that*".

*On experience-based learning curves*, a specific question was posed on how important it is to have such specialized knowledge within the VCFs for their daily routine. VC3 maintained that having internal knowledge about technology is not a requirement.

VC5 concurred with a similar perception: "*It is useful for certain things. We are limited somewhat to software, so having a developer in house who knows developer tools tends to be a bit useful – having people who have experience with certain markets tends to be useful. But I think because we invest at seed stage, I think being a generalist is more important because we have smart people that can learn. I think anyone can learn about any sector rather than needing to be an expert in one*".

VC10 had a similar perspective: "*Zero. It is pretty easy to explain that. None of our companies have technology knowledge other than knowing how to build software, and we know how to bring them up to scale. The majority of the knowledge of technology fields has to be from the entrepreneur. Otherwise, we would be the entrepreneur and that would not be optimal*".

However, for the same question, VC6 stated that: "*It is important that you understand the technology. I mean, in AI there aren't many experts who work on VC. You can't really evaluate, let's say, tomorrow, if you are talking with a company. Technically not even the Partners can*".

VC7 mentioned, "*I think it is absolutely necessary, especially now, in the last few years. And this is my personal view on this is that VCs are getting more and more specialized. So, yes, it is very important*".

In a similar assessment VC9 pondered, "*I think it is very important. But also, it is important to have a balance with different strategic areas. Let's say my own example (trained Doctor). We also have a PhD on the team that has knowledge of molecular biology. Then we have a person on the team that is very into medical devices. We have experienced CEOs serving as more executive advisors that really know the dynamics of the industry*".

VC12 stated, "*Something that became evident to me, is that there are only so many ways in which you can put together different scientific concepts. If you go up just one level of abstraction from what the technology is, there aren't that many different versions of things. You just look at it, abstract at one level, understand how the components will interact with the rest of the world, technically and commercially [..] Then you can identify what interfaces there are going to be between the science and technology and of the components that are outside of the direct control of the company. […] Once you've seen enough science and technology, most of it falls into that category. Occasionally, you get something where it just doesn't, some piece of science that is contrary to everything that you ever believed. Then it becomes more difficult – most things are easy to assimilate within a broad science and engineering belief system*".

When questioned about the quality of the knowledge within the firm, VC15 replied, "*Most of the team members have science degrees (PhDs). We understand the science. This is very important in this particular sector. The knowledge barrier is very high, and we also have worked in the industry in the past. We can understand both the science and how the industry thinks*".

### 5.1.3 Vicarious learning

Vicarious learning is defined as acquiring knowledge from a second-hand experience or learning by observing the behavior of others (Huber,1999). In the context of the interviews, elements related to this process were positively identified for 13 VCFs (see Table 9).

*Table 9. Detail on Vicarious Learning*

| Subprocess | Description | VC1 | VC2 | VC3 | VC4 | VC5 | VC6 | VC7 | VC8 | VC9 | VC10 | VC11 | VC12 | VC13 | VC14 | VC15 | VC16 | VC17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Vicarious Learning** | Aquiring second-hand experience | + | + | + | + | + | + | + | + | + | | + | | | + | | + | + |

Learning by observing others in the VC context can be related to the investment behavior of other funds. Additionally, it can be connected to co-investing, a practice that among other benefits can reduce the lack of knowledge or experience about a specific field, application or company.

When asked if they had relationships with other funds, VC1 responded, "*Yes, very much so. We talk to a lot of other investors to find out what they do. Why they invest, what they see in companies. Even though you shouldn't invest with a herd mentality, you should always try to inform yourself how to find out about a certain technology or market. To see how other investors evaluate companies*".

VC2 provided a similar answer, "*Yes, we would follow up on their deals, but not very closely. Other than the industry changing mega-deals we would look at deals every 2-3 months.*"

VC3 explained, "*Yes, often we discuss with other funds the trends and opportunities they are chasing. We also syndicate (co-invest) in many situations*."

VC4 noted, "*Other funds, sometimes. […] if they have a deep specialization then we might reach out for an understanding. But usually that would only occur when it comes to investing stage. It's a very interwoven ecosystem so we do learn a lot from each other as well"*.

VC5 added, "*Sometimes, mainly in terms of people we are looking to co-invest with. People we are co-investing with kind of just getting a second opinion, getting someone else's view on something and funds that are focused more on one market than we are*".

VC6 gave an example, "*The last two days I spent looking at leading US VCs and seeing where they are investing […] what it does, is it gives you very good signals to say, these are successful VCs that have foreseen something. If they have put time, effort and money, you should take that seriously*".

VC7 recalled, "*We recently started doing that. We are looking at the USA, NY, which is very relevant to theme that we invest*".

VC8 responded, "*Not that much, the foreigners yes, the locals no*".

VC9 explained, "*Sure, of course. We don't do any investments alone, so we work together with other funds. And I think that is also a good source of new opportunities*".

VC11 said, "*Sometimes we invite corporate funds to invest together when we know there is a perfect fit to the deal. Then we can share the expertise and experience regarding the market or technology and learn from another perspective*."

VC12 noted, "*Occasionally to co-invest, if it needs more than we can do. We will rarely make a joint decision about investing. We don't often go looking for their opinion about technology. It is just because we want to do things quickly – we think speed is really important for companies that are starting out.*"

VC14 affirmed, "*Yes, absolutely. We nearly always invest with other funds*".

VC16 provided some local context, "*It is a crucial part, I think, when you are in this business. It is an ecosystem. The Netherlands, it is pretty small, professional funds are limited. In effect, we know all the players in the field and we follow all of their investments. So, there are no surprises from that angle. We have these close meetings or one-on-one or investment meet-outs where we connect and assess the deals that we've done. On a national level that happens. On an international level, it is more interesting, because Europe is quite fragmented so it's pretty tough to find cross-border investors that you can relate to and have day-to-day or monthly check out calls with. In The Netherlands, it is evolving, there is more sharing in that space but it's still limited*".

VC17 provides an opposite direction of other funds approaching them "*Typically we are the go-to guys. And most of the VCs don't invest at this stage, they usually come to us at the later rounds to understand our due diligence, what got it over the hill in terms of getting to an investment on that particular company.*"

### 5.1.4 Grafting

Huber (1991, p. 97) clarifies that "organizations frequently increase their store of knowledge by acquiring and grafting on new members who possess knowledge not previously available within the organization". Grafting was present in 12 interviews (see Table 10).

*Table 10. Details on Grafting*

| Subprocess | Description | VC1 | VC2 | VC3 | VC4 | VC5 | VC6 | VC7 | VC8 | VC9 | VC10 | VC11 | VC12 | VC13 | VC14 | VC15 | VC16 | VC17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Grafting** | Organizations frequently increase their store of knowledge by acquiring and grafting on new members who possess knowledge not previously available within the organization | + | + | | + | | + | + | + | | | + | + | + | + | + | + | |

VC1: "*When you have a special topic that comes along or certain regulatory issues, then you would probably reach out to somebody in your network or consultants*".

VC2: "*We would be interested in putting a note to the investment committee, then at that point we would ask "internal people" or friends-kind of people, like CTO's of portfolio companies, basically people that are willing to talk to us, for free. And we can ask for their opinion. In 80-90 % of the time we would use an external person to execute a due diligence on the product itself to the extent of looking into the source code*".

When asked if technical knowledge is a valuable in a VCF context, VC2 replied: "*I think definitively. In my own carrier, part of the reasons that I was hired in this company was my foundations in technology. I think it is important for some people to understand the details of technology*".

Furthermore, VC4 explained about the acquisition of knowledge from members of their network: "*When we want to do more of a deep dive, we leverage off the technologists in our portfolio (CTOs). We also have a number of consultants. We ping our network as well, either it's a case of reaching out to people that are academics, that are ex-CTOs or current CTOs of large companies in the tech sector and speaking to them to try to get their understanding and their knowledge.*"

More specifically, VC4 explained: "*We have reached out to the head of AI learning of the University of Edinburgh and said: Would you be interested in doing a consultancy piece for us on this specific company?*".

VC6 explained, "*The externals are portfolio company's CTOs, and know what it takes to grow these types of companies. Or academic researchers. These guys are not paid, they doing it as a favor, it is a long-term relationship. None of these guys are consultants that you are paying to evaluate things*".

VC7 described, "*we have an unusual structure, we have a network of venture partners – they are not on a day-to-day, but we meet on a monthly basis and they will do the deals with us. We leverage the different profiles of people"*.

VC8 also detailed the leveraging network peers, "*we invite startups, we have a network of 30 Angels with different backgrounds. Primarily we listen to the startups as they have the vision for the future, and if we believe in that future and the team, we invest. We don't have a research department*".

VC11: "*We really try to understand the technology and the market or vice versa. We don´t invest in technology we can´t understand because there is a big risk the customer won´t understand it either. Typically, we learn by dialogue with the founder and verifying their statements by research and reference calls with experts.*"

VC11: "*It's really important to have tech knowledge to support the deal. But at the end, the real technology carrier is the founder.*"

VC11: "*We try to understand the technology to maximize the support we can give in that way. Then we identify the right partner and the right network for the deal and the founder. But we don´t try to compete with the founder's knowledge, because our expertise lies elsewhere.*"

VC11: "*The difference between the Investors is the access to a really relevant network. The money is replaceable, but network and experience are unique. So we are in a competition with all other investors (as money is replaceable) and have the obligation to enlarge and update our network every day.*"

VC12: "*We're invested in 60 companies – we have been invested in over 150. I've been involved with 30-40 other companies and partners so there are usually people with whom we can have a chat. But they are not official consultants*."

VC13: "*I was hired based on my broad macro understanding of converging trends. The idea is that the tech element is at the core of our thesis. We are more tech lead than business lead*".

VC14 on the use of external partners: "*Yes, quite a lot. It's part of the process. Every new investment that we make we try to speak to at least 2 people that are experts in that field; it is part of our due diligence".*

VC15: "*We know scientists in research institutions and universities. We read scientific papers and we contact proactively the investigators*".

VC16 stated, "*I think it is extremely important, and I think that we don't have all the knowledge in-house. We have, for example, three technology partners that help us assess if the technology is actually real. The tricky thing is when you get into the more sophisticated part, if we are talking about AI, or something that we don't have experience with, we would always get some external*

*advice. Funny enough, none of us have extensive technical backgrounds to determine if the software is right by ourselves, not enough depth*".

### 5.1.5 Searching (or noticing)

The sub process of searching or acquiring organizational information through search, is divided into three sub processes. *Scanning* is associated to perceiving the external environment of the organization. *Focused search* is an active effort, directed to a fragment of the company's environment, either internal or external. *Performance monitoring* is related to the organization's effectiveness towards reaching its own established goals. Lastly, *noticing* is unintended acquisition of information either on the organization's external environment, internal conditions or performance. (Huber,1999).

"*My speculation is that in organizational subunits and at lower organizational levels, search is largely reactive to problems, but that in autonomous organizations and at higher organizational levels, a significant proportion of search is a consequence of proactive managerial initiatives" (Huber, 1999, p. 99).*

*Searching (or noticing)* was present in 11 interviews (see Table 11).

*Table 11. Details on Searching*

| Subprocess | Description | VC1 | VC2 | VC3 | VC4 | VC5 | VC6 | VC7 | VC8 | VC9 | VC10 | VC11 | VC12 | VC13 | VC14 | VC15 | VC16 | VC17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Searching (or noticing) | Scanning | + | | | | | | | | | | | | | | | | |
| | Focused search | + | | | + | | | | | + | + | | + | + | + | | | + |
| | Performance monitoring | | | | + | | + | + | + | | | | + | | | | | |

On the sub process of *scanning* VC1 explained, "*You basically look at the landscape of technology out there for the vertical that you are covering and then you try to develop an opinion or a conviction about how technologies will develop and if they will be ready to implement and scale*

*to mass adoption. According to our beliefs, we'll go out and source knowledge about a company, and get introductions with company. Then lastly we will try to invest.*"

On the sub process of *focused search* a series of fragments appear. VC12 explained, "*We see around 100 quite relevant opportunities and 400 less relevant per year. That in itself is a very useful and good update on science and technology. We also read more or less scientific news […] we more often respond to what is available. If it is an area that we don't know much about, we try to understand as quickly as possible whether it is a complex area or not. We are quite happy to look at new stuff in areas where we don't know the science and technology, and to learn about it.*"

VC1 said, "*Yes, very much so. Because we need to really deeply understand the fields that we are investing in and for that we need to specialize. We spend a lot of time reading and researching the topic.*"

VC4: "*We are very investment driven because we are sector agnostic, and we have so much deal flow. We are all passionate about technology so we are looking at new stuff, but at the same time when we want to do a deep dive into new stuff, it's normally driven by an investment we are looking at which sparks us to pursue it a little deeper.*"

VC9: "*The other way is when we define strategic areas that we look into. And I think what we see happening in the market and for these topics, we define a strategic way to make sure that we build up knowledge. Going to conferences, events, scouting – and I think that can be very diverse sometimes.*"

VC10: "*We are opportunity-driven – they come up through different channels. Intermediaries, personal networks, events. The new proposition comes up, we decide if it is on our focus. If so, we do an investigation about it*".

VC10: "*What we do every now and then – when we hear about some new topic – we do a special report on which to base our opinion and to be able to talk to entrepreneurs who come up. When a company comes to us from a specific technology or market, then we do the research afterwards*".

VC13: "*What I do from research is that I have a large model that I constantly update around all the use cases where blockchain technology is being applied. To look at the more interesting and the ones in which we are interested to invest. We try to see what our investors are looking for, so we get to the level of what they want to see. And then the inbound comes to us, and we look through that lens. From a research perspective, any company goes initially through me and then the CTO to understand what they do, and the last aspect is a conversation about funding with our partner responsible for that*".

VC14: "*Yes, we kicked off this year. We wanted to add 4 or 5 new themes that we are interested and do some work around them. The formal process is that the person interested in the theme is expected to go to events, keep current, go out to meet entrepreneurs and people that are active in that sector*".

VC17 explained, "*We dig down pretty deep in the tech, to understand first how it works on an atomic or chemical or mechanical level and try to translate that into operational characteristics that are relevant in the market place*".

*Performance monitoring* is a variation of organizational search aimed at assessing firms' own standards or the expectations from their stakeholders. VC4 explained, "*Underpinning all of this, one thing that people often forget is that with VC we are in the business of making money for our stakeholders, our LPs. So, therefore, we are looking at this through the lens of what is the best*

*commercial deal for us that would generate the most amount of return for our LPs so we can raise the next fund, and we can keep in business*".

From a different angle, VC6 noted, "*That is what differentiates the really good VCs from the lower end ones. These are the folks who invest in unproven unknown sectors very early. Those are the ones that generate the 100x".*

*VC7 stated, "We expect a 10x return on the investment – that is our benchmark. The founders need to be aligned with us on that as well".*

*VC8 explained, "In order to meet our 10x return, we seek risk. We also double down on companies and quickly step out of deals that we believe we make a mistake getting into".*

VC12 noted, "*Technology and science gives the company an advantage that could lead to a 100x return on our money. That usually means that it has to have quite a big effect on quite a big market. Understanding how big an advantage the technology gives, at which level of the product or the market, that is a key thing*".

### 5.1.6 Addressing sub-question one

The purpose of *sub-question* one is to provide a clear answer on how VCFs acquire technology-related knowledge. Based on the analysis of the collected data, it can be argued that VCFs from the sample adhere to Huber's (1999) framework of organizational learning. Evidence was found to support four of the five propositions that positively related each sub-process with actual knowledge acquisition by the VCFs (see Table 12).

*Table 12. Supporting evidence for propositions related to KA subprocesses*

| KA subprocess | Proposition | Findings | Evidence |
|---|---|---|---|
| Congenital learning | Positively affects KA | Supported | VC2, VC3, VC4, VC13, VC14, VC15, VC16, VC17 |
| Experiential learning | Positively affects KA | Unsupported | VC3, VC5, VC8, VC10 |
| Vicarious learning | Positively affects KA | Supported | VC1, VC2, VC3, VC4, VC5, VC6, VC7, VC8, VC9, V11, V14, V16 |
| Grafting | Negatively affects KA | Supported | VC1, VC2, VC4, VC6, VC7, VC8, VC11, VC12, VC13, VC14, VC15, VC16 |
| Searching | Positively affects KA | Supported | VC1, VC4, VC6, VC7, VC8, VC9, VC10, VC12, VC13, VC14, VC17 |

It is important to note some specifics. The most dominant sub-process was *vicarious learning* present in 13 interviews, *grafting* present in 12 interviews and *searching* present in 11 interviews. Combining the main elements of these dominant sub-processes, a possible answer for *sub-question one* could be: *VCFs from the sample of this study acquired technology-related knowledge by the processes of* ***vicarious learning*** *(observing other organizations),* ***grafting*** *(adding components to itself that possess knowledge needed but not possessed by the organization) and by* ***searching*** *(often reactively) for information about the organization's external environment*.

### 5.1.7 Addressing sub-question two

*Sub-question two* aims to explore how the process of KA differs within the sample. The only proposition that was not supported by collected data was related to the sub-process of *experiential learning* (see Table 9). Within this process, four VCFs explicitly elaborated that specialized technology-related knowledge is not a requirement within a VCF (see Table 6). Looking at the profile of these VCFs (see Table. 13) there is low relevance of technology exposure in all of them, there is less industry diversification as it is mainly concentrated in internet and software, categories of "traditional" (or mature) fields.

*Table 13. VC Firms that explicitly cited internal technology related knowledge as not relevant for their investment decision*

| VC Firm | Country | Profile | Tech relevance | Industry | Stage |
|---|---|---|---|---|---|
| VC3 | Germany | Specialist | Low | SaaS, Marketplaces | Early |
| VC5 | France | Generalist | Low | Internet | Seed to A |
| VC8 | Belgium | Specialist | Low | Internet and Software | Seed and Early |
| VC10 | Netherlands | Specialist | Low | IT - B2B software | Early |

If compared to VCFs from where evidence could be found that internal specialized knowledge is relevant (see Table 14), a different profile emerges. On average technology relevance is higher, including investments in industries outside "traditional technology" – and seed-stage investments are more frequent.

*Table 14. VC Firms that explicitly cited internal technology related knowledge as relevant for their investment decisions*

| VC Firm | Country | Profile | Tech relevance | Industry | Stage |
|---|---|---|---|---|---|
| VC2 | UK | Specialist | Medium | Cyber Security, Data Analytics, Cloud, Assistive Tech | Growth |
| VC6 | UK | Generalist | Medium | Agnostic | Series A |
| VC7 | UK | Specialist | Low | Enterprise Software | Post-seed pre A |
| VC9 | Netherlands | Specialist | Medium | Healthcare, ICT, New Media, Fintech | Series A |
| VC12 | UK | Specialist | High | Biotech, Healthcare, Software | Seed to A |
| VC13 | UK | Specialist | High | Blockchain enabled businesses | Seed to A |
| VC15 | Spain | Specialist | High | Biotech | Early / Medium |
| VC16 | Netherlands | Specialist | Medium | Software | Seed |
| VC17 | US / NL | Specialist | High | Nano - Bio - Health - Clean / Tech, Energy, materials, optical, robotics | Pre-seed / Seed |

The fact that experience-based learning curves, or more specifically, having internal specialized knowledge was not seen as a requirement or that relevant by a few VCFs, is in line with the findings of *sub-question one* that indicate that the strong presence of vicarious learning and grafting are a way to bridge the lack of (internal) knowledge by leveraging external partners.

A possible answer for *sub-question two* would be: *There is no defined pattern among the VCFs within the sample related to* ***experiential learning****, and specifically considering the element of* ***experience-based learning curves****. This appears to be related to the heterogeneity in the exposure to technology-related investments, a higher diversification in technology investing and higher presence of seed stage ventures.*

## 5.2 Findings form the inductive approach

Answers from the previous *sub-questions* suggest that most VCFs in the sample of this study acquire technology-related knowledge mainly by observing or interacting with external partners or other players in their ecosystem. Nevertheless, a sub-set of firms desire to have internal specialized human capital with high knowledge base related to their focus of investing.

This next part of the research – *sub-questions three* and *four* – aim to present how findings from collected data can address the overarching topics of informational asymmetry (IA) and uncertainty. The core element that emerged from data analysis was human capital as the key component that interconnects to all other categories.

Combining these elements and building on the work of Bingham et al. (2014), it is possible to extend their "opportunity paradox" and apply it to the VCFs within the sample. Based on the interviews, a conceptual representation of the extreme cases can be illustrated: VCFs where technology is of core importance to their investments – *technology strategists*; and VCFs where technology is part of the solution and enables an innovative business model – *technology opportunists* (see Fig. 17).

In common, the interviewed companies have high tolerance for risk. Risk mitigation is mainly done by syndicating (co-investing), levering portfolio size as a diversification strategy and by carefully selecting and assessing the execution team of the portfolio companies. They differ on: (i) how relevant is the technology component of the business and subsequently how they perceive innovation risk; (b) the knowledge barrier to engage in their type of investments; and (c) their assessment about intellectual property, protectability and technology as a source of distinct competitive advantage. The next topics will detail IA and innovation risk.

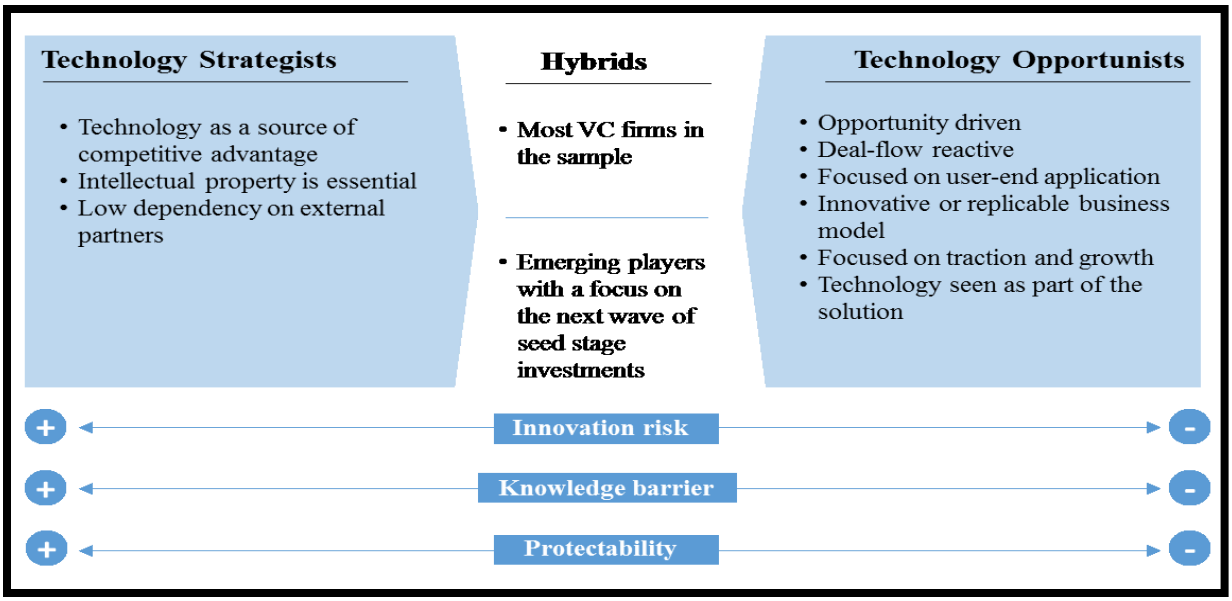


*Figure 17. Abstract model illustrating opposing profiles of VC firms' technology investors*
*Source: own depiction*

### 5.2.1 Addressing sub-question three

*Sub-question three* seeks to understand if technology-related knowledge can help reduce the effects of IA on the decision-making process of VCFs. To answer this question, it is important to understand to what extent acquiring technology-related knowledge can impact the decision making of these firms. In the literature review section, it was explained that one of the consequences of IA is the occurrence of adverse selection. A potential investor can be affected by the poor selection of opportunities. This sub-question aims to clarify if acquiring technology-related knowledge can reduce the effects of IA on investment selection. Based on the outputs of the inductive analysis, it was noted that VCFs with high technology exposure in their portfolios (i.e., technology strategists) seek to understand the details and characteristics of the technology-base of their investments. Based on the data from the interviews, it was verified that these firms possess internal human capital to assess the risks associated to IA. Their specialized human capital – with the proper background and expertise – support the assessment of business proposals that contain a strong technical element. For these investors, the existing knowledge-base is high, and strictly from a

technological knowledge point-of-view, the effect of IA is already reduced or relatively insignificant. Consequently, acquiring new technology-related knowledge, although seen as important, can only have a marginal effect.

At the other end of the spectrum of VC technology funding, there are VCFs that invest in technology-enabled business (i.e., technology opportunists). Their main concern is the application of the technology, more specifically the commercial potential of such an application, often with an innovative business model. In the deduction part of this research, it was suggested that VCFs within the research sample acquire technology-related knowledge by accessing their personal network. This means that they do not develop internal specialized knowledge, but instead they *leverage the relationship with trusted partners* that have specialized knowledge. Since these external partners don't have the incentives to take advantage of a "hidden information" situation, the effect of IA is minimized.

To attempt to avoid the negative impacts of IA, VCFs rely on a careful assessment of the team in which they invest. This was a recurrent theme regardless of the profile of the fund. Fragments from the data illustrate this:

VC2 explained, "*Then we would look at the team members. Do they have right the background and skill set to basically employ the capital that we are providing to the company?".*

VC4 shared, "*Traditional VC investing I would say, I can compartmentalize into team, product and market. The biggest driver of early-stage success is the team, without a shadow of doubt. What we are looking at is the quality of the person who is responsible. And the best people we have invested in are the people who are extremely bright, very technologically-focused but also have an ability to understand the commercial aspect of it".*

VC13 noted, *"The technology stack is part of the solution. From there, the team, their competency, what have they done. Traction – a proof of a product-solution fit or product-market fit"*.

VC17 summarized, *"You could put it into three main points or criteria. I'm looking for technology that solves a relevant problem, which means is large and meaningful. Hard to imitate or duplicate. And opportunities that are driven by technical competence and that you are able to leverage them across multiple product line or industries"*.

A possible answer to *sub-question three* is: *acquiring technology-related knowledge has limited effects on informational asymmetry for VCFs if non-technology investors (i.e., technology opportunists) have access to peers in a trusted network that bridges the internal knowledge gap.*

### 5.2.2 Addressing sub-question four

The purpose of *sub-question four* is to assess whether technology-related knowledge can reduce the level of *innovation risk* (IR) within VCFs investments. IR is inherent to new technology developments and is related to the unpredictability of the outcomes of such efforts (Reid and Smith, 2007). The practical effects are either related: to the purpose of the new technology as it might not work – technical feasibility; to the time-frame of development; and ultimately to the final cost of the initiative. Outputs from the data analysis show that the concern for technology-related issues varies significantly among VCFs. Intellectual property tends to validate technical feasibility by the means of granting patents – hence, IP was also cited by VCFs according to their investment profile.

VC3 explained, *"Most value is given to finding great opportunities (big problems in big markets where the founders can deliver a solution) rather than how innovative is the technology to solve that problem"*.

VC3 detailed, "*In most of our investments, there's no such a thing of "proprietary" intellectual property. Our companies win if they can execute very well in terms of building the best product for the customer's needs and learning how to do sales and marketing at scale*."

VC3 shared, "*We don't take much of that risk. More recently we have done a couple of investments where AI/machine learning is supposed to provide a lot of value. Because of the inherent tech risk there (because it's early to see if that technology will deliver the promise) we invested in companies that can provide value even if machine learning doesn't perform as expected"*.

VC2 expressed concern with basic technical feasibility, "*I just came across a company that we rejected earlier on because we didn't believe in the technology. The promises of the company weren't really proven. Because we are at growth stage, we want the technology to be proven or bullet proof.*"

VC5 emphasized, "*In software it tends to be more about market risk. Most things that we invest in can be done – there's not much a question there. It's more about: Is the market there? Does the market want it? Is there evidence that the market wants this? We are looking to invest in a company in seed stage that is raising money to prove that the market exists and prove that what they are doing is interesting, alleviating the market risk"*.

VC9 shared this insight, *"I think it's all part of the decision whether or not to invest. You have to build an investment thesis. In that thesis, you also stipulate the risk. All the factors that are associated with that. I think that especially in technology, there can be a higher risk that the technology is not ready or the market is not ready, although you believe in it at the moment of investing. In that sense, you try to predict as good as you can the market. It's not a science – there*

*is not a calculation involved. It is more of a well-rounded thesis rather than an Excel model that you plug in with certain numbers"*.

VC12 explained, *"We have a few general rules. The tech should give a really substantial advantage over anyone else wanting to do the thing. That is the key thing. If the tech works as it should, we should have a really big advantage over others. That is the main driver, and then you look and you judge how likely it is to achieve that advantage and how big the advantage will be if they achieve it"*.

VC14 noted, *"It depends quite a lot. People make too much of a fuss around it, and it's actually not that important. In our experience a lot of the time, when a company gets acquired because of the technology, they are actually being acquired due to the quality of the team. When a team has IP, it's almost of a proof of point, this is the kind of stuff we are capable of. The importance of IP from our experience is kind of overstated. In some traditional high-tech such as biotech and drug developments, then it becomes really important"*.

Regarding the risk that developing technology can cost more than originally estimated, VC15 stated, "*Many of these companies are very small, with few employees and limited resources. The VC money takes the business to the next validation point. Delays are common, they do happen. The way we work around that is to keep reserves for future financial rounds"*.

VC17 stated, *"Its critically important for us to have some type of ability to make the technology or the capability hard to imitate or duplicate. One of the easiest paths for that is by patents. Having a strong patent strategy around each one of the investments. We have typically different IP modes around our core technologies and in the relevant countries"*.

VC17 recalled, *"We are in early, pre-product, sometimes funding development and proof-of-concepts. Managing that part of the risk is a key value proposition of ours. We are not risk averse, for us is all risk-reward. We are always balancing that. Some have a higher technical risk but then the potential upside makes it worth the investment. And that is how we manage it in that context. Also, we are able to quantify as much as possible the potential point where there may be a problem with regards to the technology development. A big part of what we do is managing that risk by bringing in outside experts, contracting expertise and working with world-class partners to ensure that they are able to move forward"*.

In conclusion, firms that engage in deep technology investments or life sciences are highly concerned with *new developments of technology fields*, the *uniqueness of the core elements of the technology* in terms of competitive advantage and the *protectability* (i.e., IP) of their investments. For these VCFs, the issue of technical feasibility is a reality. The risk that the technology fails must be considered. Consequently, these investors attribute a higher relative weight of the *innovation component* in the balance of the overall risk assessment.

For the non-technology investors (i.e., technology opportunists) risk assessment has other ingredients. They are mainly concerned with execution and market risk – even product risk is approached in a second priority. The conclusion is that acquiring technology-related knowledge can reduce the level of innovation in a specific sub-set of VCFs.

A possible answer for *sub-question four* is: *acquiring technology-related knowledge can help reduce innovation risk for a specific sub-set of VCFs, those with risk management strategies that target the specific issues of technical feasibility, time-frame of developments and budget tracking and that are supported by internal specialized human capital.*

# 6. Discussion and conclusion

This paper has summarized key findings from research and presented arguments that VC is not the main source for innovation and technology funding. Allocating risk capital in early-stage technology ventures demands a level of understanding about the nature of such initiatives. Typically, early-stage technology developments are dependent on technical feasibility, meaning that there is risk that these efforts will fail. Only after new technologies surpass the technical validation phase and mature, do their basic functions become more predictable and shift technical uncertainties into the category of probabilistic risk. This is the general course of new technology development.

Recent increased interest in earlier-stage ventures poses the question of whether: (a) investors have become specialized and better at coping with informational asymmetry and the high levels of uncertainty in these types of ventures; or (b) the nature of these investments has changed. The answer is a combination of both factors.

Interest in earlier-stage ventures may be explained by several factors. It is not purely an outcome of competitive behavior from a deal-sourcing perspective. It reflects the impact that mass adoption of recent technological advancements had on the circumstances in which new technology-enabled businesses are created. Young technology ventures require less capital to prove a concept or find a product-solution-fit. The reason behind this is the ability to leverage a widespread set of affordable technological solutions that address the building blocks of their new product developments. The costs of the infrastructure (e.g., computing power, storage) and application needs (e.g., free and open-source software) for their products have been reduced significantly due to the outsourcing of operational tasks and the flexibility of business models that shifted to an "as-a-service" contract based on consumption.

A secondary effect of a lower barrier to start-up is the increased pool of investment prospects. "Winners" from this pool take advantage of more efficient, non-linear, capital allocation and accelerate their stages of venture development. This means that with a relatively small amount of capital they can find a product-market-fit, develop a brand or find a niche from where they can exploit a path of significant growth. This logic has altered the assessment of value-at-risk for these high-potential growth companies as investors envision high levels of ROI within their expected time-frame. Lower capital requirements for these start-ups fostered the emergence of new players in the funding space that specifically target these types of ventures. Equity-based accelerators, crowd-funding platforms, "super-angels" and their syndication networks, "micro-VCs" and "company builders" all provide an alternative to traditional VC funding.

This new profile of earlier-stage ventures that can reach maturity and be ready for an exit in a shorter time frame, attracted the attention of traditional VCFs. In the case of the software (or IT) industry, technology-enabled businesses leverage the application of proven technologies in virtually every company or industry vertical. Technical feasibility or innovation risk in these start-ups in general is minimal, if present. The nature of risk in these businesses shifted towards market, execution and to other risks not grounded in science. Currently, within all technology industries, IT as a category is the main destination of VC funds. These VCFs are not funding innovation or knowledge creation, but instead they are funding the growth potential of ventures that can provide them with outstanding returns. Traditional investors are pursuing deals in this space to guarantee a share of promising businesses and to benefit from their position to maintain shares in subsequent investment rounds.

More active engagement of formal VCFs has blurred the line that used to separate informal from formal investors within the seed-stage space. Within the VC arena there is a division between

specialized and generalist investors. This appears to be another difference within technology investing that is fading. It is increasingly hard to separate the technological component of a business into a self-contained category. For example, life sciences and energy industries have a strong dependency on the developments of "traditional" technologies (e.g., hardware and software). And the synergy among the building blocks in such fields can drive a generalist VC to invest in a specialized field or provide the incentive for a specialized investor to participate in another specialized field.

This cross effect from the presence of technology in the investment landscape becomes evident when profiles of recent seed and early-stage startup companies are considered. Looking at the agenda of technology-related investors, their screening efforts go beyond the first layer of typical prospects. Even outside of traditionally technology-focused ecosystems such as Silicon Valley in the USA, interest in the development of emerging, deep or frontier technologies is noticeable. Virtually any active technology-focused VCF is at least aware of major technology trends from which new businesses will form or be directly affected. Advancements in hardware, software, nanotechnologies, new materials, energy efficiency, robotics, artificial intelligence, autonomous systems, cryptography, biotechnologies, sensors, and enhanced data processing, among other developments, enable the creation of attractive business models for prospective investors. Together, these technology developments and their applications result in a pipeline of ideas and innovation that will shape and foster the supply of emerging businesses.

Software or IT sector industries probably will continue as the leading category in VC funding for the foreseeable future. But there is a convergence effect in the software based-applications that will enable, support and control multiple technology advancements (e.g., robotics, AI, cryptography, etc.). Outputs from new technology-based companies may have a higher weight of

the technological or innovative component. Startups in the next decade will probably have a different profile. They might have a bigger risk profile from a technology or even science based perspective – representing a higher relevance of innovation risk. Possible outcomes from this scenario is that investments and investors can be exposed to ventures difficult to assess in the pre-investment stages and hard to control in post investment monitoring. Technology bets may go wrong and this can impact the performance of funds. As an outcome, the future profile of seed and early stage companies may again become a niche activity, exclusively restricted to informal investors and with limited scale.

What seems more likely is that VCFs that are well positioned either by developing internal knowledge or by leveraging their networks to keep their knowledge base level high, will continue to take the lead, as has been seen in recent new major technology trends.

The arguments presented may partially help explain why institutional VCFs have become more interested in earlier stages companies. Additional factors may have contributed, such as policy practices and specific incentives within each ecosystem.

## 6.1 Answering the research questions

The research goal of the study was to identify how VCFs address their needs of knowledge about technology to support their investment decision-making processes. Findings are in line with previous studies that reveal a high degree of heterogeneity within VCFs (Knockaert et al., 2010). Results from the empirical data show that VCFs with high exposure to technology businesses in their portfolio possess internal highly-specialized human capital resources with a high level of scientific or technical knowledge base. This is also in line with the findings from Bottazzi et al. (2004) that human capital is a key element in analyzing and understanding VCFs' investment behavior. Previous findings classified the types of VC investors into financial investors, people

investors and technology investors (Knockaert et al., 2010). However, there is an overlap in this classification that goes against data gathered from this study. All VCFs can be considered people investors to some degree, making the typology non-exclusive. Other typologies – traditional versus technology investors – do not capture the element of opportunity that appeared as relevant in the analytic procedures. Instead, a suggestion was to synthesize literature from organizational learning that was presented in the theoretical Chapter 3 and propose the typology of *technology strategists* and *technology opportunists* to illustrate these extremes. The key differences among these investors is in their attitude towards finding which opportunities to explore, their interest and ability to understand the technological aspects of the investments, their exposure to innovation risk and their search for competitive advantage based on technology differentiation.

To address the central research question of the study, four sub-questions were answered. The first was concern with how these firms acquire technology-related knowledge. The results show the dominance of the process of vicarious learning, meaning that knowledge is acquired by observing the behavior of other funds. Furthermore, *grafting* and *searching* appear as relevant processes of learning about technology. This means that VCFs acquire knowledge that is not available internally by bridging the knowledge gap with peers in their personal network or in from the portfolio companies. The second sub-question provided evidence that there is no clear pattern for acquiring knowledge through experiential learning, more specifically experience-based learning curves. This is related to how relevant specialized technology knowledge is in their daily routines. The fact that it is seen as not relevant by a number of firms is consistent with the previous finding of bridging the internal knowledge gap (De Clercq & Dimov, 2008). Sub-questions three and four were concerned with informational asymmetry and innovation risk. To answer these questions, the data was inductively approached. Results show that acquiring technology-related knowledge has

limited effects on informational asymmetry for VCFs either because they have internal knowledge (technology strategists) or access to external knowledge (technology opportunists) to deal with the effects of IA. If opportunist firms lose access to these pools of knowledge, the value of technology-related knowledge can be much higher. The last sub-question seeks to understand if acquiring technology-related knowledge reduces the level of innovation risk. Results from the analysis indicate that this can be the case, and innovation risk can be mitigated in a specific setting. Technology-related knowledge is valuable for firms whose risk management targets the specific issues of technical feasibility, time-frame of developments and budget tracking and that are supported by specialized human capital.

## 6.2 Conclusion

This research collected primary data from 17 interviews with VCFs active in Europe. The objective of the study was to understand how these VCFs address their needs relative to technology-related knowledge to support their decision-making processes. Analytical procedures followed deductive and inductive approaches. Deductive analysis was based on the framework of organizational learning proposed by Huber (1999). Induction analysis followed the grounded theory approach. Results of the combined analysis position human capital as the core concept that connects to all relevant categories of data. Furthermore, it appears many VCFs acquire knowledge through the process of vicarious learning – by observing other funds' behaviors, and by grafting – acquiring knowledge from the personal network of the partners and from the portfolio companies. *Technology strategists* possess a high level of specialized knowledge base within their funds. For these VCFs learning about technology has only marginal effects on informational asymmetry but can help reduce the level of innovation risk within these funds. *Technology opportunists* are not heavily affected by IA because they bridge their knowledge gap through a network of trusted peers.

Furthermore, these VCFs have minimal exposure to innovation risk as they do not invest or fund companies whose products fail feasibility tests.

## 6.3 Limitations of the study

Important limitations of this study are related to the sample of interviewed VCFs. First, in terms of geography, the sample is focused on the European context. On one hand, this focuses on a market that has seen a considerable shift in investors' behavior. But on the other hand, the lack of insights from North American investors leaves out the largest most developed VC market. This restriction was mainly due to limited access to such VCFs.

Furthermore, the sample does not contain any informal investors (Business Angels). This limits the perspective as it would be interesting to see how priorities of these investors would compare relative to those of formal investors. Unfortunately, the nature of such investors is fragmented and often anonymous and subsequently difficult to identify and access.

Moreover, the validity of the data would be increased if all 17 interviewees were partners in their firms. In the sample, 10 interviews were with senior members within the funds.

Besides sample issues, an additional limitation of the study is that there is no performance assessment of the VCFs. Obviously, adding such dimension would provide interesting results.

## 6.4 Theoretical implications and recommendations for VCFs

Theoretical contribution comes from the integration of multiple fields of study related to VC and technology investing and from the proposal of an adapted typology for a conceptual classification of these investors. Furthermore, this research has contributed to bridge a gap in the literature about seed and early stage funding by specifically addressing the new configuration of the industry in

terms of the profile of the investments. This paper explored potential explanations for the change in investor's behavior and suggested multiple avenues for future research.

Practical implications from this study are recommendations for VCFs. Companies that plan to engage in seed and early-stage investments should consider that there is an emerging trend of new technology ventures that might affect a proportion of their investments. Start-ups are developing new products and business models that go beyond the exploitation of the "digitalization trend" enabled by the increasing dominance of software across firms and industry verticals. There is a breed of start-ups whose characteristics resemble those of typical technological or science-based developments in which uncertainties, technical feasibility and validation are relevant. In these innovative fields where there still is no dominant design, standard platform or category leader, bets are harder to make – this is a scenario of higher innovation risk. Specialized VCFs need to plan for that when raising capital for future funds. The following recommendations are directed to companies with different exposure to technology/innovation risk.

Based on the VC literature and on the interviews with active investors, it appears that VCFs are experts in the commercialization of technology-based businesses. They are driven by the prospect of a substantial increase in the (equity) value of an illiquid asset. However, these firms have different profiles depending on their industry focus or specialization (or both).

The first recommendation addresses all profiles of early-stage VCFs. *The influence of human capital* in these firms is present in several ways. Firstly, it appears to be an essential form of risk mitigation. VCFs explicitly say that the execution team is a major driver for investment. Considering this, it is crucial for VCFs to develop internal human capital or have access to external peers able to assess the entrepreneur from a symmetrical knowledge base. When a VCF has technical understanding approximately on the same level as the entrepreneur, this can increase the

likelihood of successful match-making. Additionally, the relational aspect and accessing external knowledge through networks and the ability to explore and maintain ties in multiple industry sectors also is critical for the discovery and validation of potential investments.

Secondly, human capital affects *decision making*. An investor who knows where and what to look for, can accelerate the process of screening and evaluating potential investments. This can result in conducting quicker and less costly due diligence analyses since part or most of the process can be done in house. Moreover, a confident investment manager with the appropriate background and expertise is less likely to follow collective behavior or herd mentality that leads to unwise investing and can be a problem among VCFs.

Thirdly, human capital is also connected to *risk management.* Having internal knowledge or external access to knowledge can reduce agency and innovation risks.

Finally, *learning and knowledge acquisition* through networks play a crucial role. It is especially helpful to be able to contact firms that are knowledgeable in multiple technical areas. The ability to contact network peers that have complementary skills can be valuable in a technology ecosystem since they can provide consulting suggestions and support, often without charging fees. This is especially relevant for VCFs where understanding about technology is not critical – in many cases they can address their knowledge needs by accessing their personal network and by leveraging contacts within their portfolio companies.

Firms that are closely related to *innovation and technology funding* – such as in life sciences industries – or VCFs that invest in emerging technologies from universities and research labs, are able to provide interesting insights. For example, this can help with understanding (i) how these companies expose themselves to real innovation/technological risk; (ii) how they operate; (iii) how

they structure themselves internally; (iv) the profile of their investment managers and (v) their priorities in terms of due diligence. Moreover, co-investing with these firms, interacting with their networks and leveraging their experience can be valuable. For example, building on their understanding about governmental policies such as tax or other financial incentives can yield interesting results.

## 6.5 Suggestions for future research

The first suggestion for research relates to how the profile of seed and early-stage ventures will develop. Studies could be done to check how new ventures with a strong technical foundation will affect investors' behavior in terms of selection and evaluation. Understanding the response of traditional VCFs to an increased presence of specialized technical knowledge within the assessment of potential investments could provide further insights. Furthermore, it would be interesting to see studies that monitor the role that new types of technology-focused VCFs will play in the ecosystem, and that compare their performance in this context of technology embeddedness and converging trends versus traditional VCFs.

A big part of the value of a building a relationship with a VCF and its network of investors is the access to next rounds of funding. This is what differentiates the big funds that can successfully manage large pools of third party capital. It would be interesting to see if alternatives to institutional VCFs will be able to provide funding beyond the initial stages of development or evolve in a way to align their investments with the big funds in order to keep deal-flow.

Additionally, another suggestion is to explore if a similar situation of a significant behavior change occurs in other settings or other niches, such as biotech or energy industries.

Several topics emerged in the interviews but were not developed in this current study. Future research could explore: (a) whether collective behavior affects patterns and performance of funds and if it differs across specific settings or industries; (b) what are the long term effects of over- or premature-funding of seed-stage companies; (c) how the competitive dynamics will affect industry concentration, industry maturity and further specialization of VCFs; and (d) what will be the impact of new models of venture funding that are being deployed in deep technological contexts such as cryptocurrencies-based models that fund their business by issuing their own currency/tokens in ICOs, thus raising capital without the need of intermediary VCFs.

# References


Amit, R., Brander, J., & Zott, C. (1998). Why do venture capital firms exist? theory and canadian evidence. *Journal of Business Venturing*, *13*(6), 441–466. https://doi.org/10.1016/S0883-9026(97)00061-X

Arrow, K. J. (1962). Economic Welfare and the Allocation of Ressources for Invention. In *The Rate and Direction of Inventive Activity: Economic and Social Factors* (pp. 609–626). Retrieved from http://www.nber.org/books/univ62-1

Atomico. (2016). The State of European Tech 2016: the future is being invented in Europe. Retrieved from http://www.atomico.com/news/the-state-of-european-tech-2016

Baum, J. A. C., & Silverman, B. S. (2004). Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups. *Journal of Business Venturing*, *19*(3), 411–436. https://doi.org/10.1016/S0883-9026(03)00038-7

Bengtsson, O. (2013). Relational venture capital financing of serial founders. *Journal of Financial Intermediation*, *22*(3), 308–334. https://doi.org/10.1016/j.jfi.2013.04.002

Bingham, C. B., & Davis, J. P. (2012). Learning sequences: Their existence, effect, and evolution. *Academy of Management Journal*, *55*(3), 611–641. https://doi.org/10.5465/amj.2009.0331

Bingham, C. B., Furr, N. R., & Eisenhardt, K. M. (2014). The Opportunity Paradox. *MIT Sloan Management Review*, *56*(1), 29–35. Retrieved from http://search.proquest.com.library.capella.edu/docview/1627693866?accountid=27965%5Cnhttp://wv9lq5ld3p.search.serialssolutions.com.library.capella.edu/?ctx_ver=Z39.88-2004&ctx_enc=info:ofi/enc:UTF-8&rfr_id=info:sid/ProQ:abiglobal&rft_val_fmt=info:ofi/fmt:

Blomquist, D. (2014). Disrupting the Traditional VC Model: VC Adaptations for Seed Investments. Retrieved from http://www.kauffmanfellows.org/journal_posts/vc-adaptations-for-seed-investments/

Boeije, H. (2010). *Analysis in qualitative research*. *October*. https://doi.org/10.1177/1049732304266820

Bottazzi, L., Da Rin, M., & Hellmann, T. (2004). The Changing Face of the European Venture Capital Industry: Facts and Analysis. *Journal of Private Equity*, *7*(2), 26–53. https://doi.org/10.3905/jpe.2004.39104

Branscomb, L. M., & Auerswald, P. E. (2002). Between invention and innovation: an analysis of funding for early-stage technology development. *Nist Gcr*, 2–841. Retrieved from http://www.atp.nist.gov/eao/gcr02-841/contents.htm

Casamatta, C., & Haritchabalet, C. (2007). Experience, screening and syndication in venture capital investments. *Journal of Financial Intermediation*, *16*(3), 368–398. https://doi.org/10.1016/j.jfi.2007.03.003

Cestone, G., Lerner, J., & White, L. (2006). *The design of syndicates in venture capital. BBVA Foundation Woking*

*Papers*.

Cochrane, J. H. (2005). The risk and return of venture capital. *Journal of Financial Economics*, *75*(1), 3–52. https://doi.org/10.1016/j.jfineco.2004.03.006

Cohen, W. M., & Levinthal, D. a. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, *35*(1), 128–152. https://doi.org/10.2307/2393553

Corbett, A. C. (2007). Learning asymmetries and the discovery of entrepreneurial opportunities. *Journal of Business Venturing*, *22*(1), 97–118. https://doi.org/10.1016/j.jbusvent.2005.10.001

Cumming, D. (2007). Government policy towards entrepreneurial finance: Innovation investment funds. *Journal of Business Venturing*, *22*(2), 193–235. https://doi.org/10.1016/j.jbusvent.2005.12.002

Cumming, D., Fleming, G., & Schwienbacher, A. (2005). Liquidity risk and venture capital finance. *Financial Management*, *34*(4), 77–105.

Da Rin, M., Hellmann, T. F., & Puri, M. (2011). A survey of VC research. *NBER Working Paper*. https://doi.org/10.3386/w17523

de Bettignies, J. E., & Brander, J. A. (2007). Financing entrepreneurship: Bank finance versus venture capital. *Journal of Business Venturing*, *22*(6), 808–832. https://doi.org/10.1016/j.jbusvent.2006.07.005

De Clercq, D., & Dimov, D. (2008). Internal knowledge development and external knowledge access in venture capital investment performance. *Journal of Management Studies*, *45*(3), 585–612. https://doi.org/10.1111/j.1467-6486.2007.00747.x

De Clercq, D., Fried, V. H., Lehtonen, O., & Sapienza, H. J. (2006). An Entrepreneur's Guide to the Venture Capital Galaxy. *Academy of Management Perspectives*, *20*(3), 90–112. https://doi.org/10.5465/AMP.2006.21903483

De Clercq, D., & Sapienza, H. J. (2005). When do venture capital firms learn from their portfolio companies? *Entrepreneurship: Theory and Practice*, *29*(4), 517–535. https://doi.org/10.1111/j.1540-6520.2005.00096.x

Dimov, D., & Murray, G. (2008). Determinants of the incidence and scale of seed capital investments by venture capital firms. *Small Business Economics*, *30*(2), 127–152. https://doi.org/10.1007/s11187-006-9008-z

Dimov, D. P., & Shepherd, D. A. (2005). Human capital theory and venture capital firms: Exploring "home runs" and "strike outs." *Journal of Business Venturing*, *20*(1), 1–21. https://doi.org/10.1016/j.jbusvent.2003.12.007

Duening, T. N., Hisrich, R. D., & Lechter, M. A. (2015). *Chapter 8 - Capital and Capital Sources*. *Technology Entrepreneurship (Second Edition)* (Second Edi). Elsevier Inc. https://doi.org/http://dx.doi.org/10.1016/B978-0-12-420175-0.00008-7

Elango, B., Fried, V., Hisrich, R., & Polonchek, R. (1995). How venture capital funds differ. *Journal of Business Venturing*, *10*(2), 157–170.

Elston, J. A., & Audretsch, D. B. (2009). Financing the entrepreneurial decision: an empirical approach using experimental data on risk attitudes. *Small Business Economics*, *36*(2), 209–222. https://doi.org/10.1007/s11187-009-9210-x

Erikson, T., & Sørheim, R. (2005). "Technology angels" and other informal investors. *Technovation*, *25*(5), 489–496. https://doi.org/10.1016/j.technovation.2003.09.007

Fiet, J. O. (1995). Risk Avoidance Strategies in Venture Capital Markets. *Journal of Management Studies*, *32*(4), 551–574. https://doi.org/10.1111/j.1467-6486.1995.tb00788.x

Florida, R., & Kenney, M. (1988). Venture capital and high technology entrepreneurship. *Journal of Business Venturing*, *3*(4), 301–319. https://doi.org/10.1016/0883-9026(88)90011-0

Franke, N., Gruber, M., Harhoff, D., & Henkel, J. (2008). Venture capitalists' evaluations of start-up teams: Trade-offs, knock-out criteria, and the impact of VC experience. *Entrepreneurship: Theory and Practice*, *32*(3), 459–483. https://doi.org/10.1111/j.1540-6520.2008.00236.x

Fried, Vance; Hisrich, R. (1994). Toward a Model of Venture Capital Investment Decision Making. *Financial Management*, *23*(3), 28–37. https://doi.org/10.2307/3665619

Fulghieri, P., & Sevilir, M. (2009). Size and focus of a venture capitalist's portfolio. *Review of Financial Studies*, *22*(11), 4643–4680. https://doi.org/10.1093/rfs/hhp012

Giacomo, D. (2004). Public Support to Entrepreneurial Firms: An Assessment of the Role of Venture Capital in the European Experience. *The Journal of Private Equity*, *8*(1), 22–38.

Gomez-Mejia, L. R., Balkin, D. B., & Welbourne, T. M. (1990). Influence of venture capitalists on high tech management. *Journal of High Technology Management Research*, *1*(1), 103–118. https://doi.org/10.1016/1047-8310(90)90016-W

Gompers, P. A., & Lerner, J. (2004). The Venture Capital Cycle, Second Edition, 375.

Gompers, P., Gornall, W., Kaplan, S. N., & Strebulaev, I. A. (2016). How Do Venture Capitalists Make Decisions ? ∗. https://doi.org/10.3386/w22587

Gompers, P., & Kovner, A. (2008). Venture capital investment cycles : The impact of public markets $, *87*, 1–23. https://doi.org/10.1016/j.jfineco.2006.12.002

Gompers, P., Kovner, A., Lerner, J., & Scharfstein, D. (2010). Performance persistence in entrepreneurship. *Journal of Financial Economics*, *96*(1), 18–32. https://doi.org/10.1016/j.jfineco.2009.11.001

Gompers, P., & Lerner, J. (2001). The Venture Capital Revolution. *Journal of Economic Perspectives*, *15*(2), 145–168. https://doi.org/10.1257/jep.15.2.145

Gorman, M., & Sahlman, W. a. (1989). What do venture capitalists do? *Journal of Business Venturing*, *4*, 231–248.

https://doi.org/10.1016/0883-9026(89)90014-1

Gornall, W., & Strebulaev, I. A. (2015). *The Economic Impact of Venture Capital: Evidence from Public Companies*. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2681841

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough? *Field Methods*, *18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

Hall, B. H. (2002). The Financing of Research and Development. *Oxford Review of Economic Policy*, *18*(1), 35–51. https://doi.org/10.1093/oxrep/18.1.35

Hall, J., & Hofer, C. W. (1993). Venture capitalists' decision criteria in new venture evaluation. *Journal of Business Venturing*, *8*(1), 25–42. https://doi.org/10.1016/0883-9026(93)90009-T

Hellmann, T. F., & Puri, M. (2000). The Interaction Between Product Market and Financing Strategy: The Role of Venture Capital. *Review of Financial Studies*, *13*(4), 959–984. https://doi.org/10.1093/rfs/13.4.959

Hisrich, R. D., & Jankowicz, A. D. (1990). Intuition in venture capital decisions: An exploratory study using a new technique. *Journal of Business Venturing*, *5*(1), 49–62. https://doi.org/10.1016/0883-9026(90)90026-P

Hsu, D. H. (2007). Experienced entrepreneurial founders, organizational capital, and venture capital funding. *Research Policy*, *36*(5), 722–741. https://doi.org/10.1016/j.respol.2007.02.022

Hsu, D. H., & Kenney, M. (2005). Organizing venture capital: The rise and demise of American Research & Development Corporation, 1946-1973. *Industrial and Corporate Change*, *14*(4), 579–616. https://doi.org/10.1093/icc/dth064

Huber, G. P. (1991). Organizational Learning: The Contributing Processes and the Literatures. *Organization Science*, *2*(1), 88–115. https://doi.org/10.1287/orsc.2.1.88

Hudson, E., & Evans, M. (2005). A Review of Research into Venture Capitalists' Decision Making: Implications for Entrepreneurs, Venture Capitalists and Researchers. *Journal of Economic and Social Policy*, *10*(1), Article 3 (1-18). Retrieved from http://epubs.scu.edu.au/cgi/viewcontent.cgi?article=1078&context=jesp

Hyytinen, A., & Ilmakunnas, P. (2007). What distinguishes a serial entrepreneur? *Industrial and Corporate Change*, *16*(5), 793–821. https://doi.org/10.1093/icc/dtm024

Jeng, L. A., & Wells, P. C. (2000). The determinants of venture capital funding: evidence across countries. *Journal of Corporate Finance*, *6*(3), 241–289. https://doi.org/10.1016/S0929-1199(00)00003-1

Kanniainen, V., & Keuschnigg, C. (2003). The optimal portfolio of start-up firms in venture capital finance. *Journal of Corporate Finance*, *9*(5), 521–534. https://doi.org/10.1016/S0929-1199(02)00021-4

Kanniainen, V., & Keuschnigg, C. (2004). Start-up investment with scarce venture capital support. *Journal of Banking and Finance*, *28*(8), 1935–1959. https://doi.org/10.1016/j.jbankfin.2003.07.005

Kaplan, S. N., & Stromberg, P. (2001). Venture Capitals As Principals: Contracting, Screening, and Monitoring. *American Economic Review*, *91*(2), 426–430. https://doi.org/10.1257/aer.91.2.426

Kaplan, S. N., & Stromberg, P. (2003). Venture Capitalists As Principals. *NBER Reporter*. https://doi.org/10.1257/aer.91.2.426

Kaplan, S. N., & Strömberg, P. (2001). Venture Capitalists as Principals: Contracting, Screening, and Monitoring. *American Economic Review*, *91*(2), 426–430. https://doi.org/10.1257/aer.91.2.426

Klingler-vidra, R. (2016). When venture capital is patient capital : seed funding as a source of patient capital for high-growth companies, *0*(0), 1–18. https://doi.org/10.1093/ser/mww022

Knockaert, M., Clarysse, B., & Lockett, A. (2010). Are technology VC investors a distinct species on the investment market? *Venture Capital*, *12*(4), 267–283. https://doi.org/10.1080/13691066.2010.486161

Knockaert, M., Clarysse, B., & Wright, M. (2010). The extent and nature of heterogeneity of venture capital selection behaviour in new technology-based firms. *R&D Management*, *40*(4), 357–371. https://doi.org/10.1111/j.1467-9310.2010.00607.x

Knockaert, M., & Lockett, A. (2006). Do human capital and fund charackteristics drive follow-up behaviour early stage high tech vcs? ... *Journal of Technology ...*, *34*(Vc). Retrieved from http://inderscience.metapress.com/index/0hnumt5ujrc7mwmj.pdf

Kolb, D. (1984). Experiential learning: Experience as the source of learning and development. *Journal of Organizational Behavior*, *8*(4), 359–360. https://doi.org/10.1002/job.4030080408

Kortum, S., & Lerner, J. (2000a). Assessing the contribution of venture capital to innovation. *RAND Journal of Economics*, *31*(4), 674–692. https://doi.org/10.2307/2696354

Kortum, S., & Lerner, J. (2000b). Assessing the Contribution of Venture Capital to Innovation Published by : Wiley on behalf of RAND Corporation Stable URL : http://www.jstor.org/stable/2696354 Assessing the contribution of venture capital to innovation. *The RAND Journal of Economics*, *31*(4), 674–692.

Landström, H. (1998). Informal investors as entrepreneurs. *Technovation*, *18*(5), 363–365. https://doi.org/10.1016/S0166-4972(98)80029-1

Lerner, J. (1999). The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program. *The Journal of Business*, *72*(3), 285–318. https://doi.org/10.1086/209616

Lockett, A., Murray, G., & Wright, M. (2002). Do UK venture capitalists still have a bias against investment in new technology firms. *Research Policy*, *31*(6), 1009–1030. https://doi.org/10.1016/S0048-7333(01)00174-3

Macmillan, I. C., Siegel, R., & Narasimha, P. N. S. (1985). Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*, *1*(1), 119–128. https://doi.org/10.1016/0883-9026(85)90011-4

Macmillan, I. C., Zemann, L., & Subbanarasimha, P. N. (1987). Criteria distinguishing successful from unsuccessful ventures in the venture screening process. *Journal of Business Venturing*, *2*(2), 123–137. https://doi.org/10.1016/0883-9026(87)90003-6

Manigart, S., Waele, K. De, Wright, M., Robbie, K., Desbrières, P., Sapienza, H. J., & Beekman, A. (2002). Determinants of required return in venture capital investments : A five country study *. *Entrepreneurship Theory and Practice*, *29*(6), 29. https://doi.org/10.1016/S0883-9026(00)00067-7

Mason, C. M., & Harrison, R. T. (2004). Does investing in technology-based firms involve higher risk? An exploratory study of the performance of technology and non-technology investments by business angels. *Venture Capital: An International Journal of Entrepreneurial Finance*, *6*(4), 313–332. https://doi.org/10.1080/1369106042000286471

Metrick, A. (2007). *Venture capital and the finance of innovation*. *Analysis*. https://doi.org/10.1017/CBO9781107415324.004

Miles, M. B., & Huberman, a M. (1984). *Qualitative Data Analysis: A Sourcebook of New Methods*. *Sage Publ Inc P O Box 5024 Beverly Hills Ca 90210Usa 1984 264* (Vol. 19). https://doi.org/10.1016/0149-7189(96)88232-2

Murray, G. (1999). Early-stage venture capital funds, scale economies and public support. *Venture Capital*, *1*(4), 351–384. https://doi.org/10.1080/136910699295857

Murray, G. C. (1998). A policy response to regional disparities in the supply of risk capital to new technology based firms in the European Union: The European Seed Capital Fund Scheme. *Regional Studies*, *32*(5), 405–419. https://doi.org/10.1080/00343409850116817

Murray, G. C. (1999). Early-stage Venture Capital Funds, Scale Economies and Public Support. *Venture Capital: An International Journal of Entrepreneurial Finance*, *1*(4), 351–384. https://doi.org/10.1080/136910699295857

Murray, G. C., & Lott, J. (1995). Have UK venture capitalists a bias against investment in new technology-based firms? *Research Policy*, *24*(2), 283–299. https://doi.org/10.1016/0048-7333(93)00767-N

Murray, G. C., & Marriott, R. (1998). Why has the investment performance of technology-specialist, European venture capital funds been so poor? *Research Policy*, *27*(9), 947–976. https://doi.org/10.1016/S0048-7333(98)00102-4

Muzyka, D., Birley, S., & Leleux, B. (1996). Trade-offs in the investment decisions of European venture capitalists. *Journal of Business Venturing*, *11*(4), 273–287. https://doi.org/10.1016/0883-9026(95)00126-3

Nanda, R., & Rhodes-kropf, M. (2013). Investment cycles and startup innovation $. *Journal of Financial Economics*, *110*(2), 403–418. https://doi.org/10.1016/j.jfineco.2013.07.001

Nanda, R., & Rhodes-Kropf, M. (2016). Financing Risk and Innovation. *Management Science*, mnsc.2015.2350. https://doi.org/10.1287/mnsc.2015.2350

Nelson, R. (1959). The Simple Economics of Basic Scientific Research. *Journal of Political Economy*. https://doi.org/10.1086/258177

Phan, P. H., Siegel, D. S., & Wright, M. (2005). Science parks and incubators: Observations, synthesis and future research. *Journal of Business Venturing*, *20*(2), 165–182. https://doi.org/10.1016/j.jbusvent.2003.12.001

Pisano, G. (2006). Profiting from innovation and the intellectual property revolution. *Research Policy*, *35*(8 SPEC. ISS.), 1122–1130. https://doi.org/10.1016/j.respol.2006.09.008

Pisano, G. P. (2010). The evolution of science-based business: Innovating how we innovate. *Industrial and Corporate Change*, *19*(2), 465–482. https://doi.org/10.1093/icc/dtq013

Puri, M., & Zarutskie, R. (2012). On the Life Cycle Dynamics of Venture-Capital- and Non-Venture-Capital-Financed Firms. *Journal of Finance*, *67*(6), 2247–2293. https://doi.org/10.1111/j.1540-6261.2012.01786.x

Ravasi, D., & Turati, C. (2005). Exploring entrepreneurial learning: A comparative study of technology development projects. *Journal of Business Venturing*, *20*(1), 137–164. https://doi.org/10.1016/j.jbusvent.2003.11.002

Reid, G. C., & Smith, J. a. (2007). Risk Appraisal and Venture Capital in High Technology New Ventures. *The British Accounting Review*, *44*(2), 125–126. https://doi.org/10.4324/9780203940389

Reid, G. C., & Smith, J. A. (2003). Reid , J . G . C . and Smith , J . A . ( 2003 ) Venture capital and risk in high- Strathprints is designed to allow users to access the research output of the University of Strathclyde . Copyright © and Moral Rights for the papers on this site are retaine, *2*, 227–244.

Rin, M. da, Hellmann, T., & Puri, M. (2013). A Survey of Venture Capital Research. *Handbook of the Economics of Finance*, (PA), 573–648. https://doi.org/10.1016/B978-0-44-453594-8.00008-2

Ritter, J. R. (2011). Equilibrium in the IPO Market. *Annual Review of Finance Economics*, *3*, 1–37. https://doi.org/10.2139/ssrn.2172332

Robson, C., & McCartan, K. (2015). *Real world research: A Resource for Users of Social Science Research Methods in Applied Settings*. *Wiley*. https://doi.org/10.1016/j.jclinepi.2010.08.001

Ruhnka, J. C., & Young, J. E. (1991). Some hypotheses about risk in venture capital investing. *Journal of Business Venturing*, *6*(2), 115–133. https://doi.org/10.1016/0883-9026(91)90014-5

Sætre, A. (2003). Entrepreneurial perspectives on informal venture capital. *Venture Capital: An International Journal of Entrepreneurial Finance*, *5*(1), 71–94. https://doi.org/10.1080/1369106032000062731

Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics*, *27*(2), 473–521. https://doi.org/10.1016/0304-405X(90)90065-8

Sapienza, H. J. (1992). When do venture capitalists add value? *Journal of Business Venturing*, *7*(1), 9–27. https://doi.org/10.1016/0883-9026(92)90032-M

Sapienza, H. J., Amanson, A. C., & Manigart, S. (1994). The level and nature of venture capitalist involvement in their portfolio companies: A study of three European countries. *Managerial Finance*, *20*(1), 3–17. https://doi.org/10.1108/eb018456

Sapienza, H. J., Manigart, S., & Vermeir, W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing*, *11*(6), 439–469. https://doi.org/10.1016/S0883-9026(96)00052-3

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research Methods for Business Students*. *Research methods for business students*. https://doi.org/10.1007/s13398-014-0173-7.2

Schumpeter, J. a. (1942). The process of creative destruction. *Capitalism Socialism and Democracy*. https://doi.org/10.1002/sej.36

Shepherd, D. A., & Zacharakis, A. (1999). Conjoint analysis: A new methodological approach for researching the decision policies of venture capitalists. *Venture Capital*, *1*(3), 197–217. https://doi.org/10.1080/136910699295866

Sørensen, M. (2007). *Learning By Investing: Evidence from Venture Capital*. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.967822

Steier, L., & Greenwood, R. (1995). Venture Capitalist Relationships in the Deal Structuring and Post-Investment Stages of New Firm Creation. *Journal of Management Studies*, *32*(May), 337. https://doi.org/10.1111/j.1467-6486.1995.tb00779.x

Storey, D. ., & Tether, B. . (1998). New technology-based firms in the European union: an introduction. *Research Policy*, *26*(9), 933–946. https://doi.org/10.1016/S0048-7333(97)00052-8

Sullivan, D. M., & Marvel, M. R. (2011). Knowledge Acquisition, Network Reliance, and Early-Stage Technology Venture Outcomes. *Journal of Management Studies*, *48*(6), 1169–1193. https://doi.org/10.1111/j.1467-6486.2010.00998.x

Suster, M. (2009). VC Seed Funding is Dead, Long Live VC Seed Funding! Retrieved from https://bothsidesofthetable.com/vc-seed-funding-is-dead-long-live-vc-seed-funding-991be9ef2b56#.3cg86bt3b

Suster, M. (2016). Changes in the Venture Capital Funding Environment. Retrieved from https://bothsidesofthetable.com/the-continued-changes-in-the-venture-climate-331c69cc4be4#.ltvrfs3fc

Tyebjee, T. T., & Bruno, A. A. V. (1984). A Model of Venture Capitalist Investment Activity. *Management Science*, *30*(9), 1051–1066. https://doi.org/10.1287/mnsc.30.9.1051

Ueda, M., & Hirukawa, M. (2008). Venture Capital and Industrial "Innovation." *Papers.Ssrn.Com*, (7090). https://doi.org/10.2139/ssrn.1242693

Walk, H. (2016). 2016 VC Half-Thoughts: The Industry Has Shifted Back to Investing in Technology, Not Business

Models. Retrieved from https://hunterwalk.com/2016/12/24/2016-vc-half-thoughts-the-industry-has-shifted-back-to-investing-in-technology-not-business-models/

Westhead, P., Ucbasaran, D., Wright, M., & Binks, M. (2005). Novice, serial and portfolio entrepreneur behaviour and contributions. *Small Business Economics*. https://doi.org/10.1007/s11187-003-6461-9

Wright, M., Lockett, A., Clarysse, B., & Binks, M. (2006). University spin-out companies and venture capital. *Research Policy*, *35*(4), 481–501. https://doi.org/10.1016/j.respol.2006.01.005

Zider, B. (1998). How venture capital works. *Harvard Business Review*, *76*(6), 131–139. https://doi.org/10.1038/clpt.2010.284

# APPENDIX

# Appendix A – Open coding

## Appendix A1: Open coding of VC Firm 1

| VC Firm | Unit of data | Code |
|---|---|---|
| **VC1** | This is was I was hinting early as how we talk to investors to inform our thinking about how they assess investment opportunities. Yes, the reality is that there is a lot of FOMO, there is a lot of herd behavior on how capital are allocated. | Fear of missing out (FOMO) |
| **VC1** | Venture investing is very risky. The first way we mitigate risk is we spread our ticket into a diversified portfolio. We don't invest all our assets in 1 company. We invest our money in about 10-15 companies and then we see how they develop over time and the rest of the money only goes to the cos that are perfoming well. And we expect part of our companies to fail. | Diversification |
| **VC1** | So you mean like a hedging? No, not really. What you will not try to do is having competing investments in your portfolio. That could be a strategy to investing in competing companies or technologies, not sure if anyone is doing that. | Avoid intra-portfolio compeition |
| **VC1** | We work with our companies. We cover them closely in terms on reporting and data we receive from them. We help them whenever we can and we also provide them with additional capital | Coaching |
| **VC1** | One thing you have to understand is that in a venture, a lot of the developments of the technology are not external they are inherent with the company that you are supporting. You have a company that develops a technology and might be pushing the boundary of the market. The better the company is at developing (marketing / pushing) that technology the higher the likelyhood that their are creating a market as well, it's interconnected. | embedded technology |
| **VC1** | 3-6 months, because it's not only reading about its also talking to other people, understanding the market and being part of the market. You really neeed to spend time on it. | getting comfortable with technology is time consuming |

# Appendix A2: Open coding of VC Firm 2

| VC Firm | Unit of data | Code |
|---|---|---|
| **VC2** | I don't think it doesn't go quite as detailed. It would be more like - is this thing marketable right now? We are growth stage investors so it has to be for us to be interested in. Than we would basically look at the exit potential from like 3-5 years from now. It has to be significant tangible market potential for us to go forward. Then we would look from a very narrow product perspective on the features but we would look from an industry perspective. Are these guys in a reasonibly good industry? | Technology readiness |
| **VC2** | That is kind of the general idea. There is an idea and there is a practical implemenation to it, sometimes colliding. There is the idea that you are either doing cyber security or cloud computing, our two specialties. And even under that, depending on which deals you lead, you specialize in that sub-are a littel bit. Given the size of our funds, basically everybody is involved due to capacity reasons. | Specialized Human Capital |
| **VC2** | I think we look at risk in several different ways. First of all, we try to be a specialist and invest in what we know. That is already mitigating some of the risk. | Specialization and risk mitigation |
| **VC2** | We would look first on an industry-level, is the industry growing? We discussed the trends, are these playing in favor of the company or against? Then also on a fairly macro level we would look at the country level, instabilly of something that could impact, for exemple from a regulatory POV. | Market forces |
| **VC2** | Then it would probably come down to market risk, product risk and team / execution risk. With the market risk we would look at the competitors that involved in that space or likely to get in that space. | Market risk |
| **VC2** | Then we would look at the prodcut level. What are the product life-cycles, how long are they? How often new products are released? What type of competiton is there? How sticky are the products? How sustainable is the BM. Does the company has genuine distictive IP? | Product risk |
| **VC2** | Then we would look at the team members. Do they right the background and skill set to basically employ the capital that we are providing the company with? | Team and execution risk |
| **VC2** | Yes, I just came across a company that we rejected earlier on because we didn't believe in the technology. The promises of the company weren't really proven. Because we are at growth stage we want the technology to be proven or bullet proof. | Technology disbelief |
| **VC2** | I think, to someway, yes. Because we want to invest in validated companies, we do not take excessive risk. Our bets are around 5-15 million. There is probably a herdling effect around certain industries. Our bets are not exclusevly on technology bets but also looking at the industry. | Herd mentality |
| **VC2** | Helping the co's in their growth journey. Through introducing them to customers and the right people, getting them through the door. Another risk mitigation, even before the investment, we think about their potential clients, have a conversation with these people. It's not a guarantee but it helps us understand what customer after. | Growth journey |
| **VC2** | One thing that we want to be sure is to don't invest in two companies in exact the same markets, to avoid the anoying things that come with that. | avoid direct competition |
| **VC2** | I think there is definelty an asymetry on the information, I'm sure that all the portfolio companies know more about the technology aspect, and what they look for, ideally is a little bit more knowledge on the market / customer side from our part to be able to open the doors to new countries or new customers. | Information asymmetry |
| **VC2** | I'm quite certain that we miss opportunities on a regular basis. We've missed companies that were in our pipeline, we did not invest and somebody else did, but we passed on them, this is the risk that we take. | Confortable with risk |
| **VC2** | I don't think we do anything explicilty. If you look at the fund, all investment should happen in a period of 3-5 years, probably even less. This would be the investmetns + plus exits T+5 years = 8-10 years of full cycle. You put your chips down and have to deal with that on. Probably, when new opportunities or fundamentally different things arive is when you raise a new fund. Then you can fashion your mandate differently if you want to. If you look at cyber secutyru, it will be around in like some shape or form. | Time pressure of fund cycles |
| **VC2** | It is very important in the company valuation process to show some IP and it can come in many forms. But we look at IP as a differentiator in the market and we always look to understand how the IP provides a lasting competitive advantage. But what we dont really do is try to put the dollar value in each of the patents the company might have and do like a some of part type of valuation thing, we dont do that at all. It's more on a qualitative level, is that particular IP providing supply for a certain demand? | IP providing competitive advantage |

# Appendix A3: Open coding of VC Firm 3

| VC Firm | Unit of data | Code |
|---|---|---|
| **VC3** | Not really, missed opportunities are because: a) knowing about the company too late; b) the valuation of the company is expensive; c) … | Missed opportunites |
| **VC3** | Not really. Risk tends to be reflected in the amount we invest and the valuation we get in. Our average initial investment is 500k and we try to buy +10% for tht (ie. 5m post valuation) if a company looks very risky (because the traction/proof of market-fit is limited) then we invest less (ie. 300k) at lower valuation (ie 4m post). If the company looks less risky because some risks have been removed (ie. it has already 50k in monthly reveneues, clear early customers, a working marketing strategy, etc.) then we can invest up to 1m at up to 10m post. It's a one by one case analysis. And many times we are forced to invest at more expensive valuations than we wanted because of the competition with other funds. Then we might decide to invest more at a higher valuation to still keep our % ownership (ie 10%) which is the key for us. | risk tradeoff in amount invested and valuation |
| **VC3** | We don't take much of that risk. More recently we have done a couple of investments where AI/machine learning is supposed to provide a lot of value. Because of hte inherent tech risk there (because it's early to see if that technology will deliver the promise) we invested in companies that can provide value even if machine learning doesn't perform as expected. | Risk technology fails to deliver |
| **VC3** | Not much. Most value is given to finding great opportunities (big problems in big markets where the founders can deliver a solution) rather than how much innovative is the technology to solve that problem | Size of the opportunity is the driver |
| **VC3** | Speed of development. The winner is almost always the one who iterates faster at the stage we invest. It's key to deliver a product that "somehow works" and iterate fast enough to keep lerning from the market to deliver a lot of value. | Perfomance signal |
| **VC3** | We try to expose ourselves to risk rather than mitigating it. Mitigating it will mean that we reduce the chances of outstanding outcomes which is a requirement to get good returns. That said, we try to mitigate risks by understanding very well the opportunities we invest and trying to understand which "bets"/risks are we making at every investment and getting comfortable about them (ie. are we betting that the team needs to grow to become a leader? are we betting that the competitiors will not chase that adyacent opporutnity? ...) | Risk appetite |
| **VC3** | In most of our investments, there's no such a thing of "proprietary" intellectual property. Our companies win if they can execute very well in terms of building the best product for the customer's needs and learning how to do sales and marketing at scale. | IP not required |
| **VC3** | They win in the long run if: a) they can create a brand/become a category leader; b) they have some form of network effect; | Cateogry leader |

# Appendix A4: Open coding of VC Firm 4

| VC Firm | Unit of data | Code |
|---|---|---|
| VC4 | What we are trying to do, is to balance that by saying: we've got these extremely smart people, they've got a runway, its an attractive market with a difficult problem that they are trying to solve, those are key components that underpin it. And if those are wright, we try to look at what risks will surround that an other ones that would mean to us that this company wont succed or is it something that we can manage to mitigate? So that is the kind of lens that we look through. | Quality of the team as risk mitigator |
| VC4 | Yes, we do. Normally we look at what is the down-side case scenario in these kind of deep technology events. If we need to extent the funding, will we be able to do that? Inherently it is impossible to work whether that is going to happen. | down-side scenario |
| VC4 | There are a couple of companies in our portfolio, one in particular that is very technologicaly driven and there is a risk factor. There are involved in docker technology, on the whole if it's a very emerging piece of tech we don't like binary technologies. We don't take binary bets. The way we look at it, there is an emerging technologies and some of these guy could be winners. What we are looking is trying to balance our down side risk | Natural selection |
| VC4 | We call it momentum investing. Founders are beginning to gain the system and have learnt how to do this better, so there is more competition in the mkt now. If you have people looking to see what other VCs are doing and if a VC with a good reputation sound interested then imediately other VCs will start to think: what did they see that I havent seen? Or I need to take more scrutinity on this. So there is definetely that kind of dynamic in the system. I've definetively seen and it's great for the entrepreneur because it becomes a competitive process and increases the ammount of valuation for the company. From our perspective we very much try to not get into that kind of competitive situation. We actually pride ourselves for actually finding diamonds in the rought. Sometimes VCs will overlook companies because they are not in a sexy or hot area. | collective behavior |
| VC4 | Personally, we haven't. I would say with probably a lot of certainty that other people have. People are very focused on hot sectors and one of the things that I think its actually kind of interesting around that is that the system is interlinked and it's something the people don't see from the outside looking in. But you are responsible with a lot of VC funds, you are kind of trying to feed bigger funds. It is kind of an ecosystem the move upwards. So you trying to almost work out that if there is a sector that looks hot there is the likelihood that a bigger VC would want to make an investment in that sector and take advantage of that. | Food chain logic |
| VC4 | I would say that we always wanted to have a relitavely diversified portfolio. So we wont double-dip into specific vertical. We try to keep it relitevely balanced and I think a lot of it actually grows organicaly. If there are certain areas that we've toyed with the idea of moving our investment towards, organically it has become a very diversified portfolio. | Portfolio diversification |
| VC4 | Some of it is case-by-case. We also try to get other late stage investors to invest early with us as that helps with fundrasing in the pipeline. | Risk sharing by co-investing |
| VC4 | We look to invest very early. We know that we are going to get diluted. So the deals economics have to work for us. Whitin a certain sector and diferent maturities whe are definetively down toward the earlier stages. As you get down to certain level of maturity, valuations go up to a point that we are out-priced and it's not good for us. | deal economics mindset |
| VC4 | Traditional VC investing I would say, I can compartmentalize into team, product and market. The biggest driver of early-stage success is the team, without a shadow of doubt. What we are looking at is the quality of the person who is responsible is key and the best people we have invested in are the people who are extremally bright, very technologicaly-focused but also have an ability to understand the commercial aspect of it. | Execution team quality |
| VC4 | Underpinning all of this one thing that people often forget is that with VC we are in the business of making money for our stakeholders, our LPs. So therefoe we are looking at this throug the lens of what is the best comercial deal for us that would generate the most ammount of return for our LPs so we can raise the next fund and we can keep in business. | Financial responsibility |

## Appendix A5: Open coding of VC Firm 5

| VC Firm | Unit of data | Code |
|---|---|---|
| VC5 | It's fine for smallers rounds. VC money comes from funds (pension funds) and I think does wouldn't investing direclty. If you looking to raise a few millions it's pretty hard to do that without necessarly go to a fund that is managing other people's money. | competition from smaller informal investors |
| VC5 | In software it tends to be more about market risk. Most things that we invest in can be done, there not much a question there. It's more about: is the market there? Does the market want it? Is there evidence that the market wants this? We are looking to invest in a company in seed stage that is raising money to prove that the market exist and prove that what they are doing is interestiing, allivating the market risk. | Market risk |
| VC5 | Yes, I think it happens. Some markets are hot at certain times, and I think that drives up valuations in certain mkt more than others. More people are talking and more investments are being made. I don't think that you can say that leads to modest returns. The best funds will be ahead of that. | Collective behavior |
| VC5 | I don't think that just to justify that we have it. You do get that in terms of, yeah, there is a hot space. I don't have any investments in this space, just to have a diversified portfolio I probably should look at this space and make an investment. I don't think we really think of following a hot trend, more often than not we will make an investment in that space 1 or 1.5 years after the trend, when it settles down. My reaction tends to be: this space is overhyped right now, I'm not going to look at anything. | Over-hyped space |
| VC5 | Not explicitly. We admit that the founders know the markets better than we do. In terms on portfolio management you can double down on the winner, that balances out. | Doubling down on winners |
| VC5 | In our stage is less of a concern. They probably don't have IP, don't have the money to go through the process. We are more concerned with infringing patents from other people. | IP infringment |

## Appendix A6: Open coding of VC Firm 6

| VC Firm | Unit of data | Code |
|---|---|---|
| VC6 | Absolutely, we love co-investing. Especially with VC firms in the US. There a couple of reason, if a Co's goes big, and they need a big inflow of capital. When you co-invest with bigger firms they have the funds to follow-on. Co-investing, you choose your partners, you build relationships. | Co-investing as relationship builder |
| VC6 | Early on, junior partners get on calls with the entrepreneurs, try to understand is that they are doing. We do a basic screen of what motivates them, are they qualified, do they understand a market? Then we try to think about, is this a problem that is really a problem, are you really solving something that is a problem? Is this something that we see has potential going forward is it something that is going to radically change the way things are done, so we value all that. And then you move on to next round, when everyone expresses interest. | Opportunity as investments driver |

## Appendix A7: Open coding for VC Firm 7

| VC Firm | Unit of data | Code |
|---|---|---|
| VC7 | You can diversify in terms of types and industries. But you can also diversify by taking account your learnings from our current porfolio and appliying to a certain stage of business. | Previous experience as risk reduction |
| VC7 | Collective thinking. There is a difference between that and herd mentallity. There is an element of that herd mentality. And I think that's possibly more money than quality deals in certain area. | Herd mentality |
| VC7 | Quite imporant. When we talk about product risk that is what we mean. One of the prerequisites is that we want to see a product roadmap. 5 year look out of where the product is going to go, how its going to evolve | Concerned with tangible products |
| VC7 | Who's raised what? | Track-record of raised capital |

## Appendix A8: Open coding of VC Firm 8

| VC Firm | Unit of data | Code |
|---|---|---|
| VC8 | We balance our portfolio by investing in 20-25 deals that our balacing and risk mitigation. The is no other balancing going on I have to say | portfolio size diversification |
| VC8 | Yes, I've seen it. Specially in the bigger funds. | need to invest |
| VC8 | In terms of agency risk, It's my job to know as much as they do. In order to meet our 10x return we seek risk. We also double down on companies and quickly step out of deals that we believe we make a mistake | fast decision making |
| VC8 | The market wasn't there. It wasn't as sophisficated as we thought. Secondly, the teams weren't decisive or creative enough (pivoting / change course). | unsecurity and lack of creatitive as reason to divest |
| VC8 | We like to invest in 2 types of Co's. Co's were we believe that are doing deep tech, research, developers. Than you have the tipical SaaS or e-commerce or marketplace were marketplace patents are less important. IP is not typical for us. This is typical in life sciences, semi-conductors and technologies related to universities | IP seen as critical in life sciences |
| VC8 | That is great to have people that have that specialization, to co-invest with. There is one difference. Running a fund is different that running a Co's. And that is something that theses people sometimes underestimate due to little experience with. Our investors now are more professionals and we have to adhere to certain corporate govs standards. These BA's or founder they sometimes struggle with the Corp Govs play. In general, I would say its positive | Competition from new smallers entrants |

## Appendix A9: Open coding of VC Firm 9

| VC Firm | Unit of data | Code |
|---|---|---|
| VC9 | Sure, because you always need to think about the moment you step in. And you need to think about the moment you exit the company. Wether that's an IPO, wether that is a trade sell to another company. | Exit potential perspective |
| VC9 | Yes, I think the company stage determines part of the risk. Also the sector type. And also the mix of company you have in your portfolio. We try to balance the amount of companies in our portfolio. | Portfolio diversification |
| VC9 | I think its all part of the decision wether or not to invest. You have to build an investment thesis, in that thesis, you also stipulate the risk. All the factors that are associated with that. I think that specially in technology there can be a higher risk that the technology is not ready or the market is not ready, altough you believe in it at the moment of investing. In that sense you try to predict as good as you can the market. It's not a science, there is not a calculation involved. It is more of a well rounded thesis rather than an excel model that you plug in a certain numbers. | Unpredictability of market and technology risk |
| VC9 | I think a couple of things. The team is important, the competition, the market the IP position. There is a big difference btw tech companies and health care companies in that sense. | different profiles of technology companies |
| VC9 | In health care it's more important. In technology, scaling is way more important. And what I mean with tech is more the online B2C plays. | IP seen as relevant in life sciences |
| VC9 | The most common way is to be on the board of the company you invest in. And make sure that we are on top of it. Setting milestones upfront. | Risk mitgation by controlling |
| VC9 | I wouldn't see it as more competition. It is growing the ecosystem. In the end it would be good for everybody, there will be more opportunities, more sucessuful companies. It's more a snowball effect than a competition game. My feeling is that specially in Europe there is still huge upside from entrepreneurs starting. | Competition growths the ecosystem |

## Appendix A10: Open coding of VC Firm 10

| VC Firm | Unit of data | Code |
|---|---|---|
| VC10 | Of course they are competition. They want the same deals as us. The thing is in VC competition can also be a colleague. You can compete for a deal and in the other co-invest | Other VCs not seen as competition |
| VC10 | All the time, I guess. Entrepreneurs are much more opportunitist than we are. | entrepreneurs seen as opportunistics |

## Appendix A11: Open coding for VC Firm 11

| VC Firm | Unit of data | Code |
|---|---|---|
| **VC11** | Yes we approach risks in types like market (incl. Business), Team and technology. Of course all 3 parts are relevant and have to fit together, but the most important ist by far the team. | Execution team quaity as risk mitigator |
| **VC11** | In Germany founders and Investors are very frugal compared to UK or USA. This means a sure deal is better than a uncertain one with higher worth. So yes, the fear of missing out instead of going other ways is really present. | Loca traits in risk persecption |
| **VC11** | We only invest in companies where the IP is in the company. We have really bad experiences where the IP belongs to the founder himself or to some research institutes, because they can block an investment at certain points (market entry, cooperations etc.) | To add value IP must be owned by the firm |

## Appendix A12: Open coding of VC Firm 12

| VC Firm | Unit of data | Code |
|---|---|---|
| **VC12** | We are quite happy to look at new stuff in areas where we dont know the S&T and to learn about it. The reason we are happy to do that is it we expect to invest in things that are new, where there is less disvantage (because its new). If we were investing on existing Co's, with existing competitors, understanding that whole market and technology that would be really key. If your the few (first) people doing something in a field there isn't much compare and constrast to | emerging fields seen as attractive due to lack of competition |
| **VC12** | For example, in a semi-conductor process, figuring out how a company will grow will be important at some point. First thing is to make sure that the process works and get a few first customers who say they are interested. We know that it uses semi-conductor, which exist, it is theoretically possible to scale. The biggest issue is finding a customer who says: this is something you've made that we are excited about. The scaling issues the will come, but they are solvable. In general, you can see whether a tech is going to be scalable or not. | Engagement with first customers is key |
| **VC12** | We have a few general rules, the tech should give a really substantial advantage to anyone else wanting to do the thing. That is the key thing. If the tech works as it should we should have a really big advantage over others. That is the main driver and then you look and you judge how likelly it is to achieve that advantage and how big the advantage will be if they achieve it | Technology as a source of competitive advantage |
| **VC12** | We don’t care about what other people do. Absolutely not concern about collective behavior. | No concern for collective behavior |
| **VC12** | We make it very clear that we are going to invest in what we want to invest in and that they would not be consulted before the investment. We keep them informed | Self confidence |
| **VC12** | Patents are usefull where the patent protects something that can be clearly seen. Some Co's simply got out and try to get IP because they think investors would want to see that. And often IP is not a sensible use of money, and in fact is positevly bad as they've disclose a secret that they didnt had to disclose. So sometimes it can be a bad thing. Most of the things we invest in have some Patents or IP around them because of the nature of what they are doing and most of them operate in sectors were is possible to protect what you are doing. But we also had Co's that just kept their secret. We like Co's that manufacture things, and if they have a secret process, that is fine, we dont need the patent. | IP process seen as costly |
| **VC12** | Understanding how big an advantage the tech give at which level of the product or the market, that is a key thing. | Technology as a source of competitive advantage |

## Appendix A13: Open coding for VC Firm 13

| VC Firm | Unit of data | Code |
|---|---|---|
| VC13 | The tech stack is part of the solution. From there, the team, their competency, what have they done. Traction, a proof of a product-solution fit or product-market fit. | Technology not the relevant issue |
| VC13 | We thought about it. We can only be risky to certain level. Anything before early stage is very risky. We are pre-seed, we are part of a new ecosystem (blockchain), so our appetite for risk is pretty big. | Risk as given in seed stage |
| VC13 | The way which we try to avoid CT internally is to make sure that we go through filters and each person look at deals separetly and give their own view. | Collective thinking avoidance |
| VC13 | Yes, we do. We are very conscious at picking deals that spread our risk. Based on our tracker, we have the top 10-15 industries and use cases and we go around and seek Co's or people that are building on that use cases. Is rare for us to go out of the same area of application twice. We have a more proactive approach | Proactive portfolio balancing |
| VC13 | 10-15. Certainly no 3-5 or 7. We try to have a balance of Co's with a clearly exit strategy, an acquirer in 3-5 years. In general we have a very long term view. Blockchain spaces will take a long time to permeate industries. We are in for the long take. | Long-term view on investments |
| VC13 | Our reason to be is because we believe that entrepreneurs at this level need more than just capital. They need tech know-how, mkt know-how, we go on the journey with them. In that sense we see ourselves more of a venture builder, a lot more active. At seed stage capital is relatively small part of what founders need. | value added beyond capital |
| VC13 | We cultivate that exact relationship. That is something we specifically do. | Exit to bigger funds |

## Appendix A14: Open coding of VC Firm 14

| VC Firm | Unit of data | Code |
|---|---|---|
| VC14 | The first criteria is the team. The leadership team, what experience, what people in our network say about them, if we have worked with them before. | Team as main value |
| VC14 | It's quality of the team and scientific reputation of the key scientific people involved with the tech. How developed it is and how long it will take to get into the market. | Technology readiness |
| VC14 | Before we make a new investments, we try to list in our mind all the possible kinds of risk. | Mapping possible risk |
| VC14 | Everyone is kind of in a weird mix of a competitor but also kind of a potential cooperator in VC. The way we see it, we are not really kind of worried about competition, because there will always be capital out there. We don't see other VCs as stricly competitors, they are potential allies. | VCs alternate competition and collaboration |
| VC14 | That model makes sense if you have enough fire power to do it. They strategy is to spray a lot of checks at seed and see what works and then backthem heavly at later stages. For the other funds that aren't so big, focusing on one stage is a good idea, because you need to have the right check size to be able to win the best deals at each stage. If we had kind of a huge fund it would be great to own the whole chain. | Verticalized funds |
| VC14 | We don't mind taking risks, we recognize it's part of the job. We try to understand where the risks are in each company and kind of balance that. For example if the company has a supercool interesting technology we don't mind much if there is less commercial sophistication, we dont mind much because we are investing mainly in the technology, we would bring in people to fill that gap. On the other types of companies we are very focused on minimizing execution risk, so things around operations. | Comfortable with risk |
| VC14 | It depends quite a lot. People make to much of a fuzz around it and it's actually not that important. In our experience, a lot of the time, when a company gets acquired because of the technology they are actually being acquired by the quality of the team. When a team has IP it's almost of a proof point, this is the kind o stuff we are capable of. The importance of IP from our experience is kind of overstated. In some tradional high-tech such as biotech and drug developments, than it becomes really important. | IP as a proof of capability |

# Appendix A15: Open coding of VC Firm 15

| VC Firm | Unit of data | Code |
|---|---|---|
| VC15 | Many of these companies are very small, with few employees and limited resources. The VC money takes the business to the next validation point. Delays are common, they do happen. The way we work around that is to keep reserves for future financial rounds. | financial reserve for unexpected funding needs |
| VC15 | We look at the competition. If there are competitors ahead of the co that we want to finance and there is no clear usp and a clear competitive advantage, then we are not interested. You really need to make sure that you've reached the market before the competitors or that market is suficiently large to acommodate multiple players. But in biotech it is very clear, looking at the competition you can know if you are going to hit the market at the right timing or not. | Clear USP |
| VC15 | There is. Some technologies became fashionable, and then there is a hype. | Fashionable technologies |
| VC15 | Yes, we take that in to account. We will look at the exits. At the end is very data driven. That needs to come up with a good package and solid data. | Exit perspective |
| VC15 | Yes, before. We monitor it very closely. We invest in different stages of developments. We do not invest in 2 companies in the same target. It plays an important role in our decision making | porfolio closely monitored |
| VC15 | In terms of geography we don't have many competitors. We are the largest in life sciences in x. Besides that, I don't like to refer as other VCs as competitors . Because we co-invest together in many opportunties. Ultimately, unless you have a very large fund is hard to invest alone. In the US, there are a few firms that have very large funds. They can fund the Co's all the way through. | life sciences is hard to invest alone |
| VC15 | Not so much. There is a range of sizes and players. What tends to happen is that if you cant exit one of the portfolio companies, and you don't have funds to follow on, then there are specific funds - close over funds. That they offer mezzanine before going IPO. | Close over funds |
| VC15 | This is one of the boxes that we have to tick. Post term sheet Before investment we run a deep IP diligence, including an FPO, freedom to operate the operate We always do that in life sciences, this is key. | IP key in life sciences |
| VC15 | Well the advantage is that you can setup a balanced portfolio. Its no so much about early or late, it is about time to exit. So we look at opportunities that we can exit wihtin the time frame of the fund. The way we assess that is by talking to ultimate buyer. Are the pharma Co's interested in acquiring this assests? If the answer is no, and the development timelines do not match, then we have to pass on that. | Advantages of bigger funds is the option to balance a large portfolio. |

# Appendix A16: Open coding of VC Firm 16

| VC Firm | Unit of data | Code |
|---|---|---|
| **VC16** | For us, primarly, the way we are currently structured, we tend to find out if the team is equiped to surpass the difficulties that they will pass, because they are competing in a global scale. So we look at the characteristics of the team instead of access if the technology is innovative from their perspective. So we are less focused on, I mean, IP is something that we should have in the Co's, but we are not focused on technology aspect. We are more focused on the execution or the resiliance and quality of the team. | Team as main criteria |
| **VC16** | The reports that we get from our DD, are based on red, green flags and we get an overview and insights about the business. From the investment thesis, from our fund perspective, we try to eliminate risk through geting in early at the best possible valuation. You try to reduce risk by focusing on 2 or 3 verticals. | Risk assessment based on outputs of due diligence |
| **VC16** | We do have a program just before we start investing. It is a short term program based on actually on what each team requires at the moment. After the investment our value is limited to primarly coaching and network access. Maybe some insight but the added-value declines up till when they raise the next round. | VC added-value |
| **VC16** | Yes, well FOMO is what drives investors in general, it is also what opens up a little bit their mindset about opportunities, so it is also a good thing. It is extremally risky for the ones taking the same route. The value of VC, if you look at all the classes that are available, I'm not sure if this model sustain. Or at least if other models will not take the place of VC itself. Crowdfunding for equity is coming up in every market. It is also, its becoming more a game of getting access to the best team and getting early enought. That is also why even the late stage VCs tend to develop this earlier funds to make sure that they dont miss out in a really early stage. I think its nice if you have a different vision, it allows you to get access to the deal flow. | Assessment on FOMO |
| **VC16** | Yes, so when we discuss this internally. So when I think about, personally, I try to make an assessment in terms of, if you look at the market and the competition, are they first in the game? Are they first in the market? Are they 2 or 3? It is nice to have an educated market, with other firms opening the market. For us the ideal moment to step in to is when another startup is competing with them. Honeslty, if a team becomes attractive to more investors and we get to know about it, then the tables are turned. | Position in the competitive lanscape |
| **VC16** | We are focused from a SW technology perspective on the front-end of the web, we are not focused on core backbone, in essence we do believe that technology should be internally owned, and even in a separate entity to protect IP. | Technology should be internally owned, ideally IP protected |
| **VC16** | The end game for me in the seed stage is also a branding game, because they is more competition and more capital available, startups can choose. VC firms have to develop other parts of the business besides being an investment managers. For example, on the technical level, other skill sets required in this field other then the partner/associate model. | Other skill sets required / changing nature |
| **VC16** | Its super good. The more capital becomes available, the more the startups can choose from. Because of competition, you see markets opening up. The more information available, the more transparent. In general is a really good development | Competition opens markets |
| **VC16** | It does, it is also a game of network and connections. If you have track record and credibility among peers, especially bigger funds, you get access to follow up rounds, it makes a differnce. Opening up and connecting to the ecosystem in a bigger scale. I'm not sure micro funds are the best option for startups to go. They have less funds for followups so there is a bigger risk. | Credibitily among peers |

# Appendix A17: Open coding of VC Firm 17

| VC Firm | Unit of data | Code |
|---|---|---|
| **VC17** | Its critically important for us to have some type of ability to make the technology or the capability hard to immitate or duplicate. One of the easiest paths for that is by patents. Having a strong patent strategy around each one of the investments. We have typically different IP modes, characterization around our core technologies and on the relevant countries. | IP seen as critical |
| **VC17** | To summ it up. You could put it into three main points or criteria. I'm looking for technology that solves a relevant problem, which means is large and meaninfull. Hard to imitate or duplicate. And opportunities that are driven by technical compentece and you are able to leverage them across multiple product line or industries. | Key invetments criteria |
| **VC17** | we are in early, pre-product, sometimes funding development and proof-of-concepts. Managing that part of the risk is a key value proposition of ours. We are not risk averse, for us is all risk reward. We are always balancing that. Some have a higher technical but then the potential upside makes it worth the investment. And that is how we manage it in that context. Also we are able to quantify as much as possible the potential point that maybe a problem with regards to the technology development. A big part of what we do is managing that risk by bringing in outside experts, contracting expertise and working world-class partners to ensure that they are able to move forward. | Risk management as a value proposition |
| **VC17** | you can play it intelligently, leverage the hype if that is a component of your investment strategy. Typically, that's one negative view on it. On a positve view, hype is build around opportunities, there's been a number of investments bubbles around certain tech or industries at different timings, unfortunally the all tend to blow up at some point. But the derivative is typically a group of winners they come out of those groups. The internet, the telecom, the datacom, the biogen, the processes, integrated circuits, all of those. Typically those hype minded hurd mentality there inst a founding principle that usually drives that, again generates winners. I understand wanting to participate, looking to create a succefull strategy inside one of these investment bubbles, but you have to make sure that your strategy is founded on a process and that you are not just trying to pick. If you are just going to be a picker, that is kind of a horse track kind of mentality | On collective behavior |

# Appendix B – Axial coding

## Appendix B1: Dominant categories

| Categories | Codes | Categories | Codes |
|---|---|---|---|
| Decision-making | avoid direct competition | Risk Management | avoid direct competition |
| | balance between technical and commercial skills | | accummulated learning can be applied to the new valuations |
| | category leader | | complex evolving system |
| | deal economics mindset | | control (board seat) |
| | deal-flow driven | | diversitication |
| | difficult problem to solve | | down side protection from tax schemes |
| | engament with first customers is key | | down-side scenario |
| | entrepreneur's industry expertise | | due diligence |
| | entrepreneurs motivation | | Financial responsibility |
| | Entrepreneurs perceived as skillfull | | limited risk limits outstanding returns |
| | expensive valuation | | product risk |
| | fast decision-making | | risk tradeoff in amount invested and valuation |
| | growth potential | | setting milestones |
| | growth rate | | specialization and mitigation |
| | innovative aspect not crucial | | staging as risk mitigation |
| | market fit | | tangible deliverables |
| | market maturity | | team and execution risk |
| | mature industries seen as complex | | risk as given in early and seed stage |
| | network effects | | high risk apetite |
| | product life cycles | | keep track of competitors' investment behavior |
| | product quality | | Recognize risk as part of the job |
| | relationships between the key components is key | | type of risk associated to the profile of the portfolio company |
| | significant market impact | | risk assessment based on outputs of due diligence |
| | solving a problem | | reduce risk by getting in early at the best possible valuation |
| | Technology as source of competitive advantage | | Low access to follow on capital is a higher risk for the companies |
| | market readiness | | |
| | technology aspects and industry apetite done internaly | | |
| | clear usp | | |
| | good package of solution and solid data | | |
| | no route to exit and long development timeline is a barrier | | |
| | position in the competite landscape is important | | |
| | access to deal flow is key | | |
| | serial (previous) ventures | | |

## Appendix B2: Dominant categories (cont.)

| Categories | Codes |
|---|---|
| **Portfolio Management** | different profiles of techonlogy companies |
| | difference between tech and health care |
| | embedded technology |
| | emerging winner |
| | emerging fields are attrative due to lack of competition |
| | extended funding |
| | fast decision-making |
| | incresed focus on the active fund |
| | lack of creativity (pivot) as reason do divest |
| | organic growth |
| | Natural selection |
| | portfolio size diversification |
| | unsecurity of the team as a reason to divest |
| | proactive portfolio balancing |
| | Need to optimize capital allocation in other to compete with bigger funds |
| | financial reserve for unexpected funding needs |
| | avoid competition inside the portfolio |
| **Intellectual Property** | IP as differeciator |
| | IP as market signal |
| | IP as valuable |
| | IP infringments |
| | IP more relevant in life sciences |
| | IP not relevant |
| | IP process seen as costly |
| | IP protection or defense |
| | IP providing competitive advantage |
| | research restricted to academics, labs or big corporates |
| | IP as a proof of capability |
| | IP is a box to tick |
| | Deep IP diligence in life sciences |
| | IP diligence key in life sciences |
| | To add value IP must be owned by the company, not the founder |
| | Technology should be internally owned, ideally IP protected |

| Categories | Codes |
|---|---|
| **Human Capital** | confindece in internal/ownn analysis on technology/business |
| | confortable with risk |
| | Founder seen as source of technical knowledge |
| | founders know the market better |
| | network access and experice as valuable resources |
| | reputation |
| | self confidence |
| | uncertainty bearing |
| | analytical and communications skills |
| | entrepreneurs reputation |
| | VC fills the gap of human capital or expertise |
| | execution capabilities and resilance important for competition on |
| | analysis of the skill gaps and aligment btw fund/company |
| | Other skills sets (technical) are required other than the the current |
| **Industry Competition** | competition as a snowball effect |
| | competition grows the econsystem |
| | competitions cycle |
| | increased competition seen as heathy |
| | Other VCs seen as colleagues |
| | keep track of competitors' investment behavior |
| | Don't see other VCs stricly as competitors |
| | VCs alternate competition and collaboration |
| | competition good for the ecosystem |
| | competition opens markets |
| | alternating negotiation power teams become attractive |
| **Collective Behavior** | collective thinking |
| | Fear of missing out |
| | herd mentality |
| | hot areas |
| | need to invest |
| | over-hyped space |
| | importance of individual views on deals |
| | fashionable technology generate a hype |
| | FOMO as investment driver |
| | FOMO has positive aspects, opens the mindset about opportunities |

## Appendix B3: Dominant categories (cont.)

| Categories | Codes | Categories | Codes |
|---|---|---|---|
| **Missed opportunities** | late acknowledgment | **Exit strategy** | divesting fails |
| | market forces | | double-down on winners |
| | market timing | | exit pespective |
| | pace of technology development | | exit potential |
| | competition dictates market timing | | Financial responsibility |
| | need to hit the market before others | | clear exit strategy |
| | when something emerges with benchmark | | cultivate relationship with larger funds for exit |
| **Performance Signal** | track-record of raised capital | | existentence of a potential byer influences decision to invest |
| | speed of development | **Fund dynamics** | Dynamic between fund related to capital needs in investments |
| | traction | | Very formal process of information generation, documentation and distribution |
| | credibility among peers gives you access | | high knowledge barrier in life sciences |
| **Technology issues** | technology readiness | | IP seen as important in life sciences |
| | technologycal fesability | | life sciences is data driven |
| | technology is part of the solution | | In life sciences is hard to invest alone |
| | becoming confortable with technology is | | in the US some big funds all the way through in life sciences |
| **Business Dynamics** | most opportunites are inbound | | Advantages of bigger funds is the option to balance a large portfolio. |
| | inability to exit a fund generates nich | | Micro VCs limit of funding can affect companies development |
| | inability to follow on next financing rounds | **Value added** | growth journey |
| | VC is also a game of network and | | support and valued added services |
| **Coflicts of Interest** | divergent technology or potetial assesment | | added value beyond capital |
| | information asymetry | | experiece journey |
| | Entrepreneurs seen as more opportunistic | | The added-value declines gradually until the next financing round when it raises |
| | opportunistic behavior | | prior to the investment we assses wht each tem requires. After the investment |
| **Fund Management** | funds cycles | **Business Environment** | natural selection |
| | Complexity of managing a fund | | ecosystem perceived as small |
| | informality | | natural advantage of the local market/ecosystem |
| | institutionalized fund | | ecosystem seen as key in VC business |
| | indepence between LP and GP seen as | | seed stage is also a branding game as startups can choose |
| | managing thrid party capital | | interlinked ecosystem |

# Appendix C – Selective coding

## Appendix C1: Details of main categories

| Categories | Fragments | Source |
|---|---|---|
| Decision-making | We would look first on an industry-level, is the industry growing? We discussed the trends, are these playing in favor of the company or against? Then also on a fairly macro level we would look at the country level, instabilly of something that could impact, for exemple from a regulatory POV. | VC2 |
| | They win in the long run if: a) they can create a brand/become a category leader; b) they have some form of network effect; | VC3 |
| | Not much. Most value is given to finding great opportunities (big problems in big markets where the founders can deliver a solution) rather than how much innovative is the technology to solve that problem | VC3 |
| | We look to invest very early. We know that we are going to get diluted. So the deals economics have to work for us. Whitin a certain sector and diferent maturities whe are definetively down toward the earlier stages. As you get down to certain level of maturity, valuations go up to a point that we are out-priced and it's not good for us. | VC4 |
| | Traditional VC investing I would say, I can compartmentalize into team, product and market. The biggest driver of early-stage success is the team, without a shadow of doubt. What we are looking at is the quality of the person who is responsible is key and the best people we have invested in are the people who are extremally bright, very technologicaly-focused but also have an ability to understand the commercial aspect of it. | VC4 |
| | In software it tends to be more about market risk. Most things that we invest in can be done, there not much a question there. It's more about: is the market there? Does the market want it? Is there evidence that the market wants this? We are looking to invest in a company in seed stage that is raising money to prove that the market exist and prove that what they are doing is interestiing, allivating the market risk. | VC5 |
| | We do a basic screen of what motivates them, are they qualified, do they understand a market? Then we try to think about, is this a problem that is really a problem, are you really solving something that is a problem? Is this something that we see has potential going forward is it something that is going to radically change the way things are done, so we value all that. And then you move on to next round, when everyone expresses interest. | VC6 |
| | Quite imporant. When we talk about product risk that is what we mean. One of the prerequisites is that we want to see a product roadmap. 5 year look out of where the product is going to go, how its going to evolve | VC7 |
| | Who's raised what? | VC7 |
| | The market wasn't there. It wasn't as sophisficated as we thought. Secondly, the teams weren't decisive or creative enough (pivoting / change course). | VC8 |
| | I think a couple of things. The team is important, the competition, the market the IP position. There is a big difference btw tech companies and health care companies in that sense. | VC9 |
| | The most common way is to be on the board of the company you invest in. And make sure that we are on top of it. Setting milestones upfront. | VC9 |
| | For example, in a semi-conductor process, figuring out how a company will grow will be important at some point. First thing is to make sure that the process works and get a few first customers who say they are interested. We know that it uses semi-conductor, which exist, it is theoretically possible to scale. The biggest issue is finding a customer who says: this is something you've made that we are excited about. The scaling issues the will come, but they are solvable. In general, you can see whether a tech is going to be scalable or not. | VC12 |
| | We are quite happy to look at new stuff in areas where we dont know the S&T and to learn about it. The reason we are happy to do that is it we expect to invest in things that are new, where there is less disvantage (because its new). If we were investing on existing Co's, with existing competitors, understanding that whole market and technology that would be really key. If your the few (first) people doing something in a field there isn't much compare and constrast to do. Therefore we are happy to catch up. We are happy to start at the answer and work downwards to the original question. To understand the field, starting from the particular invention that comes in | VC12 |
| | The first criteria is the team. The leadership team, what experience, what people in our network say about them, if we have worked with them before. | VC14 |
| | We look at the competition. If there are competitors ahead of the co that we want to finance and there is no clear usp and a clear competitive advantage, then we are not interested. You really need to make sure that you've reached the market before the competitors or that market is suficiently large to acommodate multiple players. But in biotech it is very clear, looking at the competition you can know if you are going to hit the market at the right timing or not. | VC15 |
| | For us, primarly, the way we are currently structured, we tend to find out if the team is equiped to surpass the difficulties that they will pass, because they are competing in a global scale. So we look at the characteristics of the team instead of access if the technology is innovative from their perspective. So we are less focused on, I mean, IP is something that we should have in the Co's, but we are not focused on technology aspect. We are more focused on the execution or the resiliance and quality of the team. | VC16 |
| | Yes, so when we discuss this internally. So when I think about, personally, I try to make an assessment in terms of, if you look at the market and the competition, are they first in the game? Are they first in the market? Are they 2 or 3? It is nice to have an educated market, with other firms opening the market. For us the ideal moment to step in to is when another startup is competing with them. Honeslty, if a team becomes attractive to more investors and we get to know about it, then the tables are turned. | VC16 |

## Appendix C2: Details of main categories (cont.)

| Categories | Fragments | Source |
|---|---|---|
| Risk Management | I think we look at risk in several different ways. First of all, we try to be a specialist and invest in what we know. That is already mitigating some of the risk. | VC2 |
| | Then it would probably come down to market risk, product risk and team / execution risk. With the market risk we would look at the competitors that involved in that space or likely to get in that space. | VC2 |
| | Then we would look at the prodcut level. What are the product life-cycles, how long are they? How often new products are released? What type of competiton is there? How sticky are the products? How sustainable is the BM. Does the company has genuine distictive IP? | VC2 |
| | Then we would look at the team members. Do they right the background and skill set to basically employ the capital that we are providing the company with? | VC2 |
| | I'm quite certain that we miss opportunities on a regular basis. We've missed companies that were in our pipeline, we did not invest and somebody else did, but we passed on them, this is the risk that we take. | VC2 |
| | Not really. Risk tends to be reflected in the amount we invest and the valuation we get in. Our average initial investment is 500k and we try to buy +10% for tht (ie. 5m post valuation) if a company looks very risky (because the traction/proof of market-fit is limited) then we invest less (ie. 300k) at lower valuation (ie 4m post). If the company looks less risky because some risks have been removed (ie. it has already 50k in monthly reveneues, clear early customers, a working marketing strategy, etc.) then we can invest up to 1m at up to 10m post. It's a one by one case analysis. And many times we are forced to invest at more expensive valuations than we wanted because of the competition with other funds. Then we might decide to invest more at a higher valuation to still keep our % ownership (ie 10%) which is the key for us. | VC3 |
| | We try to expose ourselves to risk rather than mitigating it. Mitigating it will mean that we reduce the chances of outstanding outcomes which is a requirement to get good returns. That said, we try to mitigate risks by understanding very well the opportunities we invest and trying to understand which "bets"/risks are we making at every investment and getting comfortable about them (ie. are we betting that the team needs to grow to become a leader? are we betting that the competitiors will not chase that adyacent opporutnity? ...) | VC3 |
| | What we are trying to do, is to balance that by saying: we've got these extremely smart people, they've got a runway, its an attractive market with a difficult problem that they are trying to solve, those are key components that underpin it. And if those are wright, we try to look at what risks will surround that an other ones that would mean to us that this company wont succed or is it something that we can manage to mitigate? So that is the kind of lens that we look through. | VC4 |
| | Yes, we do. Normally we look at what is the down-side case scenario in these kind of deep technology events. If we need to extent the funding, will we be able to do that? Inherently it is impossible to work whether that is going to happen. | VC4 |
| | There are a couple of companies in our portfolio, one in particular that is very technologicaly driven and there is a risk factor. There are involved in docker technology, on the whole if it's a very emerging piece of tech we don't like binary technologies. We don't take binary bets. The way we look at it, there is an emerging technology and some of these guy could be winners. What we are looking is trying to balance our down side risk | VC4 |
| | Some of it is case-by-case. We also try to get other late stage investors to invest early with us as that helps with fundrasing in the pipeline. | VC4 |
| | Absolutely, we love co-investing. Especially with VC firms in the US. There a couple of reason, if a Co's goes big, and they need a big inflow of capital. When you co-invest with bigger firms they have the funds to follow-on. Co-investing, you choose your partners, you build relationships. | VC6 |
| | You can diversify in terms of types and industries. But you can also diversify by taking account your learnings from our current porfolio and appliying to a certain stage of business. | VC7 |
| | In terms of agency risk, It's my job to know as much as they do. In order to meet our 10x return we seek risk. We also double down on companies and quickly step out of deals that we believe we make a mistake | VC8 |
| | I think its all part of the decision wether or not to invest. You have to build an investment thesis, in that thesis, you also stipulate the risk. All the factors that are associated with that. I think that specially in technology there can be a higher risk that the technology is not ready or the market is not ready, altough you believe in it at the moment of investing. In that sense you try to predict as good as you can the market. It's not a science, there is not a calculation involved. It is more of a well rounded thesis rather than an excel model that you plug in a certain numbers. | VC9 |
| | Yes we approach risks in types like market (incl. Business), Team and technology. Of course all 3 parts are relevant and have to fit together, but the most important ist by far the team. | VC11 |
| | In Germany founders and Investors are very frugal compared to UK or USA. This means a sure deal is better than a uncertain one with higher worth. | VC11 |
| | We thought about it. We can only be risky to certain level. Anything before early stage is very risky. We are pre-seed, we are part of a new ecosystem (blockchain), so our appetite for risk is pretty big. | VC13 |
| | Our traget is 10-15 years. Certainly no 3-5 or 7. We try to have a balance of Co's with a clearly exit strategy, an acquirer in 3-5 years. In general we have a very long term view. Blockchain spaces will take a long time to permeate industries. We are in for the long take. | VC13 |
| | That model makes sense if you have enough fire power to do it. Their strategy is to spray a lot of checks at seed and see what works and then backthem heavly at later stages. For the other funds that aren't so big, focusing on one stage is a good idea, because you need to have the right check size to be able to win the best deals at each stage. If we had kind of a huge fund it would be great to own the whole chain. | VC14 |
| | We don't mind taking risks, we recognize it's part of the job. We try to understand where the risks are in each company and kind of balance that. For example if the company has a supercool interesting technology we don't mind much if there is less commercial sophistication, we dont mind much because we are investing mainly in the technology, we would bring in people to fill that gap. On the other types of companies we are very focused on minimizing execution risk, so things around operations. | VC14 |
| | Many of these companies are very small, with few employees and limited resources. The VC money takes the business to the next validation point. Delays are common, they do happen. The way we work around that is to keep reserves for future financial rounds. | VC15 |
| | The reports that we get from our DD, are based on red, green flags and we get an overview and insights about the business. From the investment thesis, from our fund perspective, we try to eliminate risk through geting in early at the best possible valuation. You try to reduce risk by focusing on 2 or 3 verticals. | VC16 |
| | we are in early, pre-product, sometimes funding development and proof-of-concepts. Managing that part of the risk is a key value proposition of ours. We are not risk averse, for us is all risk reward. We are always balancing that. Some have a higher technical but then the potential upside makes it worth the investment. And that is how we manage it in that context. Also we are able to quantify as much as possible the potential point that maybe a problem with regards to the technology development. A big part of what we do is managing that risk by bringing in outside experts, contracting expertise and working world-class partners to ensure that they are able to move forward. | VC17 |

# Appendix C3: Details of main categories (cont.)

| | | |
|---|---|---|
| **Porfolio Management** | Venture investing is very risky. The first way we mitigate risk is we spread our ticket into a diversified portfolio. We don't invest all our assets in 1 company. We invest our money in about 10-15 companies and then we see how they develop over time and the rest of the money only goes to the cos that are perfoming well. And we expect part of our companies to fail. | **VC1** |
| | One thing that we want to be sure is to don't invest in two companies in exact the same markets, to avoid the anoying things that come with that. | **VC2** |
| | So you mean like a hedging? No, not really. What you will not try to do is having competing investments in your portfolio. That could be a strategy to investing in competing companies or technologies, not sure if anyone is doing that. | **VC1** |
| | I would say that we always wanted to have a relitavely diversified portfolio. So we wont double-dip into specific vertical. We try to keep it relitevely balanced and I think a lot of it actually grows organicaly. If there are certain areas that we've toyed with the idea of moving our investment towards, organically it has become a very diversified portfolio. | **VC4** |
| | Not explicitly. We admit that the founders know the markets better than we do. In terms on portfolio management you can double down on the winner, that balances out. | **VC5** |
| | We balance our portfolio by investing in 20-25 deals that our balacing and risk mitigation. The is no other balancing going on I have to say | **VC8** |
| | Yes, I think the company stage determines part of the risk. Also the sector type. And also the mix of company you have in your portfolio. We try to balance the amount of companies in our portfolio. | **VC9** |
| | Yes, we do. We are very conscious at picking deals that spread our risk. Based on our tracker, we have the top 10-15 industries and use cases and we go around and seek Co's or people that are building on that use cases. Is rare for us to go out of the same area of application twice. We have a more proactive approach | **VC13** |
| | Yes, before. We monitor it very closely. We invest in different stages of developments. We do not invest in 2 companies in the same target. It plays an important role in our decision making | **VC15** |
| **Intellectual Property** | It is very important in the company valuation process to show some IP and it can come in many forms. But we look at IP as a differentiator in the market and we always look to understand how the IP provides a lasting competitive advantage. But what we dont really do is try to put the dollar value in each of the patents the company might have and do like a some of part type of valuation thing, we dont do that at all. It's more on a qualitative level, is that particular IP providing supply for a certain demand? | **VC2** |
| | In most of our investments, there's no such a thing of "proprietary" intellectual property. Our companies win if they can execute very well in terms of building the best product for the customer's needs and learning how to do sales and marketing at scale. | **VC3** |
| | In our stage is less of a concern. They probably don't have IP, don't have the money to go through the process. We are more concerned with infringing patents from other people. | **VC5** |
| | We like to invest in 2 types of Co's. Co's were we believe that are doing deep tech, research, developers. Than you have the tipical SaaS or e-commerce or marketplace were marketplace patents are less important. IP is not typical for us. This is typical in life sciences, semi-conductors and technologies related to universities | |
| | In health care it's more important. In technology, scaling is way more important. And what I mean with tech is more the online B2C plays. | **VC9** |
| | We only invest in companies where the IP is in the company. We have really bad experiences where the IP belongs to the founder himself or to some research institutes, because they can block an investment at certain points (market entry, cooperations etc.) | **VC11** |
| | Patents are usefull where the patent protects something that can be clearly seen. Some Co's simply got out and try to get IP because they think investors would want to see that. And often IP is not a sensible use of money, and in fact is positevly bad as they've disclose a secret that they didnt had to disclose. So sometimes it can be a bad thing. Most of the things we invest in have some Patents or IP around them because of the nature of what they are doing and most of them operate in sectors were is possible to protect what you are doing. But we also had Co's that just kept their secret. We like Co's that manufacture things, and if they have a secret process, that is fine, we dont need the patent. | **VC12** |
| | It depends quite a lot. People make to much of a fuzz around it and it's actually not that important. In our experience, a lot of the time, when a company gets acquired because of the technology they are actually being acquired by the quality of the team. When a team has IP it's almost of a proof point, this is the kind o stuff we are capable of. The importance of IP from our experience is kind of overstated. In some tradional high-tech such as biotech and drug developments, than it becomes really important. | **VC14** |
| | This is one of the boxes that we have to tick. Post term sheet Before investment we run a deep IP diligence, including an FPO, freedom to operate the operate We always do that in life sciences, this is key. | **VC15** |
| | We are focused from a SW technology perspective on the front-end of the web, we are not focused on core backbone, in essence we do believe that technology should be internally owned, and even in a separate entity to protect IP. | **VC16** |
| | Its critically important for us to have some type of ability to make the technology or the capability hard to immitate or duplicate. One of the easiest paths for that is by patents. Having a strong patent strategy around each one of the investments. We have typically different IP modes, characterization around our core technologies and on the relevant countries. | **VC17** |
| **Human capital** | That is kind of the general idea. There is an idea and there is a practical implemenation to it, sometimes colliding. There is the idea that you are either doing cyber security or cloud computing, our two specialties. And even under that, depending on which deals you lead, you specialize in that sub-are a littel bit. Given the size of our funds, basically everybody is involved due to capacity reasons. | **VC2** |
| | We make it very clear that we are going to invest in what we want to invest in and that they would not be consulted before the investment. We keep them informed | **VC12** |
| **Industry competition** | It's fine for smallers rounds. VC money comes from funds (pension funds) and I think does wouldn't investing direclty. If you looking to raise a few millions it's pretty hard to do that without necessarly go to a fund that is managing other people's money. | **VC5** |
| | We call it momentum investing. Founders are beginning to gain the system and have learnt how to do this better, so there is more competition in the mkt now. If you have people looking to see what other VCs are doing and if a VC with a good reputation sound interested then imediately other VCs will start to think: what did they see that I havent seen? Or I need to take more scrutinity on this. So there is definetely that kind of dynamic in the system. I've definetively seen and it's great for the entrepreneur because it becomes a competitive process and increases the ammount of valuation for the company. From our perspective we very much try to not get into that kind of competitive situation. We actually pride ourselves for actually finding diamonds in the rought. Sometimes VCs will overlook companies because they are not in a sexy or hot area. | **VC4** |
| | That is great to have people that have that specialization, to co-invest with. There is one difference. Running a fund is different that running a Co's. And that is something that theses people sometimes underestimate due to little experience with. Our investors now are more professionals and we have to adhere to certain corporate govs standards. These BA's or founder they sometimes struggle with the Corp Govs play. In general, I would say its positive | **VC8** |
| | Competition growths the ecosystem | **VC9** |
| | Of course they are competition. They want the same deals as us. The thing is in VC competition can also be a colleague. You can compete for a deal and in the other co-invest | **VC10** |
| | In terms of geography we don't have many competitors. We are the largest in life sciences in x. Besides that, I don't like to refer as other VCs as competitors . Because we co-invest together in many opportunties. Ultimately, unless you have a very large fund is hard to invest alone. In the US, there are a few firms that have very large funds. They can fund the Co's all the way through. | **VC15** |
| | The end game for me in the seed stage is also a branding game, because they is more competition and more capital available, startups can choose. VC firms have to develop other parts of the business besides being an investment managers. For example, on the technical level, other skill sets required in this field other then the partner/associate model. | **VC16** |
| | Its super good. The more capital becomes available, the more the startups can choose from. Because of competition, you see markets opening up. The more information available, the more transparent. In general is a really good development | **VC16** |

# Appendix C4: Details of main categories (cont.)

| | | |
|---|---|---|
| Collective behavior | This is was I was hinting early as how we talk to investors to inform our thinking about how they assess investment opportunities. Yes, the reality is that there is a lot of FOMO, there is a lot of herd behavior on how capital are allocated. | VC1 |
| | | |
| | I think, to someway, yes. Because we want to invest in validated companies, we do not take excessive risk. Our bets are around 5-15 million. There is probably a herdling effect around certain industries. Our bets are not exclusevly on technology bets but also looking at the industry. | VC2 |
| | People are very focused on hot sectors and one of the things that I think its actually kind of interesting around that is that the system is interlinked and it's something the people don't see from the outside looking in. But you are responsible with a lot of VC funds, you are kind of trying to feed bigger funds. It is kind of an ecosystem the move upwards. So you trying to almost work out that if there is a sector that looks hot there is the likelihood that a bigger VC would want to make an investment in that sector and take advantage of that. | VC4 |
| | Yes, I think it happens. Some markets are hot at certain times, and I think that drives up valuations in certain mkt more than others. More people are talking and more investments are being made. I don't think that you can say that leads to modest returns. The best funds will be ahead of that. | VC5 |
| | I don't think that just to justify that we have it. You do get that in terms of, yeah, there is a hot space. I don't have any investments in this space, just to have a diversified portfolio I probably should look at this space and make an investment. I don't think we really think of following a hot trend, more often than not we will make an investment in that space 1 or 1.5 years after the trend, when it settles down. My reaction tends to be: this space is overhyped right now, I'm not going to look at anything. | VC5 |
| | Collective thinking. There is a difference between that and herd mentallity. There is an element of that herd mentality. And I think that's possibly more money than quality deals in certain area. | VC7 |
| | Yes, I've seen it. Specially in the bigger funds. | VC8 |
| | We don't care about what other people do. Absolutely not concern about collective behavior. | VC12 |
| | The way which we try to avoid CT internally is to make sure that we go through filters and each person look at deals separetly and give their own view. | VC13 |
| | Everyone is kind of in a weird mix of a competitor but also kind of a potential cooperator in VC. The way we see it, we are not really kind of worried about competition, because there will always be capital out there. We don't see other VCs as stricly competitors, they are potential allies. | VC14 |
| | There is. Some technologies became fashionable, and then there is a hype. | VC15 |
| | Yes, well FOMO is what drives investors in general, it is also what opens up a little bit their mindset about opportunities, so it is also a good thing. It is extremally risky for the ones taking the same route. The value of VC, if you look at all the classes that are available, I'm not sure if this model sustain. Or at least if other models will not take the place of VC itself. Crowdfunding for equity is coming up in every market. It is also, its becoming more a game of getting access to the best team and getting early enought. That is also why even the late stage VCs tend to develop this earlier funds to make sure that they dont miss out in a really early stage. I think its nice if you have a different vision, it allows you to get access to the deal flow. | VC16 |
| | you can play it intelligently, leverage the hype if that is a component of your investment strategy. Typically, that's one negative view on it. On a positve view, hype is build around opportunities, there's been a number of investments bubbles around certain tech or industries at different timings, unfortunally the all tend to blow up at some point. But the derivative is typically a group of winners they come out of those groups. The internet, the telecom, the datacom, the biogen, the processes, integrated circuits, all of those. Typically those hype minded hurd mentality there inst a founding principle that usually drives that, again generates winners. I understand wanting to participate, looking to create a succefull strategy inside one of these investment bubbles, but you have to make sure that your strategy is founded on a process and that you are not just trying to pick. If you are just going to be a picker, that is kind of a horse track kind of mentality | VC17 |
| Exit strategy | Sure, because you always need to think about the moment you step in. And you need to think about the moment you exit the company. Wether that's an IPO, wether that is a trade sell to another company. | VC9 |
| | Yes, we take that in to account. We will look at the exits. At the end is very data driven. That needs to come up with a good package and solid data. | VC15 |
| | Well the advantage is that you can setup a balanced portfolio. Its no so much about early or late, it is about time to exit. So we look at opportunities that we can exit wihtin the time frame of the fund. The way we assess that is by talking to ultimate buyer. Are the pharma Co's interested in acquiring this assests? If the answer is no, and the development timelines do not match, then we have to pass on that. | VC15 |
| Fund dynamics | I don't think we do anything explicilty. If you look at the fund, all investment should happen in a period of 3-5 years, probably even less. This would be the investmetns + plus exits T+5 years = 8-10 years of full cycle. You put your chips down and have to deal with that on. Probably, when new opportunities or fundamentally different things arive is when you raise a new fund. Then you can fashion your mandate differently if you want to. If you look at cyber security, it will be around in like some shape or form. | VC2 |
| Added value | We work with our companies. We cover them closely in terms on reporting and data we receive from them. We help them whenever we can and we also provide them with additional capital | VC1 |
| | Helping the co's in their growth journey. Through introducing them to customers and the right people, getting them through the door. Another risk mitigation, even before the investment, we think about their potential clients, have a conversation with these people. It's not a guarantee but it helps us understand what customer after. | VC2 |
| | Our reason to be is because we believe that entrepreneurs at this level need more than just capital. They need tech know-how, mkt know-how, we go on the journey with them. In that sense we see ourselves more of a venture builder, a lot more active. At seed stage capital is relatively small part of what founders need. | VC13 |
| | We do have a program just before we start investing. It is a short term program based on actually on what each team requires at the moment. After the investment our value is limited to primarly coaching and network access. Maybe some insight but the added-value declines up till when they raise the next round. | |
| Performance signal | Speed of development. The winner is almost always the one who iterates faster at the stage we invest. It's key to deliver a product that "somehow works" and iterate fast enough to keep lerning from the market to deliver a lot of value. | VC3 |

## Appendix C5: Details of main categories (cont.)

| | | |
|---|---|---|
| **Technology issues** | One thing you have to understand is that in a venture, a lot of the developments of the technology are not external they are inherent with the company that you are supporting. You have a company that develops a technology and might be pushing the boundary of the market. The better the company is at developing (marketing / pushing) that technology the higher the likelyhood that their are creating a market as well, it's interconnected. | **VC1** |
| | 3-6 months, because it's not only reading about its also talking to other people, understanding the market and being part of the market. You really neeed to spend time on it. | **VC1** |
| | I don't think it doesn't go quite as detailed. It would be more like - is this thing marketable right now? We are growth stage investors so it has to be for us to be interested in. Than we would basically look at the exit potential from like 3-5 years from now. It has to be significant tangible market potential for us to go forward. Then we would look from a very narrow product perspective on the features but we would look from an industry perspective. Are these guys in a reasonibly good industry? | **VC2** |
| | Yes, I just came across a company that we rejected earlier on because we didn't believe in the technology. The promises of the company weren't really proven. Because we are at growth stage we want the technology to be proven or bullet proof. | |
| | We don't take much of that risk. More recently we have done a couple of investments where AI/machine learning is supposed to provide a lot of value. Because of hte inherent tech risk there (because it's early to see if that technology will deliver the promise) we invested in companies that can provide value even if machine learning doesn't perform as expected. | |
| | We have a few general rules, the tech should give a really substantial advantage to anyone else wanting to do the thing. That is the key thing. If the tech works as it should we should have a really big advantage over others. That is the main driver and then you look and you judge how likelly it is to achieve that advantage and how big the advantage will be if they achieve it | **VC12** |
| | Understanding how big an advantage the tech give at which level of the product or the market, that is a key thing. | **VC12** |
| | The tech stack is part of the solution. From there, the team, their competency, what have they done. Traction, a proof of a product-solution fit or product-market fit. | **VC13** |
| | It's quality of the team and scientific reputation of the key scientific people involved with the tech. How developed it is and how long it will take to get into the market. | **VC14** |
| | To summ it up. You could put it into three main points or criteria. I'm looking for technology that solves a relevant problem, which means is large and meaninfull. Hard to imitate or duplicate. And opportunities that are driven by technical compentece and you are able to leverage them across multiple product line or industries. | **VC17** |
| **Business dynamics** | Underpinning all of this one thing that people often forget is that with VC we are in the business of making money for our stakeholders, our LPs. So therefoe we are looking at this throug the lens of what is the best comercial deal for us that would generate the most ammount of return for our LPs so we can raise the next fund and we can keep in business. | **VC4** |
| | We cultivate that exact relationship (exit through other funds). That is something we specifically do. | **VC13** |
| | Not so much. There is a range of sizes and players. What tends to happen is that if you cant exit one of the portfolio companies, and you don't have funds to follow on, then there are specific funds - close over funds. That they offer mezzanine before going IPO. | **VC15** |
| | Not really, missed opportunities are because: a) knowing about the company too late; b) the valuation of the company is expensive; c) … | **VC3** |
| | it is also a game of network and connections. If you have track record and credibility among peers, especially bigger funds, you get access to follow up rounds, it makes a difference. Opening up and connecting to the ecosystem in a bigger scale. I'm not sure micro funds are the best option for startups to go. They have less funds for follow-ups so there is a bigger risk. | **VC16** |
| **Conflicts of interest** | I think there is definelty an asymetry on the information, I'm sure that all the portfolio companies know more about the technology aspect, and what they look for, ideally is a little bit more knowledge on the market / customer side from our part to be able to open the doors to new countries or new customers. | **VC2** |
| | All the time, I guess. Entrepreneurs are much more opportunitist than we are. | **VC10** |