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Venture Capitalism and Innovation in the Danish Medical Industry

- Venturekapital og innovation i den danske medicinalindustri -

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Abstract

Eksisterende litteratur inden for venturekapitalselskaber og innovation begrunder denne afhandlings komparative undersøgelse af de fire venturekapital-typer: *business angels*, *privat venture capital, corporate venture capital* og *public venture capital*, som led i en ikke-finansiel værdiskabelse i den innovative proces hos danske biotek virksomheder. I særdeleshed fokuseres der på de motiver, der driver VC-aktiviteter, samt hvordan disse påvirker de ikke-finansielle faktorer: *screening*, *coaching*, *monitoring* og *signaling*, i relation til udviklingsstadiet for biotekvirksomhedens produkter.

For at kunne analysere industrien, udarbejdes der en contingency-teori afhængig af VC-type, udviklingsstadie og ikke-finansielle værdi-skabere. Primærdata blev generet ved via NN Markedsdata, Orbis, European Patent Office og Nordic Life Sciences databaser. Det umiddelbare mål for dette studie var at spore en regressionssammenhæng mellem VC-type og innovation målt i patenter. Dog grundet begrænset virksomhedsinformation blev markedet undersøgt gennem en gruppe casestudier.

Resultaterne for denne undersøgelse fremhæver, at dansk biotekindustri har venturekapitalmuligheder, som modstrider teorien; specielt i relation til statsstøttet venturekapital. Det foreslås at statsstøttede venturekapitalselskaber ikke skal ses som en begrænsning for dansk biotekinnovation. Undersøgelsen viser, at den dominerende værdiskabende faktor er, hvorvidt VC-typen er specialiseret inden for biotek. Denne afhandling foreslår, at for at styrke innovation i den danske biotek industri, bør specialiserede VC-typer tildeles mere opmærksomhed som et kompliment til den nuværende holdning, der advokerer at private venturekapitalselskaber er mest værdiskabende.

Denne afhandling konkludere at en regressionsanalyse baseret på den udarbejdede contingency-teori stadig er relevant. Fremtidig forskning anbefales dog at VC-typer med specialisering inden for biotekindustrien bør sammenlignes. De ikke-finansielle værdi-skabere bør efterforskes via kvalitative metoder. Resultaterne bør yderligere komplimenteres med patentdata og finansielle nøgletal. Denne undersøgelse fremstiller en række praktiske implikationer, angående forholdene mellem venturekapital, biotek virksomheder og innovations.

List of Abbreviations

VC	|	Venture Capital
PVC	|	Private Venture Capital
GVC	|	Public Venture Capital
CVC	|	Corporate Venture Capital
BA	|	Business Angels
EPO	|	European Patent Office Database
NLS	|	Nordic Life Sciences Database
BCIQ	|	BioCentury Database
DVCA	|	Danish Venture Capital Association

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1. Introduction

1.1 Relevance of the Research Problem

The first part of the chapter addresses the relevance of the research problem and gives an insight into the current venture market in Denmark and how venture capital is considered a driver of innovation.

Private venture capital has been a central source of finance for commercializing radical innovations in the US economy over the past several decades (Nanda & Rhodes-Krops, 2013). The emergence of new industries such as biotechnology, as well as the introduction of several innovations across a spectrum of sectors in health-care and information technology, has been driven in large part by the availability of venture capital for new startups. Venture capital has thus been found to have a substantial impact on innovation in the U.S. economy (Kortum & Lerner, 1998).

While the VCs are highly developed in the US and considered to be a given for entrepreneurial action, they are less profound in Europe and Scandinavia, especially in the early stages of development (Klofsten, Jonsson & Simón, 1999). Due to historical reasons, and to the distinctive features of legal and institutional environments, the supply of venture capital is extremely different across countries (Cumming, Grilli & Murtinu, 2014). In particular, there is a great difference between Europe and the US both in terms of fundraising and investments (ibid.) The best-established explanation as to why venture capital has worked better in America than Europe, relate to differences in market environment (Seppä, 2000). When venture capital first emerged in Europe, it was introduced as a public sector vehicle for SME sector development rather than of a more adventure seeking nature as it was found in the US (ibid.)

The differences in the VC market have by some research papers been addressed as the reason why growth rates of new startups in the US are higher than in Scandinavia. Carlsson (2002) identified identified the venture capitalist's primary input to be that of connecting new ventures to management and marketing competencies, and that Sweden hosted few 'competent' venture capital firms who could efficiently do this. Further, the Swedish venture capital market was also less specialized and offered fewer alternatives than the more mature and differentiated venture capital market in the U.S (ibid.)

Carlsson (2000) suggests that in order to increase the growth in small startups the European market must change its VC environment. Dansk Biotek also addresses the need for proper framework conditions for European venture capital financing, and thus the biotech industries' ability to raise finance (Dansk Biotek, n.d.). As can be seen from different European initiatives it has become a strong belief in many countries that interventions, in order to facilitate the acquisition of (financial) resources for young, innovative firms, are needed (Lindström & Olofsson, 2001; Cumming, Grilli & Murtinu, 2014).

However, some companies may have a cultural comparative advantage in inventiveness (Gassmann, Reepmeyer & Zedtwitz, (ed.) 2008). R&D management is a key ingredient to success (ibid.) Thus, a country like Denmark, which is worldly renowned for being innovative, especially in the pharmaceutical industry, might be able to attract the managerial needs through other means than the classical PVC sector. Kortum & Lerner (1998) questions whether the US VC model can seamlessly be transferred abroad. The reasons for this is explained by the different forms of government intervention to boost economic growth, and different public market conditions (ibid.)

The Scandinavian countries have a long history of government intervention and are highly more socialistic than the US. While some will argue that the socialistic milieu of the Scandinavian countries discourages PVCs from investing in early-stage high-risk products, and thus makes it more difficult for these startups to attract the PVCs, another situation might be the case in this market. Given the socialistic history and foundation of the Danish society, it can be suggested that the governmental intervention and funding is more experienced in creating incentivizing GVC funds. Some argue that Scandinavian countries have recognized the need for government-supplied capital resources for startup companies (Tscherning, Frank & Schönharting, 1999). Thus, PVCs in the Danish entrepreneurial environment might not necessarily be better at spurring innovation compared to that of the GVCs. The Danish government prides itself as supporting innovation in the healthcare sector, and in 2014 the Ministry of Foreign Affairs declared, that the Danish Government would increase the public-sector investment in research on an on-going basis to ensure that at least 1 per cent of GDP would be spent on state-funded research (Ministry of Foreign Affairs, 2014.) Thus, the Danish government is quite vested in financing innovation and considers itself to be offering excellent opportunities for public-sector funding for established public-private research partnerships, for example via Innovation Fund Denmark (ibid.)

Another important strength of the Danish pharmaceutical environment is the fact that Danish research, development, and manufacture of pharmaceutical products represent one of Denmark's commercial strengths (Ministry of Foreign Affairs, 2014.) The Danish pharmaceutical companies are involved in a range of research activities in close collaboration with smaller units. The private-sector pharmaceutical research in Denmark is distinctive in that it accounts for a very large share of the total business and industry R&D investments. The long-standing tradition and solid foundation for pharmaceutical research in Denmark have also facilitated the establishment of a number of biotech companies, for example, in the Danish-Swedish Medicon Valley cross-border cluster (ibid.) It is considered a positive development throughout the past years, that a number of big pharmaceutical companies have established new finance sources (Dansk Biotek, 2012).

In recent years a trend among PVCs to avoid supplying early-stage companies with financing and instead shift focus to less risky investment of later stage deals have been more and more prevalent (Styhre, 2015). This means that the PVC market has withdrawn from the early and risky stages, and today primarily target companies in more mature stages, where there are clearer opportunities for exits. With less PVC funding, the early-stage biotech companies become more reliant on public funding. This development is raising concerns in the field of innovation, because the past years have shown a relative decline of private corporations' share of innovation (ibid.) Especially, if in fact PVCs are better at spurring innovation than GVCs.

For these reasons, this paper will take into account business angels (BA), public venture capital (GVC), corporate venture capital (CVC), and private venture capital (PVC) as comparative VC-types. Dansk Biotek includes this categorization in their statutes of possible membership, thus the inclusions and distinction between these four players is considered important to the Danish biotech industry (Dansk Biotek, 2008).

1.2 Research Question

The second part of section 1 introduces the research question, and subsidiary questions that are point of reference for the further analysis.

The research question is:
How can different VC-types be evaluated on their effect on the innovative scope of the Danish biotech companies, and what does such evaluation suggest about the Danish VC market in the biotech industry?

The following sub-questions are complementing the general research question:

1. Industry: How are market factors shaping the Danish biotech industry?
2. Innovation: Which factors contribute as nonfinancial value-adders in the collaboration between investor and investee? How does the contribution to innovation change during the venture?
3. Motivation: What is the motivation behind venturing and collaborating?

1.3 Relevance of Research Question and Thesis Structure

This paper aims at investigating whether one VC-type performs better than the others in terms of spurring innovation given the stage of product development.

The guiding theme of this thesis is that the nonfinancial value-adding factors in an innovative process within the biotech industry are dependent on the stage of development. Literature suggests that the VC-types available to the industry have an ability to add value to the innovative process contingent on the stage of development. This thesis contributes to the literature on venture capital and innovation by developing a contingency theory based on previous research and testing this on the Danish biotech industry.

In section 1 the relevance of research field was outlined, and the research question with supportive questions were introduced. In section 2 the Danish biotech industry will be described in terms of opportunities and obstacles unique to the market. Section 3 covers the literature review, which creates the foundation for assuming a correlation between venture capital and innovation. Following the findings of section 3, the first part of section 4 reviews the four nonfinancial factors with which the VCs can add value in the innovative process. The second part reviews the cycle of innovation. The cycle is divided into three stages. Each stage review is followed by a ranking of the importance of the four factors of innovation in comparison to the stage of

development. Section 5 establishes the theoretical framework. The first half investigates the value-adding effects of the four VC-types. The second half combines these findings into a comparative ranking, which leads to a proposal of 12 hypotheses. Section 6 evaluated the data and data collection methodology and summarizes the findings in descriptive tables of the Danish biotech industry. Section 7 tests the hypothesis based on a group of cases studies. Section 8 discusses the findings in relation to the theory. Finally, section 9 draws the final conclusions and propose suggestions for further research.

2. The Danish Biotech Industry

What characterizes biotech companies is a high level of uncertainty. Most venture businesses are launched despite numerous and often consequential uncertainties that can be resolved only by going forward (Gorman & Sahlman, 1989). Furthermore, venture-backed companies have extremely limited resources (ibid.) Startups are often most reliant upon outside financing to foster their growth, however they have difficulty in finding this financial support from institutional investors because of their inherently uncertain and high-risk nature (Osnabrugge, 2000). Life science companies are regularly confronted with significant hurdles unique to that industry, such as the Food and Drug Administration (FDA) regulatory compliance, and the recruitment of employees skilled in the underlying science (Kurato & Brown, 2010). Additionally, there is a long process of patenting, phase I and phase II trials and clinical testing, which ads further to the risk. It often takes many years before the first output is sold (Carlsson, 2002).

The long-standing tradition and solid foundation for pharmaceutical research in Denmark have facilitated the establishment of a number of biotech companies. The first Danish biotech company was established in 1989. In the 1990s venture capital funding was made only by a few investors, who had a broad focus on IT, industrials and life sciences. The first specialized VCs with focus on biotech was established in 1998. Since then, close to 10 funds with specific focus on life sciences have been established (Vækstfonden, 2014). However, in the past decade venture capital financing has been lowered. This decrease is the result of VC funders focusing more on development of a specific product (ibid.)

Many of the biotech companies are located within the Medicon Valley hub, which spans from Eastern Denmark and South-Western Sweden. The Medicon Valley represents the entire (bio)pharmaceutical value chain from target identification through preclinical and clinical development, to manufacturing. More than 40,000 people are employed in the life science sector in Medicon Valley and there is a strong tradition and culture for networking and collaborating in the region (Ministry of Foreign Affairs, 2014).

This paper limits its biotech companies to those located within the Zealand region of Medicon Valley. Despite caveats, venture funding is increasingly available for initial financing of biotech ventures in the Medicon Valley of Scandinavia (Tscherning,

Frank & Schönhartig, 1999). The sources of finance found in this region are exactly that of GVCs, BAs, PVCs and CVCs.

2.1 Industry concerns

While the Danish biotech industry is highly developed and of high importance to the Danish government, it still has high requirements for capital, a long development process, and a risk associated, which many investors are unwilling to take (Kailay, 2014.) It is further being argued, that increased governmental requirements are increasing the costs associated with clinical trials to such an extent that startups cannot meet the financial needs. To overcome this, it is being suggested that the early innovation VCs needs to focus more on screening for the best projects, provide proper coaching, and motivate through supporting and not just demanding milestones, ensured by effective monitoring (Kailay, 2013). A combination of this will help the securing of more funds, as it will signal to new investors, that the risk of investment is being met and lowered significantly.

Much concern in the Danish pharma industry is regarding cuts in the public funding of innovation, especially since the industry in general lacks innovation and innovative forces (Kailay, 2015). Since the financial crisis in 2008 it has been very difficult for small knowledge-based companies to attract venture capital (Carlsen, 2011b). Especially to the biotech industry, it is vital that there is access to venture capital because of the high costs associated (Carlsen, 2010). Prominent figures within the industry believe that as long as the Danish venture market cannot keep up with leading countries of venture finance, the public sector must fuel the venture market (ibid.) While it isn't stated directly, it does imply that PVCs would be ideal to the industry.

The pharma industry is being more acceptant to the idea of fuelling venture capital into the small biotech companies instead of only focusing on the big pharma companies as innovative leaders (Vækstfonden, 2014). Several pharma companies are facing expiration of patents, which further induces them to seek innovation in the biotech companies. In 2012 the biotech products were accountable for 70% of the combined turnover of most selling drugs. The Danish VC-backed biotech companies employed more than 1.000 employees in Denmark with a turnover of more than 4 billion DKK (ibid.) The biotech companies are thus becoming an important player in the market of life sciences.

3. Literature Review

3.1 Venture Capital and Innovation

Venture capital is either private or public capital investment that serves to support the entrepreneurial function and the development of innovations (Styhre, 2015). Firms pursuing an "innovative strategy" are significantly more likely to obtain venture capital, and innovators are found to list 'obtaining venture capital' as a significant milestone in the life cycle of their company, as compared to other financing event (Gompers & Lerner, 2001). Thus, the linkage between VCs and innovation is a logical outcome of the pursuit of both VCs and entrepreneurs.

3.1.1 Nonfinancial Value-adders

Venture capital is one of the most tailored financing modes for young high-tech companies. It provides the financial resources that young high-tech companies lack due to capital market imperfections (Cumming, Grilli & Murtinu, 2014). But moreover the role of VCs is not limited to allocation of financial resources (Pina-Stranger & Lazega, 2011). VCs facilitate exchanges of knowledge between members of their portfolios, and thus the capacity of coordination and collective learning of their entrepreneurs. VC-backing can be seen as ownership rather than just finance (Seppä, 2000). VCs participate in investee governance more actively than public stock market investors, by insisting on shareholders' agreements and assuming active seats in the board of directors (ibid.) Further, high information asymmetry and high uncertainty typically limit a startup's access to traditional financing sources. In contrast, VCs have the capabilities required to deal with these factors and contribute to the management of startups (Davila, Foster & Gupta, 2003) These are the characteristics setting the VC apart from more traditional capital market or debt financing alternatives. The VC is thus a partner in the entrepreneurial venture and not but a mere source of finance, which is important in especially life sciences.

3.1.2 Collaboration with the Investee

Life science innovation is not simply a matter of raising capital from capital owners, but the relationship between entrepreneurs and financiers is more tightly knit and their interests more closely entangled (Styhre, 2015) The role of the VCs is thus not only to provide capital, but also to actively locate their partner companies in networks of relations, that help these beneficiaries tap into resources, that they would not otherwise have access to. Entrepreneurial skills and resources, shared and exchanged

in network structures in innovative fields are thus developed both in the companies and in the VCs (ibid.)

General early pitfalls involved in the start-up of new life science ventures are lack of objective evaluation, lack of market insight, inadequate understanding of technical difficulties, poor understanding of funding requirements, lack of product uniqueness, and ignorance of legal issues (Kurato & Brown, 2010). The reason why VCs might be more equipped to deal with these pitfalls compared to other sources of finance is that VCs have a way of creating relationships with their portfolio companies in which they often contribute through its organization, strategies and capabilities (Luukkonen & Manula, 2007).

Hence, besides finance, the VCs also provide other services, which are at least as important to their clients: helping establish the client′s network with other producers and customers; evaluating and improving business ideas; supplying management know-how; forming a network with other venture firms that work in the same business; advising and, if necessary, intervening in strategic decisions of the client; improving the client′s marketing capability; communicating with suppliers; finding a CEO; assigning one or more of its employees as a member of the board of directors of the client; and preparing the client′s initial public offering (Carlsson, 2002).

Davila, Foster & Gupta (2003) proposes the following rationales for expecting VC-backed firms to have higher average growth rate than startups not receiving this type of financing:

1) Self-selection of venture capitalists into startups that both have the potential to have high growth and a management pursuing high growth.
2) Venture capitalists bring a network of contacts with executive search firms and potential professional managers.
3) From a governance perspective, they take an active role in the board and in monitoring the evolution of the firm as well as in structuring top managers′ compensation.
4) Venture capitalists themselves bring a reputation effect that facilitates growth. Their due diligence process requires detailed analysis of the management team, their technology, products and the viability of their business plan.

In sum these four factors will in this paper be classified as 1) screening, 2) coaching, 3) monitoring, and 4) signaling.

Venture capital financing and collaboration have long been in the interest of researchers studying company development and expansion of the innovative scope. Several firm-level studies have demonstrated that companies backed by VCs grow faster, have better financial and operating performance, are more innovative, and are more likely to go public compared to their non-VC-backed peers (Alperovych, Hübner & Lobet, 2015). Venture funding has been found to have a strong positive impact on innovation, and that a dollar of venture capital could be up to ten times more effective in stimulating patenting than a dollar of traditional corporate R&D (Kortum & Lerner, 1998). In the same token 1 DKK of governmental funding into PVCs have been found to spur 5-10 DKK in extra growth (Dansk Biotek, 2010). Much research proving the innovative effects of VC-backing has been based on comparisons with non-VC-backed companies. Thus, the foundation for assuming that venture capital financing spurs innovation has been established.

Previous research have explored to what extend the innovative scope of a biotech firm may be attributed to its external innovation linkages (Reichstein & Valentin, 2007). This research have been based on the notion that collaboration has become fundamental in the innovation process, and that being open to external collaborators allow firms to draw on external sources of knowledge and capture opportunities (ibid.) Thus, the connections between biotech firms and external partners is highly relevant in terms of investigating innovation within this industry.

It has been established that VC-backing is to be considered in connection with innovation. However VC-backing as a general term covers a diverse group of owners, and to fully understand how VCs can contribute to the innovative scope of its investee company, one most understand the owners and the owner motives of the different types of VCs.

3.2 Venture Capital Motives

To understand how and why different VCs might impact the innovativeness of biotech companies differently, it is important to understand the VCs on a firm level. That is, what, aside from money, adds value to the VCs' 'portfolio companies' with regard to strategic management, headhunting, marketing, networking, certification and reputation (Luukkonen & Manula, 2007).

The reason why VCs are willing to invest in these high-risk firms is mainly the expectation that these high-growth firms will generate high returns, which will more than compensate them for their funding risk (Osnabrugge, 2000). However, besides

the economical prospects, depending on the VC-type, these might have other sub-motives for investing in a given biotech company at a given stage, which will have an impact on how, and to what extent, the VC is influencing the innovative product development process. The basic categories of motives for the VC can be divided into two: direct/financial and indirect/strategic (Seppä, 2000).

3.2.1 Comparative Studies

To understand how venture capital can spur innovation, it is necessary to know which resources go into an innovative process. The three important resources involved in innovation are entrepreneurial skills, managerial competence, and capital investment (Styhre, 2015). These must all be in place to achieve an innovative process and output (ibid.) How effectively these resources are brought into the startup by the VC dependents on the VC′s background and mission.

Few research papers have examined the differences between all four VC-types proposed by this paper. The theoretical framework developed in this paper will be based on a combination of what has previously been found in terms of the effectiveness of different VC-types.

Luukkonen & Manula (2007) found clear differences between VC-types in terms of overall value added in their investigation of the biotechnology start-ups in Finland. They raised the question of whether PVCs and related financial institutions are appropriate means of financing trial and error/experimentation in the life sciences and particularly in biotech drug discovery versus GVCs and BAs.

Osnabrugge (2000) studied the difference between BAs and PVCs in terms of their different approaches to limit potential agency risks in their investments. Built on agency theory, this paper conducted a detailed comparison across the full investment process, of the investment procedures and criteria of these two types of external financiers. It was found that PVCs tend to have more structured networks of referrers, and specialize more in certain industry sectors than BAs.

Lindström & Olofsson (2001) compared PVCs, GVCs and BAs in terms of their contribution to what can be qualified as monitoring functions, and found that BAs were valued most, followed by PVCs, and finally GVCs, in the early stage development.

Alperovych, Hübner & Lobet (2015) found in a study comparing the efficiency of GVC and PVC-backed firms, that the efficiency of GVC-backed firms would have been approximately 16% higher if they had received financing from PVC funds.

Thus, the literature has addressed that different VC-types have a different levels of impact on their investee company. Stuart (2000) found that the important determinants of the strength of an alliance-performance link is in the attribute profiles of the firms that an organization is affiliated with – not the mere fact that it is affiliated. (Deeds & Hill, 1996) found that not all alliances make an equal contribution to increasing the rate of new product development. The increasing complexity and specificity of the knowledge required in the product development process makes partner selection critical (ibid.) Deeds & Hill (1996) thus concludes that it is interesting to identify which alliance partners are most effective in speeding new products to the market, and identify which factors are most crucial.

3.2.2 Ownership and Strategy

The reason why it is reasonable to assume that venture capital companies might be adding nonfinancial value to a different degree, is because the venture capital process serves a different function to different types of players (Seppä, 2000). To some it is a tool of economic policy, others use it as a tool of corporate strategy, and thirdly it can be a direct source of livelihood (ibid.)

The VC-types can be viewed and studied as creators of jobs for an economy, providers of financial instruments for investors, providers of finance for entrepreneurial ventures or as vehicles of their owners (Seppä, 2000). Thus, the mission and desired outcomes vary between the different VC-types. To understand how different VC-types affect the innovative output of Danish biotech companies, it is thus necessary to understand who own the venture capital companies, why, and how. What are the venture capital companies engaged in producing, how and to whom (ibid.)? Answering these questions will shred light over the different corporate governance functions, which each VC-type deem most important. The *'who'* addresses the ownership of the VC, and thus relates to the obligation between the VC-type and its investors. The *'why'* addresses the mission; is it financial, sociologic, personal, expanding? Finally the *'how'* is the outcome of the two before mentioned questions and addresses the governance function, and thus the mechanism in which most of the nonfinancial value-adding activities depend.

Venture capitalist strategy logic has to do with ownership: personality of the owners, their activity and role in company management, nature of mission, dynamics of governance, and strategy (Seppä, 2000). The differences in actions can be addressed by asking the questions of which roles do fund-raising, entering, value-adding, and exiting play in the life of the investee? This paper thus assumes that there is a linkage between ownership and strategy in the venture capital company context, and that this strategy as a product of its ownership, impacts the innovative output.

The venture capital process can be seen as bringing together three primary stakeholder groups (Seppä, 2000): Funders, who send funds to VCs; venture capitalists, who channel the funds to portfolio companies; and entrepreneurs who offer the best investment opportunities. In this study, the funders are seen as the factor influencing how and why the venture capitalists focuses its strategy as it does. In turn, this strategy is assumed to have an influence on the entrepreneur, reflected in their innovative output measured in patents.

3.3 Stages of Development in the Biotech Development Process

This paper takes into account three broad categories: first, the four different VC-types, second, the four factors of innovative actions, and thirdly the stage of development of the startup. The final dimension is necessary to implement because the VC-types can be considered of different value to the innovative process, depending on the stage of development.

Lindström & Olofsson (2001) investigate the notion that there is reason to believe, that new technology based firms represent different levels of 'investment readiness. Hereby highlighting that there exists an interest in what roles different actors play in the product development. Their paper also takes into account, that the background of the investee company has an influence on what kind of expertise the company needs most from their VC. This paper will focus solely on biotech companies and their needs are assumed to be the same, given that they are in the same stage of product development.

4. Theoretical Foundation

4.1 The Four Factors of Innovation

How, the ones who own the VC, control for why a firm exists is referred to as governance (Seppä, 2000). Previous studies have found there to be profound differences in the complexity of governance between differently owned enterprises (ibid.) The actions and obligations put upon the VC-type depends on their ownership structure. PVCs work as representatives for their investors, GVCs function as representatives of the government, BAs operate in their own interest, and CVCs operate in the interest of their company's future earnings. Thus, the mission of these four VC-types is of different nature, and hence their governance and the mechanisms, which they wish to influence herein, are quite varying.

In order to determine how VC-types can differ from each other in terms of the nonfinancial value they are adding, it is necessary to know which factors have previously been assigned as the crucial value-adders. Based on previous literature (Davila, Foster & Gupta, 2003; Alperovych, Hübner & Lobet, 2015; Cumming, Grilli & Murtinu, 2014; Manula, 2006) this paper will distinguish between four factors of nonfinancial value-adding: 1) screening, 2) coaching, 3) monitoring and 4) signaling.

In the following section these four factors will individually be examined and discussed in terms of their value-adding contribution to the innovative process of investee companies.

4.1.1 Screening

When VCs assess which startups to contribute their money, time, and effort to, they look for elements of entrepreneurial passion (Styhre, 2015). Though, with different VC objectives, the entrepreneurial passion can be perceived from different perspective, and thus the efforts, emphasis and expertise in evaluating a potential entrepreneurial company is likely to differ between the VC-types. This action takes place in the pre-investment stage and is classified ad the screening process.

The screening process is a value-adding role of the VC, which begins even before the first investment has been made. This is due to the VC cycle of investing and VC process, which can be divided into four main stages: fund raising, entering, value adding, and exiting (Seppä, 2000; Gompers & Lerner, 2001). Before investing in a company VCs perform a valuable *'screening'* function in which they perform a

screening of potential investment targets. The screening process is very thorough, and through this function companies receive information on the ways in which investors think, they need to develop their strategies and 'routines' to become an investment target (Luukkonen & Manula, 2007). Thus, this incentivizes companies to comply to certain structures which should increase their chances of success.

VC investors pick their targets using stringent screening criteria and scrutiny in the selection process (Alperovych, Hübner & Lobet, 2015). This allows them to reduce information asymmetries around potential qualifiers prior to the initial investment (ibid.) The screening function can be seen as not only valuable to the investor company, but also to the investee firm.

The investment criteria set by different VC-types depends on the investment strategy of the VC. These investment criteria are commonly built on a combination of the following blocks: background and experience of founders, competence of management team, characteristics of markets, level of technology, and business plan (Manula, 2006). Manula (2006) found that the development of business plans or business strategies were by far the most common activity performed by the VCs.

Especially two valuable effects have previously been highlighted (Manula, 2006). First, the thorough evaluation induces the startup to achieve a certain standard in order to attract investors. Second, once a company has received venture capital financing, this signals to future investors, that this company has proven a certain value and standard.

Previous literature has found a difference in screening abilities between US and European VCs. In Europe, screening had been found to be even negligible, thus indicating low screening ability of European VCs (Cumming, Grilli & Murtinu, 2014). This might be explained by the higher level of development of the US VC market in financing entrepreneurial firms. Some argue that venture capital firms in Europe seem to be still lagging in their capacity to select projects, and that the US VCs have better screening skills than European ones (ibid.) This is an interesting note to keep in mind, because a less developed VC market in Europe could indicate that the PVCs, who have been appraised the most as adding value in the US, might not be the same for European firms, who have a less developed VC market.

4.1.2 Coaching

Once an investment decision has been made, the VCs perform a *'coaching'* function (Luukkonen & Manula, 2007). Coaching is also referred to as nonfinancial support, and can be divided into three category roles: strategic (sounding board, business consultant, and financier), social and supportive (coach/mentor and friend/confident) and networking roles (management recruiter, professional contact and industry contact) (Manula, 2006).

At this stage of the investment cycle, the VC provides management support to the companies in areas in which technology-based firms typically lack the necessary competencies e.g., strategic management, financial, administrative and marketing competencies (ibid.) It is at this stage, that the investee company can benefit from the VC's network of business contacts. Two important notes can be made at this point in regards to the difference in nonfinancial value added by different VC-types. First, the degree to which a biotech company can benefit from the VC's network depends on the extent and strength of the VC's network, which is likely to vary between the different types. Secondly, the kind of coaching needed, will depend on the development stage of the company (Luukkonen & Manula, 2007; Gorman & Sahlman, 1989). Thus, one type of VC might be better equipped at adding nonfinancial value in the early stage, when the roles of financier, management recruiter and provider of contacts is found more important, compared to when the company enters a more mature stage (Luukkonen & Manula, 2007).

Previous research has found the three categorized roles, strategic, social and supportive, and networking of varying value to the startup.

Seppä (2000) found that most VC-types consider participation in strategic planning of highest value in terms of adding nonfinancial value, and that corporate governance was of second highest importance. This suggests that the VCs, who are most experienced in performing these activities, will add much value through coaching.

In terms of serving as a social and supportive role, some literature have regarded this as the most contributing factor, based on the notion that the more closely knit relations between VC investors and CEOs are, the more the risk of failing is reduced (Styhre, 2015).

Management and the importance of networks are appreciated by several studies, not just within venture capital literature, but also in the field of innovation itself. The way

management affects the startup is through advisory and involvement services, provoking an internal restructuring of the management teams and their compensation structures, assistance in strategic and operational management, professionalization, headhunting, and additional fundraising (Alperovych, Hübner & Lobet, 2015). Further, VC investors capitalize extensively on their network of contacts to enhance the scale and empower the growth of ventures that they fund (ibid.) Especially the networking capabilities have been of interest in the nonfinancial value-adding literature of VCs.

Chang (2004) found that entrepreneurs should develop strategic alliances with prominent firms to access social, technical, and commercial resources, since these alliances would reduce the liability of newness and improve performance. Shan, Walker & Kogut (1994) found that commercial ties are a powerful explanator of innovation output, and that the network structure thus has an indirect implication for startup success.

Some researchers have further examined the ways these networking relationships are established. Pina-Stranger & Lazega (2011) states, that focusing on inter-organizational relationships only from a contractual perspective contradicts the theoretical and methodological context, that stresses the importance of social networks for the emergence, development, performance, and innovation capacities of organizations. Thus, the effectiveness of a VC′s nonfinancial value-adding is very much suggested to be influenced by its social abilities to form networks.

The chairman of Dansk Biotek, Søren Carlsen, (*Dansk Biotek*, 2011a) notes that success cannot just be measured in financial returns, but that the general conditions such as understanding of the scientific ideas and the ability to implement an invention in the fitting commercial context are important competences and factors on which to evaluate VC offices.

The value of a VCs network can be measured on both a qualitative and quantitative scale. On the one hand, VCs with a vast and wide network will have more resources to transfer to the startup. On the other hand, the value of networks is only as valuable as the knowledge and expertise these networks can contribute with. Further, the resources the VCs′ can subtract from its network, might be dependent on its ability to form trustful relationships with both its external partners and the investee company.

As stated the coaching function consists of many nonfinancial value-adding mechanisms. The literature doesn't give any unanimous answer to which factor is most contributing, though networking have received quit a vast amount of attention. The investigated VC-types place a varying degree of emphasis on the different aspects of the coaching function. This paper assumes the different aspect of coaching to be of varying value to the investee, in relation to its stage of development.

4.1.3 Monitoring

As the drug development process progresses, the VC performs continuous '*monitoring*' of the activities of the investee company. Gorman & Sahlman (1989) found the VC's role as primarily a monitoring function, and the degree to which the VC performs this activity can thus be deemed as quite important in terms of the VC's nonfinancial value adding function.

In the venture capital industry, the environment is characterized by a high degree of information asymmetry between VCs and entrepreneurs, because the VCs and the management teams are likely to have different information about and objectives for the future of the firm (Manula, 2006).

The monitoring can be performed through corporate governance mechanisms such as contractual arrangements, financial reporting systems, having representative(s) on the board of directors (Luukkonen & Manula, 2007; Alperovych, Hübner & Lobet, 2015) staging of capital infusions, and the use of convertible securities (Alperovych, Hübner & Lobet, 2015). Further, the mechanism involves syndicates of investments with other investors, measuring accurately and timely the performance of the firm, implementing incentives to exit, and provide active monitoring (Manula, 2006; Gompers & Lerner, 2001). Thus, to meet the agency risks, the VC investors monitor closely, control, and involve themselves actively in their portfolio firms after financing.

The monitoring helps the investee company to achieve the milestones set for them by the VC. The degree to which the VC adds value through monitoring thus depends on their requirements to contractual arrangements and the financial reporting systems. Further, it depends on their representation on the board of directors.

Manula (2006) found that including veto-rights in investor contracts and staging financing, are the most commonly used mechanisms of monitoring. Contractual

arrangements aim a shifting risk from the VC to the entrepreneur and keeping management "under pressure", giving it correct incentives to exert effort (Manula, 2006). Including appropriate incentives in the contracts, e.g., performance-sensitive remuneration, covenants, and convertible securities can motivate the management.

Gompers & Lerner (2001) also highlight staged capital infusion as possibly the most important control mechanism a VC can employ. Just as with the contractual arrangements, the staged capital infusion keeps the manager on a "tight leash", and reduces potential losses from bad decisions (ibid.)

Seppä (2000) found that all VC-types emphasized the role of the board of directors as the key authority. Thus, the VC-types who are most effective in getting members on the board are also most likely to have the power to be value-adding in the company.

The role of VCs on the board of directors includes providing advice and monitoring (Manula, 2006). The extent of involvement has usually been measured by the amount of interactions between the lead VC and management team, or by asking the investee to estimate the level of involvement of the VC in terms of their contribution to the activity (ibid.) An important note to be made is that investee companies might have a different perspective on what is most value-adding compared to that of the VC. This paper assumes that given the innovative nature of biotech companies, what investees perceive as most value-adding might be more in line with what creates innovative value, compared to VC's. The VCs are likely to perceive the monitoring functions, which add value to their subjective mission, as most valuable to the development process.

Introducing sound corporate governance procedures is essential no matter whether the next step of development of the investee company is an IPO, a trade sale, or even a further round of venture capital financing (Manula, 2006). The mechanisms of monitoring discussed in the previous paragraphs suggest, that VCs provide value-added to their portfolio companies through monitoring and corporate governance. Thus, the experience and degree to which the different types of VCs perform their monitoring role can have a significant impact on the product development process, and hence the innovative output.

The importance of the monitoring function is dependent on each investee's need for assistance, willingness to accept advice, the VC's expertise relative to the industry,

and personal relationships with management (Seppä, 2000). On the investee level, their needs and willingness to accept advice is assumed to be equal for each startup. This assumption can be made on the basis, that only biotech companies within the same region are being included in this study. On the VC level, it is for this paper to investigate whether their expertise and personal relationships differ between VC-types.

4.1.4 Signaling

The final important mechanism of the VC is its *'signaling'* effect. The VC's support to a company gives a signal regarding the firm's quality to its stakeholders (Luukkonen & Manula, 2007). The reputation and experience of VC sponsors play a critical role in facilitating growth and certifying the quality of a venture (Alperovych, Hübner & Lobet, 2015). Puri & Zarutskie (2012) found evidence, that VCs with a high reputation, and thus a high signaling value, generally had higher returns, which would stem from a higher innovative output. The endorsement benefits, that VCs may implicitly provide, consist of all the help associated with a VC, which it brings in the form of increased legitimacy, when attracting new investors, employees, partners, and customers (Manula, 2006).

Signaling is closely related to the VCs function as a provider of contact networks (Manula, 2006). Manula (2006) found that the investee companies would perceive VC investors as most useful when acquiring finance. However, it could also be supported that VCs help in the value-adding processes of attracting investors, customers, partners and employees (ibid.) Besides providing the contacts, VCs may convince the stakeholders about the capabilities of the company and the management. The VCs function as an objective professional, which can help convince potential new investors to join the investment.

The signaling effect has especially been found to be important in the context of exists (Luukkonen & Manula, 2007). Shan, Walker & Kogut (1994) found that established firms look for confirmation of a startup's potential in the capital market, before entering into an agreement with it. These findings highlight the importance of the signaling effect to other investors, and the fact that in each investment round it might affect how many investors the startup can attract based on its current VC investor(s).

Building on the previous paragraph, and grounded in signaling theory, Davila, Foster & Gupta, (2003) identified a significant shape that grows before the event of a venture capital funding and accelerates in the months after the event. These results are

informative about the signaling value of venture capital funding events as well as the credibility of the signal (ibid.) Chang (2004) specifically assigned attention to the final stage of exiting, and found that entrepreneurs should get funding from respectable venture capital firms so that they can enjoy the spillover effects of these firms′ reputation.

Given that VC-backing does have a significant signaling effect, this paper will investigate further, whether a certain type of VC is capable of increasing the signaling credibility more compared to that of another. More specifically, it will investigate if the credibility value of the VC-type is also dependent on the stage of the product development.

The degree to which the VCs can add nonfinancial value via signaling effects depends on how important it is for the specific VC-type to maintain its signaling effect (Manula, 2006). One factor affecting this motivation of the VC is, that the VC must have reputational capital at stake that will be damaged if their certification turns out false. A second factor is that the investee company must face a cost from leasing the VC′s reputation that is increasing in the uncertainty of the value of the investee (ibid.) If the investee does not face a cost from leasing the VC′s reputation, then they will not be induced to be more innovative in order to maintain it. In that case, the VC risks that the investee is freeloading on the VC′s reputational benefits, which in fact could have the opposite effect on the startups innovative efforts.

Thus, first of all, certain VC-types might be more attractive in the eyes of stakeholders, and thus attract more investors; increasing the resources for the investee company to be innovative. Secondly, if one VC-type is perceived of higher value to the investors, this VC-type could significantly influence the interest of investors at the later stages of the drug development. Thus, investee companies with this VCtype at the maturity and exiting stage of their product should perform better, than investee companies with a less attractive VC′s support at this stage.

4.2 Stages of Development and Theoretical Ranking

The previous section identifies the four factors of value-adding, which this paper will use as foundation for evaluating VC correlation with biotech startup innovation. However, the effectiveness and usefulness of these factors are likely to depend on the stage of development of the startup.

A vast amount of literature has been focusing on the VC side of the relationship between VCs and their investees. Gorman & Sahlman (1989) found that it is conceivable, that VCs tend to specialize in terms of the stage at which they invest and the role they take. This could indicate that certain VC-types are more specialized in serving the investee at one stage rather than another.

Following this notion, different VC-types might systematically choose companies in different stages of their life, and there may thus exist a correlation between the stage of the product development, and how well the company manages to add nonfinancial value. A positive correlation in this matter can be the result of mainly two factors; one, if the VC-type has a preference for a certain stage, they might have acquired the experience and knowledge, that makes them most effective in terms of adding nonfinancial value to the innovation process at that given stage. Second, one type of VC might be performing best overall, meaning that regardless of he stage of development, a positive correlation between patenting and investment from this VC-type will exists. If a certain VC-type mainly invests in the maturing and later stages, its effect on the early stages cannot be captured. This would present a situation in which the data will have difficulty in capturing the effects of a VC that overall is most capable of adding nonfinancial value.

According to Seppä (2000), the ownership related concerns and product-market strategies of the VC, as well as its location in the venture capital process, all vary according to the choices and preferences of the VC. This indicates that VCs tailor their strategy to a specific stage of the venture process, and thus emphasizes that different VCs might perform best at different stages.

Dynamics of innovation shifts according to a cycle of discovery in which different phases may be overlapping (Reichstein & Valentin, 2007). Moving along the cycle of discovery the mindset of the firm also shifts with respect to innovative activities. The shift between innovative regimes has significant implications for the network structure of a given firm. It is suggested, that the composition of partner types in networks should change as the innovation regime shift stage in the cycle of discovery (ibid.) The literature thus suggests, that indeed it is sufficient to assume that VCs differ in their value-adding advantages and abilities, as the startup develops and changes its need for support.

The following section will examine what previous literature has found in terms of the needs of the startup at different stages of the development. These stages have been divided into early, maturing and exiting stages. The early stage includes the pre-

clinical stage and phase I of the drug development process, maturing stage includes phase II and phase III, and the exiting stage is defines as the product being on the market. The separation and classification of the drug development process follows the classification by Nordic Life Sciences. The separation of the process into these three stages is very important in order to measure the alignment between what the biotech company needs, and what a given VC-type provides.

4.2.1 Early Stage

The pre-clinical testing and phase I trials are where the first financing is injected into the biotech company. The startup has successfully gone through the VC′s screening process and has been accepted into the VC′s investment portfolio. This is the stage when a scientist has an idea and is just starting to form a company. In this phase, the company is defining the concept underlying its business plan (Föller, 2002).

In biotech, new companies are often based on original ideas and new products. The founders thus need good networks of relationships and knowledge of the market in order to be able to raise the venture capital needed for growth (Carlsson, 2002). Further, being passionate about the technology can help on a more psychological level in terms of motivation and stamina required to overcome the obstacles of this stage (Oliva, 2014). In the initial stage, start-up firms are highly dependent on local actors (ibid.) Within policy-making circles, venture capital has been considered to be an important mean of funding early stage ventures, and hence facilitating entrepreneurship, innovation, employment and general economic growth (Manula, 2006).

The early stage of development is the exploratory stage, which requires an in-depth understanding of stand-alone, science-based knowledge (Reichstein & Valentin, 2007). At this stage a dense network and the creation of a network with high levels of diversity, on the input side, of the knowledge creation process, are almost necessities in an exploratory innovation regime (ibid.)

Gompers & Lerner (2001) suggest that due to higher levels of information asymmetries in the early stage, monitoring is most valuable and effective at this stage. Thus, startups who are financed by VCs, with a high incentive to be innovative and with an effective monitoring system, will be most likely to add value to the innovative process through monitoring in the early stage of the investee.

The seed and start-up stages are the most risky stages of a venture's life, and the most difficult ones to manage for a VC (Seppä, 2000.) The entrepreneurs at this stage often have little or no experience in building a business, the economic arguments for their ideas remain unproven, and the markets for their products are unknown (ibid.) Thus, VCs entering at this stage must have the capabilities to provide supporting functions in these areas.

4.2.1.1 Theoretical Ranking I

Based on the this theoretical foundation, this paper suggests the following ranking of importance of the value-adding functions:

1. Coaching

Specifically the VC's networking capabilities in order to attract technological knowhow and knowledge on the market are very important. Further, a passionate, likely more personal supportive role of the VC is helpful to motivate the investee at this stage. The personal relationships have been found to be most efficiently established in situations of close geographical distance. Finally, strategically the VCs with most expertise in building businesses are most likely to add the nonfinancial value, which the investee needs at this stage.

2. Screening

Given that the screening function is a pre-investment mechanism, this function is most important in the early stage compared to the two following stages. The most value-adding screening function is the kind that promotes development of strategies, and decreases information asymmetries between the VC and the investee.

3. Monitoring

The early-stage is considered to have a high level of information asymmetry, thus building on the previous paragraph, also monitoring is most effective when it can limit information asymmetry. The monitoring at the early stage is likely to be more effective when the relationships are built on trust and shared passion, rather than contractual agreements.

4. Signaling

The signaling function is considered to be least value-adding at this stage, though by no means unimportant. For the business to continue its venture it is important that it can attract further investment. The performance of the product is still highly uncertain, and a credible VC certification can possibly make potential new investors more willing to invest in the company, compared to less known VCs.

4.2.2 Maturing Stage

In the maturing stage, the output can be considered projects, which refers to clinical tests of drug candidates in phase II and phase III (Valentin, Dahlgren & Jensen, 2006). The value of a drug candidate increases notably when proven feasible for clinical trials. The clinical tests are very costly, so it is beneficial to the biotech company to carry them out in a contractual arrangement. The maturing stage is when the exploratory stage moves into a more exploitation-oriented stage.

Compared to the early stage, great technology alone is now not sufficient to bring a product further in the process (Oliva, 2014). This stage is also known as the commercialization stage. While the biotech is very dependent and influenced by the VC′s coaching in the early stage, the importance of the VC′s involvement reduces as the company matures (Manula, 2006). Especially the roles of financier, management recruiter and provider of contacts become less important (ibid.)

Instead, a need for contractual expertise, understanding of the market and its dynamics, development of concrete routes for commercializing the product and business plans, assurance of sufficient funding to bring the product to the market, definition of the first controlling and budgeting processes, and a general implementation of professional processes are required in at this stage (Föller, 2002).

4.2.2.1 Theoretical Ranking II

This paper suggests the following ranking of importance of the value-adding functions:

1. Monitoring

Monitoring becomes very important at this stage in terms of formulating contractual arrangements and implementing financial reporting systems, to ensure the controlling and budgeting function.

2. Signaling

Commercialization of the company has become a main focus to ensure the progress of the company. The signaling at this stage must thus have the reputation value to attract customers, commercial partners, and employees. The continuous survival of the firm is dependent on its ability to attract more funding for the costly clinical trials.

3. Coaching

Coaching can be considered of close to or equal value as signaling. The coaching function at this stage is most value-adding in its networking abilities. The networks and strategic alliances at this stage should be with prominent firms to access commercial resources; such alliances can reduce the liability of newness.

4. Screening

Finally, the screening function is of least value. However, it can still be important in the sense of possible restructuring of the company in order to attract new investors. Currently, many VCs don't enter until the biotech company is about to or already has left the early stage phase, thus the screening function can still induce maturing companies to restructure in order to attract more investors.

4.2.3 Exiting Stage

At this stage the product has reached the market, and it is now that the management team can create expectations of achieving an IPO. The focus shifts from project to transaction. At this stage business strategies become increasingly important, along with revenue, and cost management. The company needs to demonstrate its marketability by making alliances, deals, and strategic partnerships. The role of the management is being suggested to have a "big industry" background (Föller, 2002).

The main company goals at this stage are to maximize investor return, and prove that it can keep promises to business partners, investors, and the general public (Oliva, 2014). Taking an active role in the board of directors is considered very important at this stage. Throughout the whole venture cycle the board of directors plays a key role, but it is especially at this stage, where considerations regarding exit timing, strategies and external communication, that the board becomes very valuable to the finalization of the company.

4.2.3.1 Theoretical Ranking III

This paper suggests the following ranking of importance of the value-adding functions:

1. Monitoring

At the exiting stage the VCs ability to implement incentives to exit, time it, and strategically execute it, becomes crucial to the company. Further, the mechanisms involving syndicates of investments with other investors become important in order to create alliances and strategic partnerships.

2. Signaling

In line with the incentive to get and IPO or find an M&A opportunity, the signaling value of the VC is very important to attract investors or potential buyers.

3. Coaching

The networking roles are still important at this stage, however the signaling value can to some extent be said to compensate for this mechanism. The networks should constitute of highly professional relationships, for instance with big industries or prominent investors. The personal relationships become of a lot less value as

compared to the early stage. Professionalism in the business strategies becomes the key necessity.

4. Screening

The incentive to comply with structures, which can attract more investors, can still be a motivating factor, however this task has become more of a task in the board of directors and thus a monitoring value-adding function.

A summary of the ranking can be seen in **Appendix 1**

In the following section the four VC-types, GVC, PVC, BA and CVC will be reviewed in their ability to perform the four factors of non-financial value-adding activities, screening, coaching, monitoring, and signaling, in a framework which emphasizes at which stage the given VC-type is theoretically most likely to contribute the most.

5. Theoretical Framework

5.1 The Four VC-types

Seppä (2000) distinguishes between two venture capital classifications: individual and institutional. The individuals can be either BAs or PVCs. The institutional investors are either CVCs or GVCs. The CVCs can be further classified as either captive or independent, and the GVCs as either national or regional. This paper will focus on captive CVCs, that is VCs owned by a larger pharmaceutical company, and regional GVCs within Medicon Valley in Denmark.

Gomper and Lerner (2001) acknowledge in their study on venture capital, that it is not only the classical PVC that contributes to the capital of small and young startups, also BAs and CVCs are actively providing capital for these firms.

Pina-Stranger & Lazega (2011) characterizes the biotech industry as divided by public research centers, investors, and large pharmaceutical companies when it comes to the access of resources for biotech companies. In the milieu of biotech entrepreneurs, certain actors are considered experts in one or several of the fields of scientific, financial, and industrial knowledge (ibid.)

As can be seen from these literature findings, identification and classification of the different VC-types is valuable research in order to build a theoretical framework that can define the strengths and weaknesses of each VC. This has be done in the following section.

5.1.1 GVC – Public Venture Capital

a. Screening

i. Early Stage

The screening function of GVCs has been found to be very much like a selection process akin to credit risk acceptance (Alperovych, Hübner & Lobet, 2015). This kind of screening is suggested to be more suitable for traditional sectors with more stable cash flows, and less for high growth industries, that don't have the same streamlined nature. For the GVC to add a high level of value-adding, it can thus be suggested that it depends on the specialization of the GVC. GVC specialized within biotech finance are expected to promote development of strategies with the proper criteria to spur innovation.

The screening process can also depend on incentivizing compensation plans. The GVC funds are not used for setting up performance-based compensation structures, thus their managers are less likely to have incentives to select the best possible target (Alperovych, Hübner & Lobet, 2015). This lack of incentive from the VC perspective lowers the value-adding. Another value-decreasing factor is the fact that in public organizations the employees do not have their own money at stake, thus they do not suffer directly from bad or good performance of the portfolio companies of the organization (Luukkonen & Manula, 2007).

It has been argued, that it is the task of the public sector to support in the early stages (Klofsten, Jonsson & Simón, 1999). GVCs are thus known to face pressure to invest in marginal quality projects to compensate for market imperfections, and to keep them "alive" in order to ensure employment (Cumming, Grilli & Murtinu, 2014). The fact that GVC are pressured into investing in marginal quality project doesn't necessarily mean that their screening function isn't of value, but it does suggest, that the requirements of the investee to restructure might not be as high as that of other VC-types. Manula (2006) found that biotech startups with GVCs as their lead investor, more often had made changes in the composition of the management team and made other rearrangements in the ownership structure of the company before investment. So while the pressure to conform to certain standards might not be set as high by a GVC as compared to another type, the GVC does incentivize the potential investee to reconstruct. It might in fact be because of the lower criteria set by GVCs, that these can encourage startups to comply with their requirements. The requirements of a different VC might be too high and thus discourage early stage startups from even trying.

Further, given that GVCs spend public funds, these VCs are also subject to public scrutiny and interest in how their tax money is spent (Manula, 2006). The GVC must therefore demand a well-rounded insight into their companies' business, and thus information asymmetries a likely to be decreased greatly.

ii. Maturing Stage

Some GVCs state that they are not 'obstetricians' throughout the entire lifespan, but only until the project is interesting enough to stand on its own (Jensen, 2015). The arguments here are first, that public bodies should directly provide access to the necessary resources and, second, stimulate private actors to invest commercial money

(Klofsten, Jonsson & Simón, 1999). These two arguments suggest that as the product development process expands, the company should not aim for attracting more GVC funding. Further, the GVCs are mostly targeted at early stage companies; their screening function can therefor be suggested as to be tailored for early stage companies, and thus most beneficial as an incentive at this stage. The GVC value-adding from screening at the maturing stage is hence considered low.

In fact, if the ability to apply for GVC funding becomes too available, the screening might have a negative effect on the investees. If the GVC in comparison to other investors is easier to obtain, the availability of it will discourage investees from setting higher standards, while also discourage other VCs from making their funds available until the project becomes less risky. Lindström & Olofsson (2001) states that the mere presence of governmental actors makes it possible for the market-based actors to avoid the high-risk ventures, and instead they enter later on, when the risks are reduced.

iii. Exiting Stage

Finally, at the exiting stage, the biotech is searching for private investors or buyers, and the GVC screening is at this point considered of insignificant value-adding.

b. Coaching

i. Early Stage

GVCs can be pressured into investing in projects that are geographically remote. The GVC is hence used as a mean to compensate for market imperfections (Cumming, Grilli & Murtinu, 2014). As suggested by the literature, personal relationships have been found to be more efficiently established in situations of close geographical distance. While the GVCs in this paper are within the same national boundary, it can still be argued that GVCs, funding biotech companies in a different regional area, will be of less value-adding power. However, in the Danish culture of openness and collaboration between universities, healthcare professionals, and industry, suggests that there is close collaboration within regions, and that the GVCs concentrate regional initiatives, such that it can be committed to achieving the best possible coherence and synergy between research, training, innovation and uptake of welfare solutions (Ministry of Foreign Affairs, 2014).

The fact that GVCs can be considered an infusion made to create socioeconomic value suggests, that the passion and personal interest from the GVC is relatively low.

Again, the fact that the GVC is investing public funds lowers the GVC′s incentive to get deeply involved in their investee company.

Manula (2006) found GVCs to be perceived by the CEOs of their investee companies to be of least know-how on the biotechnology business, and even to a degree where it was mentioned as a reason for a failure of fulfillment of expectations. Thus, unless the GVC is specialized within biotechnology, they will be of low value adding in terms of technological knowhow and knowledge. However, the public sector is a major organ with access to a vast amount of industries, and has networking capabilities of high value. The political networks, that GVCs have access to, are often very valuable and beneficial to the entrepreneurial firm (Cumming, Grilli & Murtinu, 2014). Though, while the technological knowhow brought in by the GVC might be of low value, their ability to connect with the necessary sources of knowledge is highly value adding.

ii. Maturing Stage

At the maturing stage, the GVC is of high value in terms of its networking abilities. The connections, which the GVC has within its political framework, could include both government-related suppliers and customers (Cumming, Grilli & Murtinu, 2014). These connection are acknowledged for their ability to expand the investee firm′s set of opportunities in order to maximize growth (ibid.)

iii. Exiting Stage

The value of the networks that the GVC has, is its key strength as a coaching function. At the exiting stage the importance of professional relationships makes the GVC of high value at this point in the development stage. The lack of personal relationships, that the GVCs level of value-adding suffered from at the early stage, is now much less important. The professionalism makes the GVC of high value-adding efficiency in the exiting stage.

c. Monitoring

i. Early Stage

As previously mentioned, being a public sector fund sets certain standards and requirements for disclosure, when the GVC decides to fund a company. This means that GVCs must base its relationships on contractual agreements. Further, due to the minimal personal involvement in the projects, neither the GVC nor the investee would be likely to have the trusting and knowing relationship with each other that would dissuade them from even considering to have a non-contractual agreement. The literature suggests that monitoring at the early stage is most incentivizing when it is

based on shared passion, a lower level of value-adding can hence be presumed at this stage.

It can be argued that the investee only discloses the information, which is an absolute requirement from the investor. This might not decrease the level of information asymmetry to the same extent as it could in a more passionate entrepreneurial relationship between investor and investee.

ii. Maturing Stage

At the maturing stage, the contractual expertise and requirements shift from being a disadvantage to becoming an advantage. Luukkonen & Manula (2007) found that GVCs and PVCs were more active than BAs in monitoring financial performance and corporate governance, and obtaining additional financing. This finding confirms the suggested theory, that the GVC becomes more value-adding due to its corporate governance experience.

iii. Exiting Stage

GVC funds often operate with an unlimited lifetime and their exit strategy is less clearly defined (Alperovych, Hübner & Lobet, 2015). Although it is possible that these funds have statutory life-span limitations, mostly, once introduced, they become difficult to 'kill off' (ibid.) According to Seppä (2000) GVCs are so called 'care-takers', where value-adding is the thing-in-itself. Fund raising is the mean to add value, and the entering and exiting are the mere technical stages necessary on both sides of the value-adding stage. These findings suggest, that the GVC is not highly motivated to implement incentives to exit, and the value-adding in this regard is medium to low.

Another factor influencing how the GVC manages its monitoring function is the outside pressure. GVCs have been found to have a lack of independence in decision-making because they face political pressure not to fire founding entrepreneurs (Cumming, Grilli & Murtinu, 2014). Thus, even with great board representation, the board might be operating more in favor of its own socioeconomic interest, which might not be in alignment with what spurs most innovation and creates most nonfinancial value in the investee company.

The GVC's ability to create syndicates of investments with other investors is its main strength at this stage and it's key monitoring value-adder around the exit.

d. Signaling

i. Early Stage

Luukkonen & Manula (2007) found that GVCs have an ability to strengthen the signaling effect. Given that GVCs are incentivized by job creation and general socioeconomically objectives, they are perceived by other investors as a guarantor of risk. Alperovych, Hübner & Lobet (2015) found that the presence of public investors in the first financing round have a positive effect on the future efficiency of a portfolio firm. Further, the implicit pressure from tax-payers to invest their money, to make at least some profitable investments (Manula, 2006), gives the GVC a certain level of credibility in the early stage.

GVCs are, in the Scandinavian society, almost expected to be the first source of finance, and therefore their investment at the early stage is seen as the first indicator of a potentially prosperous project. GVCs are known to other investors, their credibility is hence not being questioned to an extent that is damaging to its signaling value. The high requirements from the public on disclosure of the GVC investments, makes it easier for potential investors to acquire knowledge on the technological development of the project. The GVC is thus considered of high value-adding at the early stage.

ii. Maturing Stage

GVCs are not subject to the same level of stringent financial return requirements as some of the following VC-types (Alperovych, Hübner & Lobet, 2015). Because they don′t need to be attractive in the eyes of investors the same way as PVCs they are unlikely to bear reputation constraints, and thus they do not need to worry about raising follow-on funds (ibid.), at least not to the same extent as some of the other VC-types. This indicates a low value-adding function at the maturing stage.

In fact, GVCs entering at a maturing stage can be seen as a preemptive strategy to avoid the closedown of a startup, simply to ensure employment. In such case, it can be argued that the GVCs serve to uphold a dead floater rather than directly spurring the innovative output. Chances are, that such injection is of more financial nature than strategic and nonfinancial value-adding. This suggests that the function as a ′care-taker′ (Seppä, 2000) in terms of signaling value decreases this value, because the GVC′s motive for staying in business is being questioned. The GVC might be keeping bad startups alive due to their pursuit for indirect, strategic, economic-policy related gains (Seppä, 2000).

The one positive factor that the GVC can contribute with to increase its signaling value at this stage, is its networking abilities. The research by Luukkonen & Manula (2007) is based on earlier research findings suggesting, that VCs may help in attracting, not only other investors, but also customers, partners, and employees. All factors which can support the release of resource in the biotech companies, allowing them to focus more intensively on the R&D. While this has some positive value to future investors, the overall argument is that GVC are of low signaling value at the maturing stage

iii. Exiting Stage

As mentioned the pressure to exit is quite low, and the GVC might not itself be incentivized to increase its signaling value in order to exit. Further, if a company has been highly dependent on a GVC throughout its entire development, this could send a bad signal to investors. It is arguable that investors or potential buyers will question if this company is still alive due to its technological accomplishments or due to the socioeconomic pursuits set by the government. The signaling value of the GVC at this stage is therefore low.

5.1.2 PVC – Private Venture Capital

e. Screening

iv. Early Stage

The nonfinancial value added through screening made by PVCs has been found to be valuable, at least from the perception of the investees' CEOs (Manula, 2006).

PVCs are highly motivated by their investors to make good investments. A crucial determinator for how PVCs choose which companies to invest in is their obligation to demonstrate competent behavior to their fund providers. This involves competent screening, due diligence and contract formulation, before the investment is made (Osnabrugge, 2000). The external pressure requires for the PVC to have very high screening demands. This suggests, that PVCs indirectly add a high level of value to the investee, since these must prove themselves to a certain standard in order to attract this type of investor. The investee is thus highly incentivized to promote its development of strategies and disclose the information necessary to attract an investor.

The fact that PVCs encourage restructuring is also confirmed by the literature. Lukkonen & Manula (2007) found that the high screening demands severely pushed

the small companies to improve their activities in order to fulfill the investment criteria.

While information asymmetry has been found to be lowest in more personal relationships between investor and investee, it can be argued that PVCs are of such value to the startup, that the startup is willing to disclose more information in order to attract investors. However, startups do keep their innovative knowledge quite closely, as this is their livelihood. Given that PVCs might have other biotech companies in their portfolio, which could benefit from this knowledge, the biotech's willingness to disclose more information must be taken with a grain of salt.

v. Maturing Stage

The PVCs have been found to largely be focusing on the maturing stage of the product development when entering the company (Lukkonen & Manula, 2007). Thus, it is at the maturing stage that the PVC mostly screens for new investments. On the one hand side, the increased focus by PVCs to enter at the maturing stage suggests, that they are specialized in screening companies at this stage. On the other hand, this is not to say that the PVC wouldn't be able to create the same incentives at the early stage. Nonetheless, the specialization in focusing on the maturing stage makes PVCs of high value in the maturing stage.

vi. Exiting Stage

At the exiting stage the company will be looking for buyers or getting an IPO, and it will thus be the requirements of these agencies, that will spur efficiency enhancing efforts.

f. Coaching

iv. Early Stage

The networks that PVCs can contribute with are often from its portfolio of companies. Thus, a PVC with many biotech or pharmaceutical companies in its portfolio will have a vast network supplying technological knowhow. Since PVCs vary in nature it is difficult to make a general statement on the PVC's ability to add value from such networks. Some PVCs specialize in industries, while others attempt to diversify between industries in order to diversify risk.

Companies backed by PVCs have been found to have more CEOs with a management background rather than a research background (Lukkonen & Manula, 2007). This emphasizes that PVCs are reliant on its networks to add technological knowledge.

However, the highly important expertise in building business is the value, which the PVC is high on implementing.

An important incentive for PVC to be coaching their company in the most innovative way, and hence most profitable direction, is first of all its obligation to its investors. If the PVC doesn′t manage its investors′ money effectively this will reflect badly on the company, harming its ability keep, or to attract investors. Secondly, PVC managers often have a compensations structure with a fixed fee and a performance fee, with hurdle rates, and clawbacks in the event of poor performance (Cumming, Grilli & Murtinu, 2014). Such compensation is highly motivating for the managers to constantly be improving performance. This incentive suggests, that PVCs might be adding more nonfinancial value to the company in order to achieve more value. The managers are therefore inclined to personally involve in their investee and hence contribute with a more passionate relationship. Though, the passion of the manager might be differently rooted compared to that of the entrepreneur. The PVC can thus be considered of overall adding a high degree of nonfinancial value in the early stage.

v. Maturing Stage

The value, which the PVC brings in the early stage keeps being valuable in the maturing stage, though with the value of personal relationships decreasing. However, the personal motive to be compensated for good performance remains a value-adding mechanism of the PVC. Though, a note on the compensation in correlation with the value added ought to be made. Performance is likely to be measured in patent output, which should indicate the before mentioned alignment of motivation to create innovation. However, the management of PVCs might push for patenting of perhaps less innovative findings in order to boost its own compensation. This would create a false image of the innovation of PVC-backed companies, compared to that of other investors.

PVCs have been appraised by the literature as being better at developing their portfolio companies (Cumming, Grilli & Murtinu, 2014), and as being the most active lead investor in corporate governance (Manula, 2006). These findings suggest that indeed PVCs add value through coaching.

PVCs often help startups by providing managerial advice, recruiting senior manager, and arranging alliances with potential customers and suppliers to increase the chance that these startups becoming successful (Chang, 2004). Further Luukkoenen & Manula (2007) found that PVC-backed companies were relieved more from involving

in other administrative services, and were thus provided more time and resources to develop their products and other activities. Thus, this could be interpreted as the PVC adding the administrative resources needed to push the product into the market, such that the biotech can devote more of their time and costs in the R&D function.

What all these findings suggest is, that PVCs add a high level of nonfinancial value, also at the maturing stage.

vi. Exiting Stage

The main objective of PVCs is to eventually finalize their project either by selling it or through an IPO. They are thus specialists in coaching at the exiting stage. Their networks consist of the professional relationships necessary to get the highest value at exit, thus they will also be highly valuable to the company at this stage. The PVCs' relationships with big industries will depend on its portfolio.

g. Monitoring

iv. Early Stage

The PVC does not comply with the notion that monitoring is more effective when relationships are built on trust rather than contractual agreements. Opposingly, PVCs, institutional investors, and fund managers contract with each other to effectively set the terms upon which, the funds will be invested into entrepreneurial firms (Cumming, Grilli & Murtinu, 2014). However, since PVC funding isn't based on a personal relationship in its nature, the covenants and clauses mitigate agency problems in fund management, and are hence suggested as to facilitate maximization of returns and investee performance (Cumming, Grilli & Murtinu, 2014). The information asymmetry is thus limited to the extent that can be expected by a PVC to achieve. The monitoring value-adding at the early stage can thus be said to be of medium quality.

v. Maturing Stage

The contractual arrangements now become the strength of the PVC. Further, the legal independency in terms of not having to comply with the socioeconomic requirements of the government means that the PVC is freer to make reconstructions within the company (Cumming, Grilli & Murtinu, 2014). Thus, needs for replacement of employees, who might not meet the company needs in order to grow, can be met without facing pressure to pursue nonfinancial related goals, such as employment maximization (ibid.) Thus, if the company does not have the management necessary

to implement financial reporting systems, the PVC has the power to hire the required expertise. The monitoring value at this stage is therefore high.

vi. Exiting Stage

The PVC enters with a clear exiting strategy in mind. This means that the PVC is immediately aware of the importance of being part of the board of directors. Manula (2006) found that PVCs were more actively involved in corporate governance of their portfolio companies, and of having more board meetings more often than other VCs, revealing that this VC-types in general has a more professional nature of its operations. PVCs monitor their companies in the direction that will give them the highest exiting price, which would indicate high levels of value-adding. However, once again the incentive to increase profits could come at the expense of real innovative output. It can be argued that PVCs push for earlier exits, and thus don't allow for much incubation time for truly innovative products to develop. The value of innovativeness can be difficult to capture, but the potential consequence of the return-driven PVC is important to keep in mind.

h. Signaling

iv. Early Stage

The external pressure on PVCs creates a high signaling value for this VC-type. Investors know, that before a PVC invests in a company, the company must go through a severe screening process. The PVCs are thus associated with a certain quality control because they function as intermediaries between fund providers and the investee (Osnabrugge, 2000). Alperovych, Hübner & Lobet (2015) found that the presence of PVCs in the first financing round have a positive effect on the future efficiency of a portfolio firm. Manula (2006) also found that investees perceived PVCs as of having a signaling effect, and further taking advantage of this, in order to attract new investors.

PVCs do in several ways possess qualities that endorse them with a high level of signaling credibility and legitimacy. PVCs are subject to strong contractual, financial, and reputational constraints from the institutions that they raise money from (Alperovych, Hübner & Lobet, 2015). The contractual pressure limits the potential for agency conflicts and costs. The financial pressure force fund managers to exert a considerable effort in selecting, monitoring, and value-adding activities and ensures that underperforming investments are discontinued (ibid.) PVCs are thus evaluated on their ability to be profitable, and firms that have a history of delivering extraordinary returns find it easier to raise funds from investors (Chang, 2004).

Based on these findings, the overall assessment of the signaling effect of the PVC is highly value-adding. It can be argued that some PVCs have a higher signaling effect than others, perhaps especially those who are specialized in financing biotech companies.

v. Maturing Stage

The signaling value found in the early stage remains as strong in the maturing stage. Again, the individual signaling value may influence the extent to which each PVC can add value, though in a comparative framework with other VC-types, the PVC must be considered of overall high signaling value.

An important note in terms of how PVCs can increase the signaling effect is by ensuring that the company has property monopolies, i.e. patents, since this can contribute to boosting the price at an IPO. As previously suggested, this could indicate that PVCs are likely to patent more than other VC-types, this especially in the maturing and exiting stages of the venture. Again, this use of patenting to boost the signaling value, and thus the valuation, can create a comparatively false image of the innovativeness of PVC.

vi. Exiting Stage

The high signaling value becomes very important to the PVC in the stage of exiting. This is when their investment hopefully will have higher expected and partially realized rates of return on their venture (Osnabrugge, 2000). One way to achieve this value is by agreeing to contractual arrangements, which prohibit the PVC from selling all its equity immediately after the IPO. This provides the PVC with an incentive to ensure, that the firm will remain operationally viable for at least the short term (Chang, 2004). When the PVC must stay connected with the company for a while after the IPO, other investors will feel safer to buy into the company. The signaling value is thus high.

Finally, the financial pressure related to the strong return requirements and compensations structures, will throughout the entire venture have forced fund managers to discontinue the financing of underperforming investments and adopt clearly observable exit-oriented investment strategies (Alperovych, Hübner & Lobet, 2015), which eventually pays of with a high signaling value.

5.1.3 BA – Business Angels

i. Screenings

viii. Early Stage

The BA investors are a heterogeneous group of investors (Festel & De Cleyn, 2013), and thus their intensity and scrutiny of potential investees is very dependent on the individual investor's motivation.

BAs can in many situations also be classified as 'interim-owners' (Seppä, 2000). BA investors are often entrepreneurs of the investor market, who enter companies to build value where it envisions that such can be realized on the market. This VC-type establishes and/or adds investor value in carefully selected investee companies (ibid.) The primary motive of this BA-type is financial returns on investment, hence a careful screening of companies. In such cases the BA can be perceived as value-adding in the screening process.

On the contrary, BAs can often appear as private individuals with a personal relationship with the entrepreneur or a personal interest in the product in case. The screening process of the former is possibly of lesser value-adding to the startup. This conclusion is based on the notion that the BA is entering based on trust in the inventor, thus criteria to promote development of strategies before he enters might be of limited kind. The entrepreneur with such BA will thus not try to conform to stringent requirements in order to attract the BA. However, when the BA enters he sees this as his entrance point for later on making the reconstructions and value-adding as an active part of the product development. This will be discussed further in the coaching section.

Another note to be made on the BAs with a personal relationship is the fact that their experience and/or knowledge on, which criteria it should set before entering, might be of limited kind (Festel & De Cleyn, 2013). This emphasizes first of all, why it is more inclined to postpone its value-adding to the coaching function, and secondly, the heterogeneity of BAs, which makes it difficult to generalize their abilities and thus level of value-adding.

The third BA-type considered in this examination, is the BA who invests due to personal interests in the industry and the product, proposed by the investee. This BA can be considered of knowledge to the industry, due to his passion and willingness to invest in such a high-risk company. Depending on the level of personal relationships

between the BA and the investee, this BA is likely to set up a certain set of criteria before investing. The industry-driven BA is considered to be setting the requirements of most value to the innovativeness of the product. Literature has found that it is the passion shared between the BA and the investee, that is perceived as most value-adding to the process (Festel & De Cleyn, 2013).

Overall the BA investor is considered of medium value in the screening process.

viii. Maturing Stage

At the maturing stage, attracting more BA investment can be of interest to the startup, thus incentivizing to streamline the production. However, the BA′s value at this stage can be considered to be quite dependent on the early stage funding. If the early stage funding was made by another BA then attracting funding from a new BA can be crucial to the company′s further development possibilities. The startup will thus be encouraged to improve on the fields that can attract a BA. On the other hand, if the early stage BA is a PVC or a GVC, while these are still eager to attract new investors, there could be conflicts of interest. The PVC is much larger than the BA, and is thus likely to try to attract BAs in line with their current structure, more than try to confirm to the requirements by a smaller BA. The GVC will be reluctant to make any changes that harm their socioeconomic motives, and a BA will therefore be of little incentive to create restructurings in the current business if these require firing of employment.

The BA can be of some value-adding to startups, which are already BA funded, however the BA is considered to be of limited value to startups with a different, and often larger, VC-type.

ix. Exiting Stage

At the exiting stage the BAs should no longer be classified as BAs, but as potential IPO investors or owners. Under the classification of being a BA they will thus be considered of low value at the exiting stage.

j. Coaching

vii. Early Stage

BAs tend to be private individuals, who often have started their own successful firms in the past, and now are looking to invest some of their money and experience gained into a small entrepreneurial firm (Osnabrugge, 2000). The BAs can thus be said to often have high expertise in building businesses, and be equipped and experienced in facing the challenges, which a young startup inevitably will finds itself in.

Though, on the contrary the fact that BAs are private individuals make it difficult to determine the level of experience and industry knowledge these can contribute with. Again, this is dependent on the individual BA; even with passion it can be difficult to understand and acquire the knowledge necessary to fully grasp the complexity of a biotech product development process if one does not have such educational background. Osnabrugge (2000) finds that BAs in general are of less experience and sector knowledge than PVCs. This can also be explained by the fact that BAs are small, and have smaller networks of resources to extracts knowledge from.

BAs have been found to be entering the firms while they are youngest (Lukkonen & Manula, 2007). The expertise by BAs in terms of starting up a company cannot be clearly defined due to the heterogeneity of BAs. However, the pattern of them entering the firms at the early stage indicates a certain entrepreneurial DNA and passion within BAs, and this is especially useful in the relationship building with the investee company.

Luukkonen & Manula (2007) found BAs to be ranked highest in terms of perceived value-added and fulfillment of expectations. The relationships between BAs and their investees have been found to be closest and most frictionless compared to GVCs and PVCs, suggesting that their value of involvement is greater than that of the other types (Manula, 2006). Thus, the BA functions as a great motivational and supportive coach, which also explains why BAs are perceived as most value-adding. Obviously, a close relationship between the investee and the BA, will bias the investee in terms of perceiving BAs as adding more value than one of the other VC-types. The value of a personal relationship might be more immediately graspable to an investee, than the value added without a personal face. Nonetheless, the theory suggests that personal relationships are important in the early stages, and the BA is thus considered to be contributing with a high level of value-adding at this stage.

The value-adding from the BA comes from the more active and hands-on roles, performed in the investee firms (Luukkonen & Manula, 2007). As explained in the screening review, the BA brings its value-adding with it upon investment, rather than before. Most BAs have a great store of knowledge, skills, experience and hands-on involvement strategy, and are therefore vested with an extensive value-adding potential (Manula, 2006). Further, Manula (2006) found that BAs were clearly more active in providing business contacts, operations aiming at internationalization of the investee, and development of actual products or services, compared to GVCs and

PVCs. Thus, the personal incentive to succeed the company makes the BA highly value-adding as a coach in the early stage.

viii. Maturing Stage

As the company matures, the need for expanding the network of resources and knowledge becomes more important to the future existence of the startup. Given the small size of BAs, these are constantly aware of the need to expand their resources of both funding and knowledge. Thus, on the one hand, BAs can relief their investee company from focusing on the search for networks, because they themselves have a great incentive to function as a networker. On the other hand, the BA will in many cases find it more difficult to create strategic alliances with big prominent firms, once again due to their small size.

Compared to PVCs and GVCs, the BA does in general not have the same vast network of technical and commercial resources, meaning that the BA cannot relief the investee from spending time on this development to the same extent as the two former VC-types. This means less time spend on R&D, which has the consequences of less innovative output. Further, the BA's minor network also decreases the possibility of innovative input, which in turn can limit the output. BAs can find it difficult reduce the liability of newness, and though their hands-on approach is value-adding on a micro level, they might face difficulty in adding value on a more macro level.

ix. Exiting Stage

As the company reaches its exit stages, the value of having professional networks becomes very important in the success of the company. This is when the BA as a consequence of its size may really begin to fall short. The need for personal support becomes less important, while the need for big industry knowledge and access becomes crucial. Thus, the BA is considered to be of little value-adding as a coaching function in the exiting stage of the company.

k. Monitoring

vii. Early Stage

BAs have been found to not prefer to include special veto-rights, unlike most PVCs, and GVCs (Manula, 2006). This suggests that BAs prefer to monitor their investments by being actively in contact with their portfolio companies, and not by using more formal contractual arrangements. The previous section's emphasis on the strong relationships between BAs and their investees, further confirms the theory that BA investments are built on a more mutually trusting foundation, rather than mere

contractual. The minimalized contracting encourages the BA to be more actively in contact with his investee. Manula (2006) confirms this in their study, which found that BAs were clearly more actively in contact with their investee companies than other VCs. The value added was also found to be more outside the board meetings, and through indirect contact instead (ibid.)

The active engagement by the BA decreases the information asymmetry to an extent, which contractual arrangements might not be able to. This is given that the relationship between the BA and the investee is truly mutually trusting.

Another incentive for the BA to get actively involved is the fact that it is investing its own money. The personal risk for the BA in case of a failure is therefore extremely high. The BA is freed from external pressure, but this comes at the expense of high personal costs in case of failure to succeed the business. The BA is thus highly motivated to know as much about the processes in the company as possible, and use this knowledge to stir the company in the right direction.

A conflicting theory on the BA′s involvement strategy should be noted. BAs could be reluctant to agree to some decisions, which the investee might deem necessary, but which inherently are very risky, and thus conflicts with the BA′s individual risk avoidance. In such cases there will be a conflict of interest and the future innovativeness of the investee will depend on the trust between the partners. Seppä′s (2006) ′interim-owners′ will typically be adding value when they lack confidence in the owner-managers′ will and ability to establish and preserve shareholder value. In this case it can be hard to tell, if the investor or the investee is adding most value to the innovativeness of the company. Innovation is costly but does on the other hand sometimes need a firm hand of guidance. How, the BA′s involvement in such situation affects the value-adding, will vary from case to case.

Despite potential risk avoidance by the BA, the BA is overall considered of high monitoring value to the investee at the early stage because of the decreased level of information asymmetry stemming from the trusting relationship.

viii. Maturing Stage

BAs are considered to be involved in fairly similar sets of activities as the PVC, however, the latter being more inclined to establish formal reporting and operating controls, and be involved in staffing and financial management (Luukkonen &

Manula, 2007). This difference can be explained by the lack of external pressure on BAs to behave professionally (Osnabrugge, 2000). While this was an asset to the innovative process at the early stage, it becomes less so at the maturing stage. Once again, the BA′s ability to implement the financial reporting systems, which are most crucial at this stage, depends on the individual BA. It is adequate to assume that larger VC organizations have more experience in formulating the contracts, which will benefit the investee most at this stage. The BA′s value-adding at this stage thus decreases compared to that of the early-stage.

ix. Exiting Stage

Manula (2006) found that BAs were actively value-adding more outside the board meeting, and through indirect contact instead. Throughout the venture, the BA might not have shown itself as a strong member on the board of directors, so unless the BA can switch from having a more hands-on approach to fulfilling its purpose through the board of directors, the value of the BA is further decreased at the exiting stage.

The BA′s ability to add value at the exit is dependent on its initial motivation for entering in the first place. The BAs, who perceive success as measured by return on investment from the profits made when the shares are sold at exit, are likely to be more demanding in the exiting stages, and thus push the startup in a direction that is clearly exit oriented in its strategic nature. These BAs can help increase the overall value of the company, however, as with PVCs, their financial motivation might come at the expense of innovativeness. The BA might encourage patenting of less innovative products in order to get an earlier exit, and more tangible assets within the company, which would help increase the final valuation.

The contrary situation is that of which the BA is more entrepreneurially driven. BAs have been found to be wiling to keep their investments in the enterprise for a longer period of time, and not necessarily intend to exit from all of the investee companies (Manula, 2006). It can be assumed that the BAs, who are less eager to exit, allow for more explorative product development, and thus spur innovation more.

However, slack can occur if the investee is not properly motivated to finalize their research, and this will be of no benefit to the innovativeness, nor the value of the company. Further, monitoring at the exiting stage is value-adding if the BA is capable of creating alliances and strategic partnerships. Again, larger VC organization can be argued to have better access to such resources, hence be more value-adding at the exiting stage in terms of monitoring.

l. Signaling

vii. Early Stage

The BA can, due to its size, be argued as being most dependent on finding further investors, while at the same time, and for the same reason, have most difficulty in doing so, because it is lesser known. Manula (2006) found that BAs added less value indirectly through signaling, as perceived by the CEO of the investee company. This finding argues that BAs will be of low value-adding in this sense. In can be argued, that since BAs cannot rely on a reputation to attract more investors, they will have to be even more focused on improving the product of the company. This will add value in the coaching of the company. Thus, while the signaling value of the BA is low, it indirectly adds value to the product development process, which will spur innovation.

A high signaling value of the BA, however, can be deducted from the fact that BAs are investing their own money. This signals to new investors, that here is a company in which the investor has high faith in the potential outcome. New investors will though also be wary of the fact that the BA potentially have invested in this company with limited screening before entering the venture, and that the BA might be desperate to find further funding in order not to have too high of a personal loss. The signaling value of the BA is thus considered quite low as suggested by Manula (2006).

viii. Maturing/xi. Exiting Stage

In the maturing and exiting stages, the signaling value of the BA is considered to remain the same. A BA who has remained in the company throughout the entire venture could signal faith in the business. This BA can also be of value to other investors because of his inside knowledge of the firm, which can limit information asymmetry. However, this paper will assume an overall low signaling from BAs.

5.1.4 CVC – Pharmaceutical/Corporate Venture Capital

m. Screening

x. Early Stage

CVCs are big pharmaceutical companies who are known to the public for their success within pharmacy and innovation. Thus, strategically it is very important for these prominent organizations to be selective in their choice of partners in order to preserve their own reputation, which may otherwise be damaged if they transact with low-quality or disreputable firms (Stuart, 2000). Thus, CVCs have high standard

requirements for their potential investee companies. A high value-added in the screening process is therefore suggested.

While the ultimate objective of most any VC is a financial gain the additional objectives of CVCs are also strategic, and the investments are made to spur the investor's own business (Manula, 2006). Hence, a company making strategic investments may be aiming at learning about markets, technologies, or processes (ibid.) This suggests that the criteria, which CVCs are looking for in their screening processes, have to fulfill some novelty requirements. Thus, not only do CVCs encourage their investee to meet a certain quality standard, but they also provide strong incentive for the investee to produce something truly innovative. CVCs are thus considered to rank highest in adding value.

xi. Maturing Stage

CVC are considered quite valuable in the maturing stage of biotech companies in terms of screening. Many established firms find it beneficial to form corporate agreements with startups to learn biotechnology techniques and lessen the threat they pose as substitutes for traditional product development (Shan, Walker & Kogut, 1994). The market for CVC funding has been increasing in the later years, and it can be very beneficial for a maturing biotech company to be able to rely on the resources of a big pharmaceutical company.

Many R&D alliances between established pharmaceutical firms and dedicated biotechnology firms are structured such that the pharmaceutical firm, in exchange for funding a research project, acquires the right to observe the development process of the biotechnology firm, besides the claim to a large fraction of the revenue stream generated by the resultant discoveries (Stuart, 2000). For some biotech companies, being supported by a CVC can be a goal in itself, since this increases the chances of the biotech to be able to sell off its innovation to the CVC. Thus, CVC screening remains highly value-adding in the biotech companies, especially on a more innovative level.

xii. Exiting Stage

At the exiting stage CVCs would be considered a buyer of the innovative product, or an adopter of the biotech research company. At in the maturing stage, the possibility to join forces with a CVC can for some biotech companies be the ultimate goal and thus motivate these to create a novel product for the pharmaceutical industry. One factor decreasing the value of the screening process, in the eyes of the investee

company, is if the investee is keener on going public as its own individual identity, rather than being absorbed by a big corporation. However, this only limits the value of the screening function on a relative measure. In absolute terms the CVC is considered as overall, highly value-adding in terms of screening.

n. Coaching

x. Early Stage

Traditional pharmaceutical companies provide technological know-how, financial resources, manufacturing know-how, marketing ability, and regulatory expertise (Deeds & Hill, 1996). Since CVCs are also seeking to acquire knowledge from their investee firms, they often leverage their resources or complementary assets in order to increase demand for, and availability of, its own products (Manula, 2006). Further, the passion to invent a valuable product for the industry is what has attracted the CVC to invest in the first place. Coaching made by the CVC will be highly innovatively oriented. Seppä (2000) finds that CVCs have a greater interest in participating in R&D, compared to other VC-types, which indicates that they focus more on the technological solutions of their investee.

Stuart (2000) found that the effect of the innovativeness of alliance partners is a highly significant predictor of the patent rate. This further advocates, that biotech companies with technologically advanced alliance partners, i.e. big pharmaceutical companies, spurs innovation through their investment. Previous research has found support for the correlation between firm size and R&D inputs (Shan, Walker & Kogut, 1994). However, the relationship between firm size and R&D outputs has been found to be quite different (ibid.) Thus, there is theoretical support behind the notion that there may be many opportunities for cooperation between small startup and large established firms, in order to exploit technological spillovers and transfer of resources for product commercialization.

The novel objective for pharmaceutical companies to outsource the R&D function by investing in smaller biotech companies is, that the pharmaceutical company itself can actively support the outsourcing activities by making financial investments into legal entities that serve as an outsourcing partner. That is, creating their own venture funds, which provides capital, and thus releases the entrepreneurial responsibility and capability of the biotech company, giving them more room to focus on their innovative output (Gassmann, Reepmeyer & Zedtwitz, (ed.) 2008)

What all of these findings indicate is, that the CVC can increase the level of innovativeness in the investee through technological resources, market understanding,

shared passion, and business expertise. The CVC becomes the organ, which facilitates the business aspect in order to release the resources within the biotech company, such that these can be fully R&D focused.

xi. Maturing Stage

As already discovered in the early stage examination of the CVC′s coaching function, the CVC has plenty resources within marketing ability, and regulatory expertise (Deeds & Hill, 1996). When startups have relationships with established firms, the innovative and non-innovative components of biotechnology business are located in two institutions (Shan, Walker & Kogut, 1994). This means that the startup can increase its focus on the R&D activities, and thus increase the likelihood of achieving innovation (ibid.) The big pharmaceutical companies have developed into an idea-licensing, pharmaceutical formulating and manufacturing, clinical testing, patenting, and marketing industry (Styhre, 2015). The CVC can thus be said to be completely specialized in coaching the investee in a sense, where the CVC becomes the intermediate between the startup and the market. Exactly what the startup needs at the maturing stage.

Kortum & Lerner (1998) found that CVCs become increasingly more valuable to the product development process as the project matures. This is due to their knowhow on the more technical issues that may arise, and thus they are more specialized and have more experience with the technical difficulties, and can provide more knowledgeable expertise.

Further, prominent organizations typically have many potential strategic partners, and Stuart (2000) found evidence that the value of having a well-known strategic partner is of greatest value for small firms. Hence, the startup companies receiving funding from CVCs are also more likely to get access to the value of important partnerships. CVCs are continuously of high value to the innovative process as it moves into the maturing stage.

xii. Exiting Stage

Seppä (2000) classifies the CVC as a ′bounty-hunter′, hunting for strategic gains. Exiting for CVCs takes place after the value-adding work is completed, and the ′ divestee′ can be dis-divested i.e., absorbed within the parent′s group structure (ibid.)

A biotech startup with a CVC might thus not necessarily have an exiting strategy; rather the CVC will want to keep the startup as its outsourced R&D function. In fact,

if the startup exits through an IPO and becomes and individual entity, it can become a competitor to its CVC. The exit of the biotech is more likely going to be a sale of its product. The value of the CVC at the exiting stage, in terms of motivating the innovativeness, is very dependent on the contract between the investee and the investor. The CVC will at this stage want to reap the fruits of the investments it has made, possibly through a licensing agreement on the product made upon the first investment (Tscherning, Frank & Schönhartig, 1999.)

The CVC has a high technological understanding through the entire product development process, thus it is capable of setting up appropriate milestones to motivate the startup. The final milestone will be a product that has made it through all stages and is now a viable product for the market. The exit strategy of the CVC is focused on increasing its own market share in the pharmaceutical industry. To do so, it must stay at the innovatively competitive forefront, and this can only be achieved by having a unique product to offer to the market. Thus, the CVC, already being part of a big industry, makes it its own most important relationship with the startup.

Coaching at the exiting stage can thus dependent on the incentives, which the CVC can make in order to make the investee want to work for them, compared to getting a high valuation at an IPO. These incentives are likely to be a combination of financial incentives, personal relationships, and agreed upon contracts. Theory suggests, that personal relationships at this stage are of less value-adding. A loyalty feeling between the investee and the investor might discourage competition, but also not encourage to the same level of innovativeness as an IPO. The startup might be 'too comfortable' under the wings of a big pharmaceutical company, which can create slack in the process. For the exiting stage to spur innovation, the CVC must create valuable incentives to the investee in order to make them realize all their milestones. It is difficult to make a generalization of the value of the CVC at the exiting stage, but this paper will consider it lowered to some degree compared to the previous two stages.

o. Monitoring

x. Early Stage

The high information asymmetry looming in the early stage is likely to be both more challenging for the CVC to overcome, but also more knowledgeable for it to assimilate.

When small biotech companies receive funding from a CVC, this can be seen as an alliance with a pharmaceutical company. The pharmaceutical will demand strict

adherence to a certain strategy, and it is by some be suggested, that biotech companies should be careful not to wed their personnel and IP to a strategy of research difficult to abandon if the strategy seems unprofitable. If the goal of the startup is to be independent it is wise to keep research in-house and thus increase the value of the company (Tscherning, Frank & Schönhartig, 1999).

Unless the CVC and the biotech have license agreements, or a shared goal of the biotech to be absorbed by the pharmaceutical company, the biotech might be unwilling to unravel all its research knowledge to the CVC. Knowledge, which would be very valuable to the CVC in order to both monitor the investee adequately and also to limit its own risk bearing. Thus, the biotech could be considered more wary in terms of sharing technical knowledge with CVC compared to another VC type. This would increase the level of information asymmetry between the two parties.

On the other hand, even if the biotech is making it difficult for the CVC to penetrate its pool of knowledge, the CVC might still have a better understanding of the risks and results presented to it compared to the VCs with less industry knowledge. The increasingly rapid pace of innovation in the pharmaceutical industry calls for more flexible and looser forms of innovation agreements (Gassmann, Reepmeyer & Zedtwitz, (ed.) 2008). This suggests, that even though the investor and investee might suffer from trust issues, the CVC will in the current pharmaceutical environment have to agree to some less favorable agreements in order to stay competitive in the market.

A point regarding the Danish culture should be noted. Denmark has a long-standing tradition for close and fruitful collaboration between parties of industry knowledge, based on a culture of open-door policy, a spirit of inquiry and mutual interest in turning new ideas into real products (Ministry of Foreign Affairs, 2014). This is characterized as a uniquely Danish culture, founded on trust and informal relations, which makes for flexible, dialogue based, and equitable collaboration on the development and testing of new products (ibid.) This indicates that specifically in the case of Denmark, relationships are built on trust.

Thus, even though it cannot be denied that the biotech will to some extent want to ensure, that it isn't being ripped off its unique knowledge, the uniqueness of the Danish pharmaceutical culture is suggested to overcome the information asymmetry to a large extent. Further, the CVC is fundamentally the most knowledgeable VC partner in terms of technical and industry knowledge. Thus, the monitoring will be considered of high value at this stage.

xi. Maturing Stage

Seppä (2000) found that the CVCs address their role as a source of professional contacts more than their role as a sounding board. Building on the previous findings, it is exactly these more administrative functions, which the CVC specializes in, that create high value as a monitor in the maturing stage.

xii. Exiting Stage

While the importance of having networks have previously been stated as very important in terms of adding nonfinancial value, most of the previous literature studied suggests, that it is in the board that they can be most influential. Thus, the fact that the CVC considers itself less of a role in the sounding board means, that it might be less value-adding at the exiting stage. Valentin & Jensen (2007) partly confirms that the number of board members coming from a pharmaceutical background had a non-significant impact on the valuation of the firm. Valuation in this study was correlated with number of patents, and thus correlating with the measure of innovativeness applied in this paper. This finding was however only apparent in the case of large molecule firms. For small molecule firms the number of board members had a significant impact. It is beyond the scope of this paper to differentiate between the specializations of the biotech. The finding is though however important in terms of getting a fuller picture of the CVC activity and performance in the board.

The monitoring of the company in the exiting stage is, as previously noted, likely to be quite different from that of the other VC-types. This could be why the CVC considers itself of more of a source of professional contacts. The different exit goals set by the CVC means, that its function in the board will also be of different nature. The findings by Valentin & Jensen (2007) suggest, that the pharmaceutical company is capable of positively affecting valuation in the board. This paper thus suggests, that CVCs continue being of high value.

p. Signaling

x. Early Stage

A biotech with a CVC investor has high signaling value to new investors. First, the biotech has gone through a screening process specifically focused on the novelty of the entrepreneur, and performed by industry leaders in this area. Highly regarded organizations are likely to be perceived as reliable evaluators, that are capable of discerning quality differences among potential partners (Stuart, 2000). Secondly, building on sociological literature, Stuart (2000) finds that intercorporate alliances with large, highly skilled, or otherwise well-known organizations can convey status to

the focal firm. Startup biotech companies are obviously often quite unknown, as they are still in a development phase trying to establish themselves as profitable sources of innovative products (ibid.) And finally, partnering with big pharmaceutical companies signals, that the startup might have additional transfer of knowledge-based resources.

The CVC is hence of high signaling value from the very early stage.

xi. Maturing Stage

Through the CVC the investee can lease customers, commercial partners, and employees, due to the CVC's infiltration into the industry. The CVC can be considered a spokesperson for the biotech, convincing the networks of the pharmaceutical company funding the CVC, to trust the product of the biotech. The signaling value is thus very valuable to the startup as it matures.

Pharmaceutical alliances are often seen as the Holy Grail for a startup venture, in that they validate the young company and demand strict adherence to a certain strategy, demanded by the pharmaceutical company (Tscherning, Frank & Schönhartig, 1999).

xii. Exiting Stage

At the exiting stage, the startup can brand itself as a company supported by an industry leader. The company can thus reap the benefit of its investor's brand value. Alternatively, if the pharmaceutical company, as part of its product line, adopts the product, it will naturally achieve a stamp of approval in the eyes of the customers. Assuming that the pharmaceutical company is renowned to and acclaimed by the public.

5.2 Comparative Evaluation and Outline of Theoretical Framework

The following section summarizes the key findings of the previous section, listed in terms of the perceived comparative ranking.

Early stage

Screening

1. CVC: searches for novel products, thus the screening criteria will be based on proof of innovativeness.
2. PVC: the criteria are high because of the high risk involved, thus meeting these will be a great advantage to the investee.
3. GVC: can be forced to lower its criteria to function as a mechanism that evens out market inefficiencies.

4. BA: sees its function more as intervening once the investment has been made, rather than try to motivate companies to attract them.

Coaching

1. CVC: has technological knowhow, valuable networks and a general passion for innovation.
2. BA: brings strong relationships and entrepreneurial knowledge.
3. PVC: has a high compensation incentive, however the value of the PVC's technological input is dependent on the individual PVC.
4. GVC: has little personal relationship and personal stake, however brings in a large network and is specialized in early stage development.

Monitoring

1. BA: monitors through strong personal relationships, which lowers the information asymmetry.
2. CVC: has the greatest knowledge to understand the information shared with it, and possibly also the information that is not shared.
3. PVC: investments are mostly based on contractual arrangements.
4. GVC: investments are based on contractual arrangements, and information is possibly only disclosed to the absolute minimum.

Signaling

1. CVC: is a stamp of novelty and quality, and also an indicator to other investors of the investee being able to get access to technological support.
2. PVC: is a stamp of quality due to the screening process it performs and its personal risk.
3. GVC: sends a signal that guarantees for risk.
4. BA: investors are possibly unknown and the network small. The BA is no guarantee for risk rather it might be highly dependent on new investors.

Maturing Stage

Screening

1. CVC: is considered a milestone.
2. PVC: is specialized in setting criteria for this phase.
3. GVC: is more specialized in setting up the criteria at the early stage.
4. BA: enters with a purpose to change rather than require changes before entering.

Coaching

1. CVC: has a huge network of relevant alliance partners within the market.
2. PVC: has a key profession in coaching its investees at this stage. It is the fact that it is not as specialized within the industry which ranks it second.

3. GVC: is experienced in contractual arrangements, however, its obligation to serve socioeconomic purposes might limit its ability to make reconstructions.
4. BA: has the lowest level of professionalism and less contractual expertise.

Monitoring

1. CVC: is specialized in the functions needed at this stage, with a high focus on the innovativeness of the product.
2. PVC: has the contractual experience needed, and is further freed from socioeconomic obligations.
3. GVC: is experienced in contractual arrangements, however its obligation to serve socioeconomic purposes might limit its ability to make reconstructions.
4. BA: has the lowest level of professionalism and less contractual expertise.

Signaling

1. CVC: has the networks, which the startup needs, and the investee can lease its reputation.
2. PVC: has in its nature a valuable signaling value.
3. GVC: can have a signaling value through its vast networks, however, as the company matures investors might in fact be suspicious towards the true profitability of the startup if it is not capable of attracting enough investors to relief them from their governmental support.
4. BA: investors are possibly unknown and the networks small. The BA is no guarantee for risk rather it might be highly dependent on new investors.

Exiting Stage

Screening

1. CVC: can also be seen as a buyer, thus it can encourage the startup to try and make structural changes in order to attract the CVC.
2. PVC: provides the strong alternative to being bought, namely exiting through an IPO.
3. BA: is attractive in order to provide more capital.
4. GVC: is considered most insignificant as it is assumed that the startup is aiming to be a private company.

Coaching

1. PVC: exiting is the main objective of the PVC, and it is thus specialized in achieving this most effectively.
2. CVC: encourages the biotech to stay at the innovative forefront, however, the investee might have become 'too comfortable' under the wings of the CVC.
3. GVC: is highly focused on exiting and is highly professional.
4. BA: has a smaller network and is more entrepreneurial than professional.

Monitoring

1. PVC: has a clear exiting strategy.
2. CVC: has been proven capable of positively affecting the board and thus the value of the exit.
3. GVC: the exit strategy is not clearly defined, however the vast network is still of high value.
4. BA: has a small network, however the overall abilities are difficult to generalize.

Signaling

1. CVC: can leverage its own signaling value onto its investee.
2. PVC: has a high signaling value and a clear exiting strategy throughout the entire venture.
3. GVC: has the professionalism and alliances in its network to signal to.
4. BA: is better served with leasing the value of other investors than using itself as signaling value.

A summary of the comparative rankings can be seen in **Appendix 2**

The hypotheses for further investigation have been developed based on the contingency theory proposed by this table. A further development of the theory, combining the results of Appendix 1 & 2 can also be seen in Appendix 3-6.

Appendix 6b provides a summary of how each VC-type overall ranks based on the proposed theory.

The following section outlines the hypothesis proposed by the theoretical framework.

5.3 Hypotheses

Early stage

H1: The CVC is best at adding value in three of the four factors; the BA is best at monitoring.

H2: The BA adds least value through screening and signaling, but performs second best in terms of coaching.

H3: The PVC is second best at screening and signaling, and second worst at coaching and monitoring.

H4: The GVC is worst at coaching and monitoring, and second worst at coaching and monitoring.

Maturing stage

H5: The CVC is best at adding value at all stages.

H6: The PVC is second best at adding value at all stages.

H7: The GVC is second worst at adding value at all stages.

H8: The BA is worst at adding value at all stages.

Exiting stage

H9: The CVC is best at adding value in terms of screening and signaling.

H10: The PVC is best at adding value in terms of coaching and monitoring.

H11: The GVC is worst at adding value through screening

H12: The BA is worst at adding value at the stages of coaching, monitoring and signaling.

These hypotheses will be the point of reference as this paper aim at investigating the proposed theoretical framework. The following sections will evaluate the proposed data in order to investigate the theory, and test the hypotheses based on this data.

6. Data and Methodology

6.1 Data

6.1.1 Data Collection

This study draws on data extracted from *Orbis* company database, comprising information on 760.000 Danish companies, including historical data on ownership, shareholders, and subsidiaries. The company selection was identified by the database *Navne & Numre Erhverv*, which provides data on industry, regional segmentation, and company size. Patent data was obtained from the *European Patent Office* (EPO). Ownership classification was supplemented by individual research of the company websites, whenever necessary and possible. Information on the individual biotech companies' stage of development was extracted from *Nordic Life Sciences* (NLS) database and *BioCentury* (BCIQ). Data on the stage of development have also been further investigated and verified by individual company research of their official webpages, when possible.

6.1.2 Sample

Navne & Numre Erhverv database identified 262 biotech companies within the region of Zealand (**Appendix 7**). The companies were all classified within the branch "*Research and Experimental Development in Biotechnology*" (branch code: 721100). This branch code was identified as most beneficial in order to exclude biotech companies nonrelated to life sciences. The sizes of the companies were identified and companies without size information were eliminated from the sample (**table 2**). From this sample companies without ownership information were eliminated from the sample (**table 3**). Finally, companies where 100% of the ownership was embodied by what could be identified as also the entrepreneur were eliminated (**table 4**). This elimination was based on the notion that in order to see the effect of the collaboration with an outside investor, the investee would in such case not be influenced by this effect. Further, biotech companies identified as holding companies were removed from the sample (**table 5**). This left a sample of 119 Danish biotech companies within the Zealand region (**Appendix 8**)

In order to investigate if there was a correlation between the PVC type, innovation measured in number of patents produced, and the stage of development of the company, it was necessary to know 1) the full ownership history of each company, 2) at which stage the investee was at in relation to the ownership structure at that point in time, and 3) the number of patents produced at that time. Ownership history could

reasonably be obtained through Orbis database, however patent data could only be obtained for 58 companies in the EPO database (**Appendix 21**). Of these companies, the stage of development could only be obtained for 33 companies; half of these from NLS and BCIQ, and the other half from company webpages (**Appendix 22**). This left the study with only 28% of the total sample for further investigation. This sample size was considered too small for making the initially sought correlation study of the industry as a whole. Thus, the evaluation of the contingency theory would instead be based on a sample of case studies identified through the data research. However, before approaching the case studies, a small review of the variables of the proposed data is to be investigated in the following section.

6.2 Variables

6.2.1 Venture Capital Classification

Orbis database provided a comprehensive history review of the company ownership structure of each investee back to 2000. The ownership was determined by the percentage of shares held in the company. However, in order to identify the type of VC the shareholder belonged to, most shareholders would require an individual investigation to determine its belongingness. DVCA identifies PVC companies as *structured partnerships, which administrates one or more funds. The money comes from institutional investors, pension funds and investors with a large liquidity*. BAs are identified as *often investing either as an individual or through a holding company with other investors*. GVCs either constitute of capital directly funneled into the company by the state, but more often it is indirectly funded via VCs earmarked for a certain industry.

The first step was to eliminate investors outside of Denmark and Sweden in order to create a sample reflecting the biotech environment in the Medicon Valley. However, companies with a foreign PVC or CVC with an ownership share of more than 10% were kept in the sample. Due to the stake of these investors, and their assumed professionalism in operating across boarders, they were considered to still have the value-adding effect on their investee.

Secondly, separating between the different VC-types would prove some difficulty. This paper is based on the premise of VCs providing a value, which other financial institutions do not, thus PE companies needed to be excluded from the sample. It would sometimes be difficult to separate between a PVC and a PE. This was done on an ad hoc basis. Further, some BAs would be of such size, that they could be confused

with a PVC. In such cases the separation was made by individual evaluations and based on a combination of the number of shareholders and the number of investee companies in their portfolio. Investor companies with an ownership structure containing several investors were considered PVCs, and vice versa, ownership structures embodied by fewer, individual, investors were categorized as BAs.

In terms of identifying GVCs, this would in many cases also require a background check of the VC. Indirect investments would prove to be difficult to capture, and lack of identification of these can have contributed to skewing the data.

CVCs were the least difficult to separate from the other for VC-types, however it could be discussed, when a CVC is functioning as a VC, and when it has fully absorbed the biotech company as a wholly owned subsidiary R&D function. In case of the latter it can be discussed whether such biotech company should be excluded from the sample, as it is no longer an individual entity competing on the same market conditions as the other biotech companies. In this study, companies fully owned by large pharmaceutical companies have been kept in the industry sample.
(**Appendix 23**)

6.2.1.1 Data Analysis I

A summary of the investor classification can be found in the **Appendix 9** and **Appendix 10**. This is to give an overview of the Danish biotech industry and its VC investor compositions. The data is based on the current ownership structure as per ultimo 2015, thus ownership history has not been examined in these tables.

6.2.1.1.1 Investor Composition

As can be seen from the tables in **Appendix 9b** BA′s (**table 1**) and GVC′s (**table 4**) are mostly found to be investing in small biotech companies. CVC′s (**table 2**) are more evenly dispersed regardless of the size of the company; however slightly decreasing as the company increases in size. The PVC (**table 3**) is the VC-type, which is most active in the larger companies, both as the sole investor type, and in combination with others. These patterns confirm the theory of how the VC-types are most likely to make investments.

In small companies, the BA was least found to be in collaboration with other VC-types (**Appendix 9a, table 1**). This indicates that BAs often have a high stake, and are thus likely to be highly motivated to have a personal relationship with the company.

As the company grows, the data suggested that the investee acquires, and perhaps also requires more investors, making the share of leading BA investors decrease.

In comparison to PVCs (**table 3**), this VC-type was only found in combination with other VC-types in small companies. PVCs are overall investing most in combination with others (**table 3**). This could support the notion that PVCs prefer not to enter until the investee has already acquired investments from other investors.

The CVC (**table 2**) was overall the second least combined VC-type, which could indicate that this VC-type has a tendency to take much control of their investees. The result can be seen as a consequence of the previously discussed issue of the biotech company no longer being an individual entity.

Finally, the GVC was very prone to invest along with other investors (**table 4**). The fact that PVCs have a higher percentage of collaboration in the small companies compared to GVCs could indicate, that GVCs in many cases have to take the risk of investing in small biotech companies, which the PVCs are not willing to invest in yet.

This paper is built on the assumption that joining forces with a VC-type adds nonfinancial value to the investee to a different degree at different stages. Many biotech companies have more than one of the four investor-types, and **Appendix 10** provides a summary of the current investor patterns. As can be seen from **table 1**, companies were most profound to have just one investor type. For small companies 82% of these single investor-types were embodied by BAs, whereas for large companies the BA as a single investor decreased to constitute only 27% of the sample (**table 3**). CVCs on the other hand went from representing only 16% of single ownership in small companies and increased to 58% for medium companies, the same pattern could be seen on behalf of PVCs. This further highlights, that CVCs and PVCs are more found to enter when companies have grown. Only 1% of the sample was found to have all four investor types as their current investor composition.

6.2.1.1.2 Lead Investors

A final investigation of the industry sample was to define and find the lead investors. The lead investor was defined as the sum of percentage ownership of each VC-type (**Appendix 24**). The VC-type with the highest total ownership share was classified as the lead investor. A different approach could have been to assign the single investor with the absolute highest share as the lead investor. The former option was chosen because the individual BA is often not capable of investing the same amount as a

PVC, however the sum of BAs sometimes exceeded this amount. Thus, the joined value added by BAs would in this sense be larger. The arguments against this method would be, that it would be easier for the PVC to impose its preferred strategy because it on its own has a level of ownership, that would require the BAs to be able to agree to disagree in order to counteract this strategy. An example of this ownership composition in the sample is the medium sized company Genobiotix ApS, which has 33% PVC ownership and 53% BA leadership; however, this leadership is shared between four different BAs.

Appendix 11 shows that BAs are largely the lead investors of small companies, whereas CVCs and PVCs become more leading in the large companies. The GVCs were in all cases found as least appearing as a lead investor.

These results and data discussion were made to give an overview of the current Danish biotech industry. The results and data will help put the case studies into perspective, and to investigate if the industry, as suggested by the literature, could be supported by figures. The results discussed above appear to confirm the theorized market situation. The following section will review and evaluate the use of patents as a measure of innovation, and why it was deemed too insecure of a measure for this paper to base strong industry conclusions on.

6.2.2 Patents

Several papers have used patent data as measure of innovation at a given time or stage of development of a company (Kortum & Lerner, 1998; Nanda & Rhodes-Krops, 2013; Meyer, 2006). This paper considered an industry in which inventions could be pursued through a range of different VC-types. In order to use patent count as a measure of innovativeness this would require a range of assumptions. First, patenting must be assumed to be a production function of a given VC-type, at a certain stage of development of the firm. Secondly, innovations must be translated into patents in a proportional manner. Third, all patents represent a product of equal level of innovativeness. And finally, all VC-types push for the same patenting strategy.

Assumption two and three could to some degree be met in the data handling. In order to satisfy the second assumption the patent data had to be identified in terms of its applications date and verified as having being granted. Without performing this match the study would risk either including filed patents that were rejected, or matching granted patents with the wrong VC in terms of when the invention was made. The third assumption would be made more reliable by matching the patent with count of

citations (Nanda & Rhodes-Krops, 2013). Previous literature has demonstrated a strong relationship between the number of patent citations received and the economic importance of a patent (ibid.)

EPO provided patent data on 58 biotech companies (**Appendix 12**). The patents were identified by matching the applicant with the company name. It can be difficult to say whether the 61 remaining companies without patent data simply did not have any patents, or if they were filed under a different search term.

6.2.2.1 Data Analysis II

Overall **table 1-4** (**Appendix 12**) reports that small companies have the highest lack of patent information. This could indicate that these in fact have not achieved any patents; in that case it would be wrong to exclude these companies from the sample. In absolute measures, especially small companies, with a BA as lead investor, lacked patent information, which could lead to a discussion of whether this VC-type is less value-adding, or it could oppose the fourth assumption previously stated. The companies with a CVC as lead investor only had patent data for 53% of its total sample. This could be a result of the patents being filed under the name of the CVC.

6.2.3 Stage of Development

Finally, the stage of development for each of the 58 companies was sought identified, and as previously stated, this could only be obtained for 33 companies (**Appendix 13**). Some companies would have products in more than one stage. In such cases the highest stage was chosen based on the assumption, that the company would already have built the network of value-adders desirable in the former stages. Another implication is that no historical data on when a company had moved from one stage to another could be obtained through the data available to this thesis. Thus, while a snapshot of the current industry could be attained for at least 33 biotech companies, it was not possible to make the historical backtracking, which would be necessary in order to match the VC-type and the patent count.

6.2.3.1 Data Analysis III

Appendix 14 provides data on the current distribution of biotech companies in terms of their stage of development, and their current VC-type. From this separation it also becomes obvious why the three stages could not be set equal to the size of the company. For instance **table 1** reports having only small and large companies in the mature stage but no medium sized companies at this stage, which contradicts the logical assumption of mature companies being medium sized. All VC-types, except

the GVC, were found to function as the lead VC-type in each of the stages. Interestingly, the PVC was the least found lead investor in the exiting stage. The current worry of the biotech industry was, that PVCs are not investing enough in the early stages, but are waiting until the maturing and exiting stages. The data found by this study contradicts that picture. However, due to the very small sample size, it is critical to draw hard conclusions based on this sample. This is further emphasized by the findings of the GVC financing, which is 100% in the exiting stage. This again paints a complete opposite picture than that described by the theory and the spokesmen of the industry.

Appendix 15a and **15b** show the total current count of all patents achieved at each stage for each VC-type. In the sample, five companies had had an IPO (**Appendix 22**). Because this thesis focuses on companies up until their final exit, patents achieved after the IPO were removed from **Appendix 15a** providing the results shown in **15b**. An interesting observation was, that three of these five companies were found to be in a stage prior to the exiting (**Appendix 22**)**.** Either this is a due to inaccuracy of the data collection, or the theory of the linear development from early stage to exiting needs to take account for exceptions. In case of the latter it is interesting to see if such exceptions are the result of a certain VC-type.

Finally **Appendix 16b** divides the total count of patents with the number of companies at that stage and size, given the VC-type. This provides a snapshot of the patent productivity in each VC group at the different stages. However, this provides no information on the VC history leading up to this sum of patents, thus the numbers must be interpreted with caution. The results are for this paper merely to give an industry picture rather than draw conclusions on the value-adding of the different VC-types in the industry as a whole. The variety in the numbers indicates, that possibly some very different cases of stage development and successes can be found in the sample, and it is based on these numbers, that the final cases have been chosen for further investigation.

7. Cases

The following cases can be supplemented by **Appendix 17a-17n** which outlines ownership history and patent data. This data has been normalized in **Appendix 18**, and the following cases have been evaluated based on the visualization of the numbers in histograms (**Appendix 19**).

7.1 Early Stage Analysis

7.1.1 Glycom A/S

In support of H1 is the medium biotech company Glycom A/S, founded in 2005. From 2006 to 2011 Glycom A/S had only a BA in its portfolio of VC investors. In the range of those years, the BA constituted of 33% - 68% of the total financing, and 100% of the total venture capital financing. In 2012 the CVC, Nestlé S.A., supported with 35% of the total company financing, constituting 53% of the total venture capital financing. Glycom Holding supplied 39% of the total venture capital financing, and the GVC, Pre-seed Innovations A/S, embodied the final 8%. Glycom A/S had a spike in its patent production in the years when the CVC was the lead VC-type. The fact that the second most supporting VC was a BA should according to the theory, make this company in the most ideal setting for nonfinancial value-adding in the early stage, supporting H2. The patenting level dropped as more GVC substituted the CVC financing. This is in support of H3. Another notable observation of Glycom A/S′s patenting level is the fact that it is very high in comparison to most other early stage biotech companies. Again this could support H1 of CVCs and BAs bringing most nonfinancial value to spur the innovative process.

The issue of investment strategies should however be taken into account in this analysis. The risk of investing in biotech companies is among others, the fact that they have few tangible assets. The most valuable assets for a knowledge-driven company are its patents. Thus, an increase of patents, make other VCs more willing to invest because of the acquisition of assets. In this case, the patent increase could also be a result of the CVC′s attempt to attract more investors. This perspective does not mean that the CVC is not adding value to the investee by patenting in order to attract VCs; in fact this could be part of the high signaling value, which the CVC contributes with. The sudden increase in patents could also be a result of the screening value of the GVC, which may have pushed the investee to be at the boarder of patentable innovations right before the CVC entered. Pre-seed Innovations A/S is a GVC

specialized in investing in innovative projects. Thus, while H4 states that the GVC is of second lowest value adding in terms of screening, it should first of all be noted, that this doesn't mean that it is not of value. Secondly, this particular GVC could be of more signaling value than other GVCs due to its specialization. It is interesting though that the patenting level promptly drops after the GVC becomes more invested, this could to some degree support H4.

The discussion following this case concerns considering patenting as a function of the innovativeness brought about by the VC-type. Instead of viewing the correlation from this perspective, patenting should perhaps be seen as a financial value added to the investee by the CVC. Patenting can be a consuming task, and based on the theory the CVC could be considered to have more of the professionalism necessary to bring about a patenting than a BA. Thus, from this case it can be concluded that the CVC does possible add all four values to the investee, and further, that in combination with the BA, this is the ideal foundation for producing patents. The case supports H4 due to the fall in patents after the GVC entrance. However, since the GVC is not substituting the CVC, the value of the CVC should still be considered as added to the company, and it is unlikely in this case, that the GVC is decreasing the patent production. Rather the abnormal increase in patents in 2012 and 2013 should be seen as a result of the CVC entrance. The level of patents in the later years appears to be more of a normalization of the patent production.

In summary, this case supports H1 and H2. Further, this case lead to a discussion of H4 in terms of how value can differentiate between a specialized GVC and a non-specialized GVC.

7.1.2 Adenium Biotech ApS – Minervax ApS – Pcovery ApS

The three biotech companies, Adenium Biotech ApS, Minervax Aps and Pcovery, ApS have all existed in close to the same range of years, which creates a suitable foundation for comparison. Another consideration for comparing these three companies is the fact that this study does not take into account the amount of money invested by the given VC, only the share of the VC-type in relation to other VC-types. This is a critical factor influencing the validity of comparing the chosen companies with each other, and in relation to their level of patenting. This issue can be addressed to some extent by identifying the given VC. All three companies in this examination had Novo A/S as their CVC investor, thus it is assumed that the same degree of support was invested in all three.

Minervax ApS has not produced any patents in the span of its existence. Noticeable is, that its only venture capital financing in the first three years is from a GVC, in the following two years this is shifted to only CVC financing from Novo A/S, and in the final year, PVC financing entered, while the GVC reentered, however still leaving 53% of the total venture capital support to the CVC. The fact that this company had no patent production could support H4 of the GVC performing worst as a coaching and monitoring function. At the same time the GVC might have contributed with the signaling value necessary to attract the CVC. In that case, the signaling value could perhaps be suggested as higher than suggest by the theory because the GVC is capable of completely opting out for a few years. Finally, the signaling value of the CVC could again be proven high (H1), because of the entrance of both a PVC and the GVC in the final year of measure.

In both of the cases of Adenium Biotech ApS and Pcovery ApS, their patenting was achieved in a year of a high level of CVC financing. Building on the conclusions of the Glycom A/S case, it could be argued that the CVC is especially good at providing the professionalism necessary to understand when a patenting opportunity arises and follow through with it. In the Adenium Biotech ApS case, it seemed once again that after an increase in patents, new VCs were attracted to invest in the company. The causality can be difficult to determine; is it the signaling and monitoring value of the CVC which attracts the PVC, or is it the screening value of the PVC, which encourages the high patenting of the CVC? According to H1 and H3, both VC-types ranked high at these factors at the early stage, so possibly the duality of the relationship is reinforcing the value of each party.

An interesting observation of these two cases is the fact that, while the CVC share increased, the patenting only had one spike. This could indicate that the CVC does not bring about the coaching necessary for developing innovations; instead their value-adding comes from securing the innovations already made. This suggests that the value of the CVC is lower than that suggested by the theory. Adenium Biotech ApS is a spin-off of Novozymes A/S, thus the investee was already in affiliation with Novo A/S, and it could be suggested that the screening functions of Novo A/S has been the motivating factor creating a situation, in which the CVC had good foundation for patenting the innovations brought to them, when they invested in Adenium Biotech ApS, supporting H1. In comparison Minervax was established in order to develop on an innovation by a professor from Lund University. Because a university is already affiliated with the public, it can be argued that having a GVC as its only VC-type did not add new activity in the company in the same sense that a different VC-type would

have. Given H4, this situation would be considered least value-adding and perhaps could explain the lack of patents.

In summary, these cases support H1 in terms of screening and signaling, however the value of coaching is suggested lower than the theory suggests. H3 is supported in terms of its screening value. H4 is supported in terms of its low coaching value, however the signaling value is argued as possibly having a higher value.

7.1.3 Antibiotx ApS – Gubra A/S

Two final cases to be considered are Antibiotx ApS and Gubra A/S. In comparison with the former cases, these two companies have only been, or to a large degree, supported by BAs. All three companies have been able to patent at some point in their existence, which is in favor of H2. In comparison with Minervax ApS, this shows that it is not unreasonable to expect a patent to be developed within the first years of company existence, thus this is further speaking in favor of the BA being more value-adding than the GVC. Overall these cases support H2.

7.2 Maturing Stage Analysis

The following cases will discuss companies, which have made it into the maturing stage. However, it should be kept in mind that no data was obtained for when a company went from one stage to another, thus while the theory of mature stage companies will be applied, the early years must be evaluated with some consideration of the early stage theory. As can be seen from the selection of companies, it is possible for a firm to be in phase II after only 2-3 years. However, some of the companies from the early stage cases have existed for up to 10 years. Thus, no rule of thumb in terms of when a company goes from one stage to another was deemed applicable. A second note to be added is, that some companies are started off with a maturing stage product in its pipeline, while others become specialists within a certain phase, and then outsources their products as they move to the stage of exiting. Thus, some of these companies may never have been early stage companies, and others might not be aiming at pushing their products further than to the end of phase III, before selling it to another company. These considerations should also be kept in mind in the cases for exit stage companies.

7.2.1 Orphazyme ApS

Orphazyme ApS is a medium sized company, which went from having a BA with 100% ownership to having the CVC, Novo A/S, enter in 2011. In the following year

this CVC became the lead investor. According to H5 and H8 this would take the company from the least value-adding VC-type to the most value-adding VC-type. As can be seen from the patent development, the patents increased as the CVC entered. The first patent was achieved in the year of the CVC′s entrance into the company. The CVC entered in medio 2011, and the patent application was filed in ultimo 2011. In favor of H5, this could be an indicator of the CVC having added value through its screening function, which is why Orphazyme ApS shortly after was ready to apply for a patent. Further, this could also be a result of the professionalism of the CVC in order to file for a patent.

In the following years, there was almost an annual patent granting. In comparison to the early stage, in which the BA would be more ideal than a CVC in terms of coaching, H5 says that at the maturing stage, the CVC should be better. Based on the steady patenting and the high share of CVC, this speaks in favor of H5. In the year before the PVC entrance, there were even two patent filings. According to H6 the PVC is second best at providing value in terms of screening, and since the CVC is more likely to be trying to attract a PVC rather than another CVC, the PVC is the most value adding VC-type in terms of screening. Thus, the patenting could be a result of either, or, both H5 overall and the screening value of the PVC. This case speaks highly in favor of H5, H6, and H8.

7.2.2 Symphogen A/S

Symphogen A/S is a large company in phase II. In this case an interesting spike in the years of which the GVC, Vækstfonden, entered in the ownership share was observed. Following H5, H6, and H7, the company should already be in the most favorable situation just by having only the PVC and the CVC. In this case, it can be discussed whether having more different VC-types overall is more beneficial than just having the one that overall is theorized as being the most value adding. The theory of this study claims that different VC-types contributes with a different set of value increasing factors, thus having several different VC-types could be reasonably assumed to be adding a combined even stronger set of value-adding factors. This could lead to a new hypothesis: a combination of VC-types is more value adding than the most value adding VC-type on its own. In this case the hypotheses can thus not be directly proved.

Another interesting observation of this case is the fact that the GVC entered later in the product development. Theory suggests that the GVC enters as a mean to support a small company in its early stages, and as will be seen in the following cases the GVC

is usually added in the beginning of the company's life. In this case the development of products may have been suffering from a lack of finance, however having the potential to produce something. Thus, the financial support from the government can be seen as the financial aid necessary to proceed. In that case, the GVC truly functions as a mean to support a company, when the market is inefficient. This further highlight the concern from the industry spokesmen regarding the struggle to stay innovative when financing is difficult. The most likely conclusion from this case is, that in the maturing stage, the GVC adds most value as a provider of funds. The company's ability to attract a GVC could be assigned to the high signaling value of both the CVC and the PVC.

7.2.3 7TM A/S – ACE Biosciences A/S

7TM A/S and ACE Biosciences A/S were both founded in 2000, are in phase II, and have received GVC founding from Dansk Innovationsinvestering P/S in the early years of their venture, making them interesting to compare.

The CVC supporting 7TM A/S is Novo A/S. The company has a high level of patenting compared to the industry. If the first few years can be considered early stage development, then H1 and H2 support the favorable foundation for innovation. In 2005 the case showed a great increase in the patent production. This happened in a year right after a GVC was the sole VC-type. Again this could support the statement of the previous case of the GVC being the financial aid necessary to proceed, rather than a nonfinancial value-adder. Thus, this speaks in favor of H7.

ACE Biosciences A/S had its first spike of patents in the year of PVC financing, however the absolute number of patents was notably lower than that of 7TM A/S. This supports the ranking of H5 and H6.

In the final years of the two companies they faced two theoretically opposing situations. 7TM A/S was supported only by a BA, while ACE Biosciences A/S was supported by only a CVC. Interestingly, the former had produced no patents in the time of having a BA, whereas the latter has managed to keep up the level of patenting. This supports H5 and H8.

Investigating the years right before the VC changed, this actually contradicts the theory. According to H5, 7TM A/S had the VC-type with the better signaling value, thus this company should have been able to attract more high profiled investors than what appears to have been the case. ACE Biosciences A/S on the other hand was

close to a 50% split between a GVC and PVC, whereof the GVC should be of less signaling value. The reason for this theory contradiction can again be found by investigating the specific VC-type. ACE Biosciences A/S was to a large degree financed by the PVC Sunstone, and the GVC Vækstfonden. Both of which are specialized within the biotech industry, and thus their value-adding functions. Especially their signaling value could be considered quite high. On the other hand, 7TM A/S only had a CVC, Novo A/S, specialized in this industry, whereas it's PVC and GVC were of a more general investment background. This finding suggests that VCs of a certain specialization are better at adding value to its targeted industry, than what can be found through a generalization of all VC-types. More importantly, the Danish GVCs might be of such professionalism that they are comparable to PVCs.

7.3 Exiting Stage Analysis

7.3.1 Evolva Biotech A/S – Ferring Pharmaceuticals A/S

In the exiting stage, only two companies were found on the market without yet having had an IPO. These two companies would be considered disproving the CVC as being second best at adding coaching and monitoring value, since neither of the companies appeared to have been producing any patents under the support of a CVC. In fact, Evolva Biotech A/S had a patent drop immediately after being fully financed by a CVC. However, what could be the case is, that in both these cases the patents have been filed under the name of their CVC. These two examples emphasize the issue of separating between when a small biotech company is still a separate entity, and when it has been adopted as an R&D function for a larger pharmaceutical company. The latter would be the alternative to having had an IPO.

7.3.2 Zealand Pharma A/S

Zealand Pharma A/S completed its IPO in 2010, which was rewarded with the Transaction of the Year Awards (Zeal&, 2011). Thus, this case can be considered of having had the strong signaling strategy and monitoring necessary to make a successful IPO. In 2009, the PVC, Sunstone, invested a large share into the company. The fact that a PVC had a strong signaling value is supporting the theory. However, in this case, because Sunstone is specialized in biotech ventures, it is possible that this particular PVC overall performed better than what would have been the case for a CVC. Once again this concludes that a generalization of VCs, even when divided into types, can be difficult, perhaps especially in the biotech industry.

Another striking observation is the fact that Zealand Pharma A/S has been heavily supported by GVCs, which the theory in general has assigned less value. In the years from 2005 to 2008 the investee received GVC finance from Vækstfonden. Some of the theory touches upon the suggestion, that having a GVC in the exiting stages could actually be seen as a bad sign, because the market should be able to spot the companies with most success, and thus attract other investors. However, in this case, Zealand Pharma A/S had an exceptionally good IPO, and an overall steady development of patents. Thus, the GVC in this case has possibly not been of less value than that of a CVC or more PVC investors. The data in this case does neither prove nor disprove H11, however Zealand Pharma A/S has sought GVC financing even at this stage, so some efforts must have been put in place in order to attract Vækstfonden, which could jeopardize H11.

7.3.3 Zymenex A/S

The former case had no CVC finance, but was however very successful. Though, in order to evaluate H9, the former case can be compared to that of Zymenex A/S. This company was found as to be in phase III, nonetheless it had and IPO in 2010 just as Zealand Pharma. As can be seen, Zymenex A/S was far from having the same patenting level as Zealand Pharma. Thus, in comparison, this finding would disprove H9. The CVC did not appear to have been adding much value through signaling, since it is the same holding company which have supported the company in all years. However, the same comparison speaks in favor of H10.

The theory assumes a linear development from early stage to exiting, however in this case the company had an IPO while still being in phase III. Usually a biotech company doesn't get an IPO until it has a product on the market. Thus, in this case the fact that the company was capable of having an early IPO could be in support of H9; that the CVC has a high signaling value.

7.3.4 Exiqon A/S

Exiqon A/S had its IPO in 2007. According to H12, this company had the least beneficial VC structure in its exiting stage. It is striking that after the IPO the company had a great increase in governmental investing. In this case, it is possible to consider, whether the fact that Exiqon A/S had strong BA financing in its exiting years, was what lead to a lower signaling value and thus less attraction of private investors. In that case, H12 can be somewhat supported. Another noticeable element is the fact the PVCs in this case were not specialized life sciences venture funds. This

finding is in support of what have previously discussed; that specialized life science VCs could be the real key to having a truly value adding VC-type.

7.4 Evaluation of Hypotheses

7.4.1 Proposition H1 – H4

In the early stage support was found for all four hypotheses. H1 was supported in the sense that the CVC was best at screening and signaling. H2 was supported in the sense that the BA seemed to be adding value both through monitoring and coaching. H3 could support the PVC as having a high screening value, and H4 was supported in its ranking of coaching and monitoring.

However, some of the weaker findings were that of the CVC being best at coaching, which perhaps the BA was actually better at, or at least equally as good. This partly disproved H1 and H2. This issue could be met by allowing for equal ranking of the VC-types in the theory. Further, the GVC could possible be assigned a higher screening and signaling value, partly disproving H4.

7.4.2 Proposition H5 – H8

In the maturing stage H5 was supported in terms of the CVC ranking best at screening, monitoring and coaching. The cases further supported H6 in terms of the same factors for the PVC.

Much of the finding suggested that the GVC was merely a provider of finance. Thus the level of nonfinancial value could perhaps be seen as lower than that suggested by H7. In such case, the ranking suggested by H8 should perhaps also be reevaluated, however H8 was supported in the sense that the BA added lesser value in terms of coaching and monitoring.

In H5, H6 and H7 contradicting findings regarding the signaling value was found. The cases suggested that PVCs and GVCs of a certain specialization would most likely have a higher ranking in terms of their signaling value. Thus, the CVC would not necessarily be the best VC-type at adding this value.

7.4.3 Proposition H9 – H12

In the exiting stage only H12 was supported in terms of the BA having a low signaling value. Strong evidence of the ranking of H9, H10 and H11 could however not be found from the cases. Instead, several of the cases suggested that specialized

PVCs and GVCs were likely to be comparable, if not even better, than the CVC in terms of signaling value and possibly also coaching and monitoring value.

8. Discussion

The aim of this study was to identify how different VC-types, and combinations of these, shape the innovative scope of biotech companies.

The literature review highlighted that VCs had a positive impact on innovation in biotech companies. Especially the PVC company had received appraisal for its nonfinancial value-adding in the innovation process. The issue proposed was that the Scandinavian PVC market was too hesitant and to ill-matured, to provide the financial and nonfinancial value necessary to achieve the best growth potential within the innovative industries. Especially the Danish biotech industry would suffer from having to accept financing from lesser value adding VCs.

However, what previous literature has not taken into consideration is the history of Danish pharmaceutical innovations, the highly innovative market conditions within the Medicon Valley, and the governmental interest in spurring this particular industry. Thus, this paper proposed, that despite the lukewarm PVC market, it would be interesting to investigate whether the financing from other VC-types necessarily created a lesser innovative industry.

Three types of investigations had to be made in order to determine what could be expected of the industry. First, an extensive literature review of the four VC-types in case was made in order to build relevant hypotheses. Secondly, descriptive data regarding the industry was provided in order to see if the market was in line with the suggested theory perspective. Finally, a range of case studies was made in order to investigate the proposed hypotheses.

The literature review proposed four factors of main value adders as determining for how the VC value-adding process could affect the innovativeness of the investee. The factors screening, coaching, monitoring and screening were found to be of varying value to the biotech company depending on the stage of development of the investee′s product, thus proposing a contingency theory. Each factor was ranked in comparison to the others within the stages early, maturing, and exiting, and the conclusive ranking was summarized in **Appendix 1**. This paper proposed that no factor was of equal value at a given stage. However, as the literature review revealed certainly it could be debatable whether some factors should have been set of equal value.

The contingency theory was further developed by a theoretical evaluation of the performance of each VC-type in relation to the four factors and the given stage of development. Again the ranking left no room for equality between the VC-types. The extended theory was summarized on **Appendix 2**.

The initial aim of this paper was to make a regressional correlation analysis between a given VC-type, its stage of development and it's innovative output measured in patents. However, due to limited access to industry information on the key variables, the paper investigated its contingency theory by examining 14 case companies.

9. Conclusion

Based on the suggested theory this paper developed 12 hypotheses for further investigation in the Danish biotech industry.

The most interesting finding from these case studies was the effect of having a sector-specialized VCs as a main investor. In both the maturing and exiting stages, biotech companies with a specialized PVC or GVC would appear to perform better than suggested by the theory, which mainly favorized the CVC.

The fact that specialized VCs perform remarkably better than the general VC can also be supported by the theory. While it might not be a surprise, that specialized PVCs will be performing better, it is interesting that perhaps the GVC is just as efficient as the CVC and the PVC. This conclusion supports the question of whether the Danish VC market is of a different nature than that of the US. Thus, the notion that innovation is suffering from an ill-matured PVC market could be suggested as being compensated by a very well structured GVC market. The specialized GVCs are likely to have the innovative requirements, professionalism, qualitative networks, and clearly defined exiting strategy necessary in order to increase their level of value-adding, and especially their signaling value. However, some of the findings did suggest that the GVC was merely a source of finance.

The Danish biotech market does seem to be dependent on BA investments in the small companies, however CVCs do appear to be entering the market as well. The CVC was suggested as of being highly value adding, and thus it might be in the CVCs that the biotech industry should focus its attention on developing its financing of new biotech companies.

9.1 Answering the Research Question

The concluding notes of this paper are that it is reasonable to assume that different VC-types do differ in their nonfinancial value-adding. Due to the limited data it was however difficult to state whether the value-adding was much dependent on the stage of development. However, the theoretical framework would suggest that this is a valid assumption.

The theory of this study allowed for no equality in the ranking of the four factors in relation to the stage of development, and neither so in the ranking of the VC-types. Thus, the theory was very stringent, and this generalization could very well be debatable and reconsidered. However, for the sake of this comparative study the inflexible ranking of variables was deemed appropriate in order to prove or disprove the most dominating theories of the industry.

The literature review suggested that a measure of patents would be an appropriate measure of the innovative influence of the VC-type. However, for this paper the patent data was merely a measure of guidance in terms of how the different VC-types influenced and perhaps used patenting as part of their value-adding strategy, rather than being a measure of their ability to increase innovation in their investee. Thus, this paper will refrain from concluding whether one VC-type is better at spurring innovation compared to that of another. Rather the findings of this paper suggest that the Danish biotech industry has an innovatively supportive VC market that goes beyond that of the PVC. In order to increase the growth and innovative output of Danish biotech companies more effort should be put into specializing certain PVCs and GVCs in the biotech industry. Further, the big pharmaceutical companies should be encourage to funnel more money into their CVCs and increase the innovation in the industry through the small biotech companies.

9.1.1 Future Research

The theory of this paper is build on the assumptions that VCs ad nonfinancial value to their investee, and that some VCs are better at doing this contingent upon various stages of development. While this paper investigated this by separating between a generalized separation between BAs, PVCs, CVC, and GVCs, based on the results of this paper it is suggested that for future research this theory should only be applied on a sample of clearly specialized VCs within the biotech industry. Instead of approaching this theory from an industry level to a firm level, future research should consider comparing the innovative scope of biotech companies within the portfolio of a four specialized VC-types. Further, a study of whether the combined forces of these VC-types add nonfinancial value to the investee would be interesting in a future

research studies. Such research would add to the knowledge of which VC-types should join forces, in order to compliment each other's strengths and weaknesses throughout the risky venture of financing a biotech company.

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11. Appendix

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