Do Firms Always Want to Learn from Corporate Venture Capital Investments?

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ABSTRACT

In this paper, the learning intentions and outcomes for corporate venture capital are questioned. Through qualitative research in the oil and gas sector, we identified a desire to control the direction and pace of innovation as the main driver for this type of investments. A new model and framework for CVC are presented. Contrary to the traditional model of CVC, which features a dyadic relation between corporate investor and venture entrepreneur, our model shows that CVC investments create a more complex conjoint of relations between multiple stakeholders. These relations challenge the neo-Schumpeterian model of competition.

Using the grounded theory approach, we created a theoretical framework explaining and predicting outcomes of corporate venture capital other than learning. At firm level, our framework conceptualizes CVC programs as dynamic capabilities, and suggests a competitive advantage for the corporate investor through its ability to faster and better integrate the new technology. At market level, we proposed that CVC investments positively affect the pace of innovation in the market through an increased speed of acceptance of technologies supported by corporate investors.

Keywords: Corporate Venture Capital, Innovation, Strategy, Dynamic Capabilities, Evolutionary Economics
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1. INTRODUCTION

In the last two decades, academic research on corporate venture capital (CVC) – and corporate entrepreneurship in general - has increased significantly (Ireland, Reutzel & Webb, 2005; Narayanan, Yang & Zahra, 2009). The attention for corporate venture capital can be seen in the context of increased popularity of the ideas on open innovation (Chesbrough, 2002) and acceptance of the idea that established firms have a critical need for externally developed knowledge and technology in order to stay competitive (e.g. Almeida & Kogut, 1997; Katila & Ahuja, 2002; Berchicci, 2013). In the search for access to external knowledge firms have several tools at their disposal (outsourcing, acquisition, licensing, and joint venture, among others) (Schildt, Maula & Keil, 2005). The uncertainty surrounding new technologies and products, however, makes them reluctant to make major commitments to venture entrepreneurs (van de Vrande, Vanhaverbeke & Duysters, 2009; van de Vrande, 2013). Compared with other forms of external cooperation, CVC investments are characterized by low commitment and easy exit, which is more attractive to established firms in uncertain situations (van de Vrande, 2013). In this context, corporate venture capital has been celebrated in academic literature as fruitful instrument for established firms to acquire external knowledge (e.g. Dushnitsky & Lenox, 2005; Wadhwa & Kotha, 2006; Gaba & Meyer, 2008).

In spite of the increased attention for corporate venture capital there has been no substantial and integrated research attempting to understand the phenomenon of CVC investments. The absence of strong theoretical and empirical support has not withheld researchers from analyzing CVC almost exclusively through organizational learning theories. The purpose of this paper is to create alternative approaches for the studies on
this phenomenon. Because the link between CVC and organizational learning dominates this field of research we formulated a counterintuitive research question: Do firms always want to learn from CVC investments? And if not, then what are the real drivers of CVC?

Based on our in-depth qualitative research we found that for companies in the oil and gas industry, CVC programs are a tool to control the pace and direction of innovation in the market they operate. To offer a more complete theory this paper presents a model of CVC and a theoretical framework explaining the phenomenon of corporate venture capital. The model as well as the framework deviates significantly from what has been used in mainstream literature.

Our model presents a more complex context for CVC than the dyadic relation that has been used in former research. The theoretical framework developed here suggests outcomes on the market and on the firm level. At the market level the framework suggest that CVC investments allow companies to control the pace and direction of innovation. This correlation is mediated by the speed of acceptance of the new technology. At the firm level we propose a positive correlation between CVC investments and firm efficiency, mediated by the integration of the new technology.

The absence of literature on the drivers of CVC made us follow a grounded theory building approach (Charmez, 2006; Eisenhardt, 1989; Yin, 2004). This approach allows the researcher –through data analysis and coding- to find the theory that is ‘grounded in the data’ (Charmez, 2006). Through a qualitative study of CVC activities conducted in the oil and gas industry a model and theoretical framework on corporate venture capital have been created. The oil and gas industry provided an excellent context for our case studies because the oldest venture unit, Chevron Technology Ventures, has been created 15 years ago. Thus, we had the opportunity to talk to people involved in the foundation
and structuring of the program. Also, CVC has not been studied in this very specific industry sector which recently came under a lot of pressure from increasing safety and environmental standards, the difficulties in finding new oil reserves, and the problematic access to unconventional reserves (Brown, 2014). Presumably, this urgent need for new technologies leads to the search for externally developed technologies. Our data were collected from CV units of major oil and gas producers and service providers in the oil and gas industry, as well as from consulting companies closely involved in their CVC activities. As such, we analyze the phenomenon from the point of view of the corporate investors in the oil and gas industry.

Through a better understanding of the drivers of CVC programs and investments, this study answers to Maula’s (2007) call. He states: “research on when and why corporations invest in CVC is far from saturated” (Maula, 2007: 380). Until today this call remained unanswered. Later, Narayanan et al. (2009: 65) expressively stated: “Measuring the short- vs. long-term value added of CVC is problematic”. In the absence of a theory to explain and/or predict the phenomenon of corporate venture capital (Priem & Buttler, 2001), how can we adequately measure its effects? If the initial intentions of companies are unknown, and it is unclear how CVC programs function in practice, we cannot understand what value the investment has for the corporate investor. Noting that these investments moved more than U$ 12 billion in 2014 worldwide, and show an increasing trend (CBInsights database), it is necessary for academic research to understand this phenomenon better.

By explaining in detail what drives companies in the oil and gas sector to engage in this type of investments our research contributes in the first place to the field of corporate venture capital research. The understanding of the drivers of CVC brings significant progress and creates an alternative approach to the study of CVC. Presenting new
potential consequences for the corporate investor and the market in which it operates broadens the scope of research in this field. Secondly, the paper also contributes to the emerging field of co-opetition by presenting other motives for engaging in strategic alliances with competitors, as well as different consequences at network and market level. Thirdly, the research on networks and strategic alliances can also be inspired by our findings, as there is no restriction for those ideas to vertical relationships. Lastly, evolutionary theorists are challenged to nuance their view on market competition. For example, CVC requires a dynamic collaboration between established firms and the venture entrepreneur. The dichotomy between these two entities, as presented by evolutionary economists, seems not to be contradicted by the facts.

Clarifying other than learning consequences of corporate venture capital investments helps managers to evaluate the potential of this investment instrument. Where until today CVC has mainly been seen as a tool for innovation, managers might become aware of the other features CVC holds. When considering the creation or evaluation of a CVC program, different aspects than learning could be taken into account. For entrepreneurs, this study will contribute to a better understanding of the goals and interests of corporate investors. Focusing on the learning objectives of corporate investors Dushnitsky and Shaver (2009), and Park and Steensma (2012) warned that a conflict of interest between the venture entrepreneur and the established firm emerges. By providing another context of CVC research, however, entrepreneurs may become aware that this conflict is not inherent to CVC investments.

We have structured the paper so that in the next section we briefly elaborate on the definition of CVC, as used in this paper. The next chapter discusses the literature on CVC that formed the basis for our reasoning and research design. In the third part, we describe our research method and data sample. Chapter 4 presents the model of CVC in the oil and gas industry we developed. In chapter 5 the framework and propositions on
the outcomes of CVC are discussed. We conclude this paper with the discussion of our findings, limitations of our study and suggestions for further research.

1.1. Corporate venture capital

Besides the absence of a clear framework to study CVC, there is also a lack of a set definition of what CVC investments are. The numerous definitions of CVC investments show one commonality: there must be an equity investment from an established firm in a venture entrepreneur\(^1\) (Maula, 2007; Narayanan et al., 2009). Dushnitsky and Lenox define CVC as “investments that consist of minority equity stakes in relatively new, not publicly traded companies that are seeking capital to continue operation” (2005: 948). Wadhwa and Kotha limit their definition to “externally equity investments made by established firms in privately held start-ups” (2006: 1). Gaba and Meyer (2008) see venture capital as tool for making investment decisions in the face of risk and uncertainty. Narayanan et al. (2009) go further and include the company’s possible objectives in their definition (2009: 59): “CVC refers to equity investments made by incumbents in start-ups to gain access to their innovations, technologies, and other discoveries.” Because there does not exist a universally accepted definition of corporate venture capital, for the purpose of this research, we define CVC as those investments made by established firms – the corporate investor- in venture entrepreneurs that need capital to continue operating. A company is considered to be an established firm when it already operates in at least one market and possesses a certain market share in that market. The main activity of the venture entrepreneur involves the development of a not yet commercialized technology of which the commercial value also has not been established. CVC is normally used for investments in new technologies in an early stage of development (Gaba & Meyer, 2008; Basu, Phelps & Kotha, 2011; van de Vrande,

\(^1\) We consider that ‘venture entrepreneur’ and ‘start-up’ refer to the same type of firms. For the consistency of the text we will further use ‘venture entrepreneur’.
Therefore, the investment itself involves uncertainty and risk. We presented this definition to our interviewees, who gave their consent. Some of them also included investments in technologies developed by already functioning companies or investments at a stage where the commercial value of the technology was more certain. However, this seemed to be related with the character of the investments that fell under the responsibility of their firm’s CVC program.

2. LITERATURE REVIEW

Former research has analyzed drivers (Siegel, Siegel & MacMillan, 1988; Lantz, Sahut & Teulon, 2011) and antecedents for CVC (Basu et al., 2011; Dushnitsky & Lenox, 2005; Dushnitsky & Lavie, 2010), the link between CVC and later acquisitions (Anand & Galetovic, 2000; Benson & Ziedonis, 2009), and the relation between the established firm and venture entrepreneur (Dushnitsky & Shaver, 2009). A vast part of the research on corporate venture capital has focused on the consequences of CVC investments for both the established firm (e.g. Dushnitsky & Lenox, 2005a; Maula et al., 2013; Wadhwa & Kotha, 2006), and venture entrepreneur (Park & Steensma, 2012)\(^2\). Dushnitsky and Lenox (2005a) and Wadhwa and Kotha (2006) analyzed the relation between CVC investments and innovation performance. The relation between other modes of (external) knowledge sourcing and innovation performance was the subject of studies by van de Vrande (2013) and Berchicci (2013). Ahuja and Katila (2001) explored the relation between technology acquisition and innovation performance. All these studies examined corporate venture capital from the organizational learning perspective. A few studies focus on the financial side of the companies’ CVC policies (Gompers & Lerner, 2000; Benson & Ziedonis, 2009), or the timely attention to change of the corporate investor (Maula et al., 2013), but other ‘strategic reasons’ have been ignored. There are

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\(^2\) For an extensive review of past research on CVC see Maula (2007)
several reasons, however, to doubt that the learning objective of the corporate investor would be the unique driver.

First of all, the studies on the influence of CVC investments on innovation performance of the corporate investor show inconsistent results and face some observational problems. Dushnitsky and Lenox’s (2005a) results are mainly in line with the enthusiasm of Kortum and Lerner (2001) on the positive effects of venture capital on innovation. They find a positive linear relation between CVC investments and the corporate investor’s innovation performance. Wadhwa and Kotha’s (2006) empirical research results in a U-shaped relationship between CVC investments and the overall innovation output of the incumbent company, which is in line with other studies on external knowledge acquisition and innovation performance (Grimpe & Kaiser, 2010). Although Wadhwa and Kotha (2006) praise CVC investments for their innovation-related benefits, they recognize Schildt et al.’s (2005) findings with regard to the lack of efficacy in learning when CVC is compared with other modes of external venturing. Schildt et al.’s (2005) and Keil et al.’s (2008) research results on direct learning through corporate venture capital investments are rather disappointing.

Second, it also has been problematic for researchers to define an accurate time lag for the measurement of innovation performance. This time lag should cover the time between the access to the new knowledge or technology and the application of it by the incumbent firm, through patent activities. Because the authors of the above cited studies presume that it is the established firm’s objective to immediately start the learning process they define this time lag arbitrarily as 1 year. However, Chesbrough’s (2002) case study on Intel’s venture investment in Berkeley Networks shows that there was no ‘organized knowledge transfer’ between the two in the first year after Intel’s investment. The problematic definition of this time lag is another sign that it is not clear if and when firms learn from the venture entrepreneurs they invest in.
A third limitation of the above cited research is that they do not explain how CVC contributes to organizational learning. Dushnitsky and Lenox (2005a) and Wadhwa & Kotha (2006) count all patent registrations after the investment, and as such conclude that there exists a positive effect of CVC on innovation performance. Keil et al. (2008) and Schildt et al. (2005) count specific for these patents referring to the patents registered by the ventures, and find disappointing results for this direct learning effect.

Also, none of these studies account for CVC investments that did not lead to patent registration by the established firm. The lack of patenting could indicate that the technology was never internally developed by the established firm, or at least not successfully. Considering this, the researchers potentially are positively biased regarding. Measuring the learning consequences of CVC investments, the investments that did not result in innovative activities for the company should be taken into account.

Fourth, there are several factors that could inhibit a corporate investor from exploiting the technology developed by the venture entrepreneur. Although Dushnitsky and Lenox (2005, 2005a) declare that a weak Intellectual Property (IP) regime gives better access to privileged information on technology, we know that venture entrepreneurs are very cautious when dealing with corporate investors (Dushnitsky & Shaver, 2009). In the contract signed between the established firm and the entrepreneur there will normally be a non-disclosure clause present (Anand & Galetovic, 2000). In practice it is easy to innovate around the patent and the venture entrepreneur has no financial means to fight the corporate ‘imitator’, but the established firm has a reputation to uphold (Dushnitsky & Shaver, 2009; Park & Steensma, 2012). If a corporate investor ‘abuses’ the information it gets through its venture projects, there will be no future investment opportunities for that investor. Therefore, even if the corporate investor has access to certain privileged information on new technologies through CVC investments, we cannot assume that this knowledge can and will be further developed in the internal
R&D sector of the investor. In addition, our data show that corporate investors co-invest with other corporations. Co-investors will not allow that one of them takes and develops the technology in-house as this would devalue the return they could get from their investment.

On top of these formal factors, an investor, even with access to the new technology and the right to use it, can have other reasons to not integrate new knowledge. In the case of Intel and its Berkeley Networks investment, there existed a fear that a knowledge flow from the venture entrepreneur to the internal R&D department of the established firm could ‘contaminate’ internal engineers (Chesbrough, 2002). The idea was that once Intel’s engineers became aware of the new technology, they could have difficulties resolving a given problem another way or possibly became unmotivated to try to find another solution for a seemingly already solved problem. This was also confirmed during our interviews, a contamination in both ways should be prevented following interviewee 4:

“We make sure when we are learning about a new company that we do not expose confidential information to people within (name of the company) that could be developing something similar. That could create contamination issues.”

Additional reasons for halting the transformation from external knowledge to the internal R&D could be that there is a lack of skills in the company to deal with the new technology, or that there are missing co-assets.

It must be clear that the knowledge transfer from ventures to established firms is not guaranteed or an easy process and it is very unlikely that corporate investors will try to develop all new technologies available, as studies of Dushnitsky and Lenox (2005, 2005a) and Wadwha and Kotha (2006) presume. If this learning process through CVC is difficult and embedded in uncertainty, why do firms engage in those activities? And what are the outcomes and consequences of this process?
2.1. Proactive corporate investors

Evolutionary economists have explained on numerous occasions how ‘Schumpeterian shocks’ create a turbulent environment for firms (Schumpeter, 1950; Nelson & Winter, 1982; Tushman & Anderson, 1986; Henderson & Clarck, 1990). These shocks change the ‘technological paradigm’ that rules the market (Dosi, 1982; Nelson & Winter, 1982; Christensen & Bower, 1996) and are considered ‘competence-destroying’ (Tushman & Anderson, 1986) or disruptive innovations (Christensen, 1997) because they require capabilities the established companies lack. It is generally agreed that these disruptive or destroying technologies come forth from new companies (Schumpeter, 1950; Tushman & Anderson, 1986; Henderson & Clark, 1990; Sood & Tellis, 2011) and create environmental uncertainty for existing firms (Tushman & Anderson, 1986).

Managing market uncertainty is a principal task for established firms (Thompson, 1967; Toh & Kim, 2013). One way of dealing with these uncertainties is through finding a balance between exploration and exploitation. Although Toh and Kim (2013) defend that some firms ‘bet’ on specialization at the expense of exploration of different markets, there is a general belief that companies should invest in exploration to stay aware of what is going on in the market and not be blindsided by sudden changes (Levinthal, 1997, Maula et al., 2013; Katila & Ahuja, 2001; Wadhwa & Kotha, 2006).

Levinthal’s (1991, 1997) model of local and distant search defends explorative activities through the concept of ‘fitness’: distant search provides a company information about technologies different than the one are developed inside the company, or the ones the company knows. Building up knowledge on these ‘new’ technologies prepares the company for when this technology becomes the ruling paradigm in its market. The earlier and better you can adapt to this new organizational form, the ‘fitter’ the company will be. This ‘fitness’ is considered crucial for the survival of the company in a changed market environment (Levinthal, 1997; Maula et al., 2013). Maula et al. (2013) have
shown that CVC helps companies to direct its management’s attention to technological discontinuities, assuming that the company consequently will react timely and adequately to changes. This literature has conceived companies as reactive entities, trying to adapt to a new market landscape. But are companies really reactive?

Another way of dealing with market uncertainties is to adopt a proactive approach. Instead of adapting, companies can proactively try to influence their market environment (Araújo & Gava, 2012). Evolutionary economists such as Nelson and Winter (1982), Tushman and Anderson (1986), and Christensen and Bower (1996) have already shown that established companies do not merely react to market changes. Firms engage in the development of technologies they consider the most appropriate under certain conditions (Christensen & Bower, 1996; Nelson & Winter, 1982). Tushman and Anderson (1986) even state that organizations may be able to use investments in R&D and technological innovation to shape environmental conditions in their favor. Ferrier et al. (1999) argue that companies need to be aggressive, or otherwise they will succumb to the moves of more aggressive rivals. CVC investments create a flexible relationship between venture and corporate investors (van de Vrande, 2013). For the latter, it is a relatively cheap tool to keep an eye on these new, potentially disruptive technologies as shown by Maula et al. (2013), but it can be more than this. With the influence the corporate investor gains (e.g. through a chair on the board) (Gaba & Meyer, 2008; Park & Steensma; 2012), it can orient the future developments of technology invested in. CVC investments can be a powerful instrument to control market evolution. Although Keil’s (2000; 2002) concept of venture capital is broader than corporate venture capital alone, he recognized monitoring of markets and market enactment as strategic objectives of corporate investors. Monitoring of markets refers to the detection of weak signals on the future development of the market. Market enactment consists of a
proactive approach, where corporate investments are used to shape markets, set standards and stimulate demand.

Considering all this, we conclude that there are indications in extant literature that companies may use CVC investments as a tool to control innovation in current and new markets. There are potentially other than learning reasons to engage in CVC. Considering the absence of strong arguments for studying CVC through organizational learning theories and the idea that companies can have other strategic benefits through this investment tool, we realized there was a need for an in-depth study to better understand the strategy behind CVC programs, their outcomes and consequences. Our qualitative research project showed that instead of a focus on learning, oil and gas companies use their CVC investments to develop and commercialize new technology of external venture entrepreneurs. These companies do not show interest in further developing this technology internally. The urgent need for new technologies combined with the current pattern of innovation in the oil and gas industry has led to the adoption of CVC programs in the oil and gas industry, allowing direct investments in venture entrepreneurs. Using the guidelines of Charmez (2006), we first developed a model for CVC (figure 1), to understand how CVC in the oil and gas industry functions. Afterwards, we aggregated our case studies to build a theoretical framework (see figure 2) on the phenomenon of CVC. Primary and secondary data were used to develop the propositions made.

3. RESEARCH METHOD

The aim of our research was to understand corporate venture capital more in-depth, its driving forces, the process, and its consequences, so we adopted an inductive qualitative research method. Following the process of grounded theory building as presented by
Eisenhardt (1989) and Charmez (2006), we constructed a theoretical framework on CVC in the global oil and gas sector. The data obtained during our multiple case studies allowed us to define the drivers, the process of investment, and the final outcomes of this investment tool.

3.1. Research context and sample

We chose to study the global oil and gas industry because it offered a splendid environment to study the drivers of corporate venture capital. First of all, several oil majors have created a CVC unit in the last decade. Starting with Chevron in 2000, most of the major oil producing companies have since provided themselves with a CVC program. Because these companies recently decided to engage in this type of investments, we had the opportunity to speak with the persons involved in the creation of and current decision making in the oil and gas industry’s CVC programs. Second, the short history of these oil majors’ CVC investments indicates that clear policy shifts have taken place. On the one hand a shift from a strong focus on renewable energies to a focus on technologies related to the core business. On the other hand, some producers have outsourced their venture funds to ultimately bring them back in-house. This policy revision could have occurred for several reasons, e.g. dissatisfying outcomes. The presence of these policy shifts makes the oil and gas industry a very interesting setting to study the company’s drivers for corporate venture capital. A third reason for us to choose the oil and gas sector is based on its unique combination of high-tech and conservatism. Former studies on CVC have also focused on high-tech companies, which operate in very innovative and dynamic markets, but the oil and gas industry gives us a different setting. Although the exploration and production of oil and gas requires highly sophisticated technologies, the high safety standards for trials or commercialization make the adoption of new technologies a very slow process. The market can be characterized as conservative. Without claiming that the adoption of innovation in other
markets is without any risk, we could say that e.g. the internet or pharma-industry show a greater dynamism and openness towards new technologies. The unique and specific market environment of the oil and gas industry likely gives us interesting insights to better understand CVC. The last factor in choosing the oil and gas industry is the pressure the producers feel to innovate. More and more safety, security, and environmental requirements are imposed upon oil producing companies. They feel the need to come up with better and cleaner solutions. In addition, conventional oil reserves became the exception and unconventional reserves the rule. Companies need to improve their technologies, or find cheaper solutions (Brown, 2014). Otherwise, petroleum and gas could lose their price and/or scale advantage to alternative energies (Petkova et al., 2014).

For our study, each interview conducted is considered to be one case. Conducting multiple case studies allows the researcher to validate the data emerging from one study (Eisenhardt, 1989; Yin, 2004). Using cases from a single sector gives us a deeper understanding of the CVC model in the oil and gas sector, but begs extra caution when formulating conclusions about CVC in general. The prime sources for our qualitative data collection were 20 interviews with persons active in the oil and gas corporate venture capital world. The interviewees work or worked for the CVC programs of one or more oil and gas producers or service providers, or work as consultants for such programs. Some were venture principals, others directors or presidents of the company’s venture unit, and others investment directors of the core company. All had a long career in the oil and gas industry, and in the company for which they did CVC investments. It is worth noting that the CVC units are very small operating units within the core company. They consist of between 2 and 15 people. Our sample is a substantial share of them. We selected most of the interviewees, but some were indicated by others: the so-called snowball effect. In total, the 20 people we interviewed worked in 10
different companies, of which 7 are major oil and gas producing companies. These companies all have a CVC unit, with the exception of one – Petrobras. Petrobras had considered setting up a CVC unit, but the plan did not materialize. The companies that formed our case studies are spread geographically and are private as well as state-owned companies.

The interviews conducted were semi-structured, and all held during the first half of 2015. The average length of the interviews was 30 minutes. Due to the physical distance between the researchers and the interviewees, most of the interviews were conducted by Skype or phone and were on the record, unless requested otherwise by the interviewee. The recorded interviews were all transcribed. For reasons of confidentiality – clearly requested by our interviewees – we numbered our interviewees and refer to them by this number. Upon invitation to interview, we informed the interviewees about the objectives of our research and the interview itself. At the start of each interview, we gave the interviewee our definition of what CVC investments were and asked if they could agree with it. This was to make sure there was no misunderstanding on the subject of study. Sometimes the interviewees had a broader definition, mainly in alignment with the scope of investments of their CVC program. Upon clarification of what would be understood as CVC investments during the interview, we started the actual interview. We focused the questions on the oil and gas industry as a whole and not on company for which the interviewee worked.

As Eisenhardt (1989) describes, the advantage of inductive research is the ability to adapt and change the questions based on the data you are obtaining. Based on the first interviews and secondary data, the questions of the subsequent interviews were adjusted to focus more on the missing information. The congruence in the answers of the interviewees was striking. After conducting the first 14 interviews we sensed a theoretical saturation. We decided to conduct several more interviews, but thought 20
interviews sufficient, given the small number of people active in this area. The interviews were our main data source, but also secondary such as the company’s portfolios, working papers from the industry, and company’s websites were used.

3.2. Data Analysis

To construct a theoretical framework on corporate venture capital in the oil and gas industry we analyzed our data by creating a case study for each interview conducted. This allowed us to cross-analyze the data and verify with the secondary data. Since we had no direct interest in understanding the CVC process for each company, when possible, the questions posed were market orientated. Understandable, the interviewee will always be influenced by their personal experiences when answering questions (Charmez, 2006).

To analyze the data obtained through the interviews and to create our case-studies, we first transcribed the interviews and coded using Charmez’ guidelines (2006). An initial coding phase brought up the different drivers and processes each interviewee considered important. For each case, we mounted a schema of how the CVC model worked in the oil and gas industry based on the wording of each interviewee. We cross-analyzed these frames to find similarities and differences. The similarities for each case were impressive. The main differences lay in the absence of a factor, e.g. not mentioning the final acquisition by the service providers. However, this could mainly be due to the absence of a question asking for this kind of answer. After this initial coding phase, we analyzed the different frameworks during the focused coding phase, to sort, synthesize, integrate, and organize the data (Charmez, 2006). These constructs, integrating the various similar terms resulting from the initial coding, were linked to finally create the framework we were seeking. The links emerging from the data were verified with secondary data to create a solid and credible model for CVC in the oil and gas industry.
Although the case of social constructivism is very strong, we tried to avoid any researcher bias during the analysis of our data and the construction of the model and framework. Cautiously and repeatedly indexing and grouping the results under the different categories as drivers, benefits, outcomes, and consequences we were able to construct a model and framework ‘grounded’ in the data (Charmez, 2006). After mapping the model for CVC and the framework, we revisited the data to assure there were no incongruences with the framework. This intense process, neatly following Charmez’ (2006) and Eisenhardt’s (1989) guidelines, allowed us to develop the constructs, their connections, and the theoretical insights that will be discussed in the following chapter.

4. CVC MODEL

The research context of the oil and gas industry provides us with a model of CVC (see figure 1) that is significantly different from the model used in previous studies on the subject. Where the classic model to study CVC represents a dyadic relation between the corporate investor and venture entrepreneur, we found a more complex model with different stakeholders. First of all, our data made clear that besides the oil producer -as an established firm- and the venture entrepreneur, several co-investors are part of this relation. The interviewees made clear that it is rare to have an oil producer investing alone. Interviewee 8 (I8) declared: “we like to have co-investors, we like to have allies in [sic] the board”. Another points to the fact that these co-investors can be of a different kind: “We always co-invest with others. It can be oil companies, it can be pure venture capitalists” (I13). Besides the presence of co-investors, our model differs from the traditional one due to the presence of a third acquirer in the framework. Whereas former studies (Benson & Ziedonis, 2009; Lantz et al., 2011) claimed CVC investments to be a ‘try before you buy’ instrument, we see that in the oil and gas sector there is no
interest from the corporate investors to acquire the technologies in which they invested. When asked about the interest in the acquisition, interviewee 18 answered: “We have never acquired a portfolio company”

A consultant (I17) framed the process like this:

“They really just want the technology and make it to step up and fund the technology to the point where it can be proven, where (name of service provider) steps in and purchases them. And that is fine.”

It was clearly confirmed that in most of the cases the technology co-developed by the oil producer and venture entrepreneur was sold to a service provider of the oil and gas market. Sequent, this service provider offers the technology to the oil producers as part of its service portfolio. As will be discussed in more detail below, this complex relation is the result of a situation where the service providers do not offer the technologies the oil producers are actually requiring. Through the co-development of the technologies and the companies’ proven interest to have them provided, the oil producers force their service providers to add the technology to their portfolio.

What is, besides the multifaceted relationship between the different players, also interesting in the model presented here, are the challenges it poses to the neo-Schumpeterian market model. CVC was not yet happening at the time Schumpeter developed his ideas on disruptive entrants and the challenges they posed to established firms. We must note, however, that reality did change and the model has not been adapted on this point. During our interviews, it was confirmed several times that the oil producers actively promote the development of disruptive technology. Established firms invest to let new entrants grow and survive. Knowing that these small enterprises need those investments to enter the market, a corporate investor can control the technologies that will be developed in its market. In the oil and gas sector, co-
investments and a network of corporate investors can even coordinate these investments in disruptive technologies. To use the words of one of our interviewees (I19): “If it is going to be disruptive, we might do it ourselves, right?”

To better understand the drivers of CVC, the framework and its concepts, links, and consequences, we will discuss them separately in the following sections. Where appropriate, research propositions have been made.
Drivers for CVC activities:
- Dissatisfaction with pace and direction of innovation in the industry:
  - New technological challenges
  - Need for better and cheaper technologies
  - Inability to work together with small entrepreneurs
- Interest in other energy sources or demand-disrupting technologies

O&G producer to VE:
- Fast development of needed technologies
- Development of ‘ready-to-use’ technologies
- Discounts & Geographic preference
- Financial return/equity
- Board seat

VE to O&G producer:
- Investment
- Qualification technology
- Feedback on technology
- Market expertise
- Trial opportunities
- Credibility

Oil & Gas Producer

Venture Entrepreneur

Service Providers

Innovation O&G producers want

Co-investors:
- Other O&G producers:
  - Risk sharing
  - Increased credibility
- Independent VCs:
  - Risk sharing
  - Financial discipline

Innovation O&G producers want

Figure 1: Model of CVC in the Oil and Gas Industry
4.1. The drivers for CVC in the oil and gas industry

In the oil and gas industry, the oil producers are generally seen as end consumers of technology. The majority of the technology they use is provided by a limited number of service providers. Several long term joint R&D projects are in place in which the producers and service providers work together. For innovation, oil producers also collaborate with university research centers and in joint industry projects. During the interviews with the venture principals of several oil majors, dissatisfaction with the model of open innovation as it existed became clear. Interviewee 8 stated: “The big oil service companies, they just like to provide the services they already have”. As in other industries, the oil producers became aware that a lot of innovation comes from small enterprises and venture entrepreneurs (Almeida & Kogut, 1997). However, they missed a tool to work together with companies too small for M&A’s or a joint venture. Observing the CVC movement in the internet and telecommunications industries by the end of the 20th century and the start of the 21st century the oil producing companies saw an opportunity in corporate venture capital to engage with these small and innovative entrepreneurs. It would be a tool to select interesting technologies to develop out of the numerous technologies provided to them through their CVC unit. Oil and gas producers decided to invest in those technologies that made their production process more effective and efficient. To compensate the service providers’ delay or disinterest in the development of specific technologies, the oil producers decided to do it themselves. All interviewees declared a wish to accelerate innovation in their market. To quote interviewee 5:

“The main reason we do it is to accelerate the development and production of technology.”
From the side of the service providers this dissatisfaction was confirmed when an interviewee stated that the oil producers “also have a vested interest in prototyping certain technologies from their side. They do not like the high prices (name of a service company) charges for our services” (I15). It must be clear that this corporate venture capital movement has its roots in the dissatisfaction of the oil and gas companies with the pace and direction of innovation in the oil and gas industry, as it was controlled by the service providers. Like interviewee 8 noted, the oil producers want to see the development of those technologies developed in which they are most interest in:

“The main driver is really to help small companies to create and get new technologies in place, make them commercial so we can use them in our operations afterwards. And the implementation, it should either increase oil recovery or cost reduction as the results of those technologies. We are not looking for making or taking these technologies in house. We just want the technology gets available for our operations. That is the main driver really, to get the technologies implemented in our operations. Leading to cost reduction or increased oil recovery. Or also,..., reduction in CO2 emissions.”

Therefore, the oil producers adopted the tool of corporate venture capital to help new technologies develop and commercialize in the oil and gas industry. They aimed at providing guidance and feedback to these venture entrepreneurs, so their technologies would be quickly available on the market.

It must be clear that the main drivers for corporate venture capital in the oil and gas sector are the slow pace of innovation in the market, and the dissatisfaction with the type of technologies developed by the market. The oil producers are looking for better and cheaper technologies that can impact their core business. We do not find a direct interest in becoming more innovative, or to learn from the technology. They try to create a more innovative market in which they are the clients. The oil producers become the buyers of the externally developed technologies. Contrary to what has been assumed
in CVC literature (Benson & Ziedonis, 2009; Dushnitsky & Lenox, 2005a), the corporate investor does not start innovating in these branches themselves nor do they actively search for the acquisition of these technologies. Although several interviewees spoke of a ‘technology transfer’, in this context the term should be interpreted as the search for internal integration of the externally developed technology. The oil producers are looking for technologies that can be deployed on their assets, not for internal development of an external invention. To quote interviewee 1: “We do not have the intention of owning the technology... The ownership of the technology remains with the start-up and we help the start-up to sell their product and services to competitors.” The corporate investor incubates a desire for tailor-made solutions, leveraging the market’s money. Interviewee 13 stated clearly:

“You can drive being on the board of the company. You can drive what you want the company to get out. So basically, you can have a seat at the table, to drive it towards your benefit and also try and accelerate it to your requirements”.

Quoting interviewee 18:

“So that is one of the strategic benefits of being involved with these companies at an early stage. You can help shape the product direction by being a customer and doing evaluations and doing trials and provide meaningful feedback that they can incorporate in the next generation of products and services”

This factor of controlling the innovation process has been confirmed by several other interviewees. Dissatisfied with the model of innovation as it was functioning, the oil and gas producers set up their CVC programs. It was a way to create access to small entrepreneurs developing the technologies they actually needed. By getting a seat at the table, they are now able to define the pace of the development of tailor-made disruptive technologies in the branches they want.
Being confronted with the market environment as described above, the oil producers developed a strategic approach that stayed between the buy or do-it-yourself-options. Transaction cost theorists (e.g. Williamson, 1979) argue that based on the balance between costs and benefits, a company has two options: in-house or external development of technologies. If developing a technology is cheapest in-house, you do it yourself. If it is cheaper to buy on the market, you buy it. CVC investments are not one or the other. Contrary to what Pisano (1990) found in the pharmaceutical industry, for technologies developed by venture entrepreneurs oil and gas companies do not base their R&D outsourcing decisions on the costs and benefits balance. Oil and gas companies see themselves as consumers of technology, except for certain technologies that are considered to be ‘differentiating’. Therefore, the decision to not buy the technology and let it be developed by the venture entrepreneur -who stays with the IP- is a consequence of absence of interest in bringing the technology inside. The decision to not buy the technology did not lead to an attempt to develop these technologies in-house. The focus of the in-house R&D team stayed on long-term technology improvements and core differentiating technologies. CVC investments are considered a much cheaper middle-way to get access to new technologies; cheaper and more flexible than internal R&D development and technology acquisition. Through the input of a relatively small amount of money (investments can be of USD 1 million), oil producers can leverage the money of other investors to get new technologies available in a short timespan (e.g. 12 months). By virtue of the accumulation of money and expertise, a flexible and highly motivated venture entrepreneur is able to deliver technologies faster than internal R&D projects that easily take up to 5 years. Observing this potential of CVC in other industries, oil and gas companies started developing their own CVC units to help small venture entrepreneurs with the development and commercialization of new technologies that could be deployed on their assets.
For oil and gas producers, the need for new technologies is not only based on the idea of profit maximization, as Tushman and Anderson (1986) thought. The oil and gas industry is currently challenged by extreme environmental conditions, increasing safety standards, and a social pressure to drastically reduce its ecological footprint (Brown, 2014). The industry is under great pressure to solve these problems, as one consultant stated (I17): “these majors need these developments to be successful if they want to exist in the future.” So the quest for new technologies is no mere quest for profit maximization, it is a matter of survival. The industry is also aware of potential disruption of the demand side of their market. If a product that disrupts the market of hydrocarbons becomes fully commercialized (e.g. electric car), the demand for oil will diminish drastically. With an interest in improved and cheaper production processes to compete with new energies, the oil majors broaden the scope of their corporate investments. Although it is more modest, we see an interest in exploring other branches of the energy market through corporate investments. Getting access to new markets -or in this case, other branches of the energy market- has also been recognized by Siegel et al. (1988) as a driver for CVC.

As mentioned previously, there is little literature that focuses on what motivates companies to adopt the model of corporate venture capital in their innovation strategy. Siegel et al.’s (1988) study is used as a reference to strategic benefits as a main objective for corporate venture investments by Dushnitsky and Lenox (2005, 2005a). This study found that the most important strategic objective is the exposure to new technologies and markets. We see that Dushnitsky and Lenox (2005a) and Wadhwa and Kotha (2006) interpreted this exposure as an interest by companies to integrate the knowledge of this new technology into the company itself. Although some companies indeed show interest in discovering new markets or at least want to stay aware of
evolutions in these emerging markets, our data analysis made clear that in the oil and gas sector, the producers see CVC investments as a tool to let technologies that improve their core business be developed. The potential to improve the manufacturing process, here the production process of the oil producers, is also found in Siegel et al.’s (1988) and Lantz et al.’s (2011) research. In this context, it bears mentioning that the financial returns are more of a bonus for the oil producers. The investments done by the CVC units consist of USD 1 to 3 million, and as example, Chevron’s quarterly profits are around USD 5 billion. Therefore, financial return is by no means an objective for oil producing companies, but a mere criterion for investment that the CVC units impose upon themselves. They cannot become a unit of accumulated losses for the company.

To summarize, we can say that a more nuanced view of the drivers for CVC has emerged. The idea of undertaking CVC investments to improve the internal innovativeness of the company does not seem to suit all industries; if it is suitable at all, remembering the disappointing learning outcomes presented by Schildt et al. (2005) and Keil et al. (2008). We note that the strategic benefits sought by the corporate investors are related to the development and access to new technologies, and the ability to guide the development of such technologies.

4.2. Evolutionary market models and the CVC movement in the oil and gas industry

The model presented above significantly impact on the neo-Schumpeterian or evolutionary view on market competition. Evolutionary economic theorists (e.g. Dosi, 1982; Helfat, 1994; Levinthal, 1997; Nelson & Winter, 1982; Tushman & Anderson, 1986) see the market environment as an instable continuum wherein established firms try to survive. Their survival is principally threatened by new products or new processes, suddenly introduced in the market place. These moments of ‘constructive
destruction’ (Schumpeter, 1950) require the established firms to adapt to the new market situation. It will be those companies that best ‘fit’ in the changed environment that will grow, or at least survive (Levinthal, 1997). Although Dosi (1982) states that also organized R&D efforts of established firms can create innovations - what was empirically confirmed by Sood and Tellis (2011) - it is generally accepted that disruptive innovation happens outside of established firms (Levinthal, 1997), and most likely come from new small firms (Almeida & Kogut, 1997, Tushman & Anderson, 1986). The latter was also confirmed by our interviewees. Oil and gas companies observed that a lot of disruptive innovation was going on outside their company walls, and especially in small entities. What is interesting here is that the oil and gas companies, nor the service companies, not simply try to adapt to these upcoming innovations as is presumed in evolutionary theory literature (e.g. Levinthal, 1997). The oil producers actively engage in the development of the technology by giving financial, technical, and commercial support. Where Schumpeter (1950) is convinced that established firms have come to a point that they accept that they will be confronted with moments of uncertainty brought by ‘constructive destruction’, we actually note a desire for disruptive innovations by the oil and gas producers. Interviewee 13 noted:

“I think we are looking for disruptive technologies, financing you know”

The fact that technological progress is considered to be a price-performing improvement (Tushman & Anderson, 1986) makes it acceptable that companies not ‘fear’ new, disruptive technologies they can take advantage of. In the oil and gas sector the disruptive technology initially presented by the venture entrepreneur is not seen as a threat by the oil and gas producers, or by service companies that offer substitutable technologies. The new technology needs to pass through a process of improvement and acceptance by the producers to become sustainable. In this process the oil and gas
producers work together with the venture to create a technology that fits their production process. The disruption will take place only when the technology is ready to be applied by the oil producers, who will abandon the product offered by the service companies until then. However, these service companies will acquire the technology once its value is established. As such the direct threat is neutralized, because incorporated. With this process there is a disruption of the ‘service model’ as it functioned. But it must be reiterated that there is no reactive action from the service providers to adapt to the technologies in an early stage. The acquisition only happens after the technology has been proven and shows some good commercial records.

The fact that the oil producers create tailor-made disruptive technologies also means that the rest of their production process will continue to function the way they want it. Maybe that is why Schumpetarian shocks are very rare in the oil and gas sector (the interviewees only remembered horizontal drilling as example of an innovation that has been disruptive for the whole oil and gas producing sector). The absence of ‘constructive destruction’ can be a consequence of the investment policy of the oil and gas producers. During the interviews it became clear that oil and gas companies mainly invest in those technologies that solve their problems. But as one interviewee stated (I15), the companies are not always aware of what their problems actually are. Consequently, a technology that is not being understood can be denied investment. Remembering that the survival of a venture without support of an established oil and gas producer is difficult, the chance that this disruptive technology becomes an actual threat is very little.

Another limitation of the neo-Schumpeterian model is the idea that the entrepreneur’s technology is directly operational in the market it is introduced to. As became clear during the interviews, the oil and gas sector has very high safety and security standards, as well as very complex technological issues to deal with. It is hard for an industry
outsider to readily know how to create an operational technology. Therefore, a venture entrepreneur entering the oil and gas market without the technical support of the oil producers will need to adjust his technology to commercialize it. Evolutionary economists conceive the process of search as one direction movement from established firms reaching out for new technologies. We see however that there exists a reciprocal search where also the venture entrepreneurs looks for established firms to understand how his technology can be integrated in their production process. A third aspect that should be addressed by evolutionary economists is the financing of innovations. The development and trial of certain new technologies can be very expensive. The current models do not question where the entrepreneur has the money from to survive initially. We have seen here that the entrepreneurs trying to enter the oil and gas market often need the financial support of oil and gas producers. Like interviewee 17 declared: “if oil and gas corporate venture groups do not fund companies, no one else will”. In the fourth place, as it has been said by evolutionary economists (e.g. Helfat, 1994, Nelson & Winter, 1982, Tushman & Anderson, 1986), established firms have difficulties with change. In general people have a resistance to innovations (Schein, 1985). Considering this resistance, the interviewees declared that the venture entrepreneurs need their support to give credibility to the new technology. With their support the new technology will be accepted by other oil companies and potentially be bought by a service provider. With this upgrade in credibility, the chances for survival of the venture entrepreneur increase significantly.

Analyzing that established and small firms work together in a dynamic and complementary way during this process of innovation, the dichotomy between established large firms and entrepreneurs, uphold by evolutionary economists should be reconsidered (Florida & Kenney, 1988). Evolutionary economists do not consider the
situation where a new, disruptive technology is co-developed by the venture entrepreneur and established firms.

In sum, we agree with Florida and Kenney (1988) that evolutionary economic theorist should try to adapt the model of strict dichotomy between large firms and entrepreneurs in the innovation process. Through corporate venture capital investments a process of co-development of innovation emerges. Also the idea of reactive adaptation (Levinthal, 1997) should be reconsidered if we remember the quote of interviewee 13: “if it is going to be disruptive, we can do it ourselves, right?”

Finally, we should ask ourselves if the Schumpeterian entrepreneur still exists today. In the evolutionary economic models the venture entrepreneur will take advantage of the inability of the large firms to change, to grow and become an established firm as well (Nelson & Winter, 1982, Tushman & Anderson, 1986). Especially since the venture capital-boom at the beginning of this century we reckon that venture entrepreneurs most often want to sell their technology for several million dollars, what has been confirmed during the interviews. Therefore, the movement seems no longer to be of an embryonic firm becoming a new giant. Before the embryo grows, it is bought by an established firm. In the oil and gas industry, it is the service company or in rare cases the oil producer itself. This movement is not only emerging in the oil and gas sector but also can be observed in the telecom and internet industry, where Intel, Microsoft, Google, Facebook, etc. invest in start-ups and buy them as soon as they look promising enough.

5. FRAMEWORK AND RESEARCH PROPOSITIONS

Our theoretical framework proposes two outcomes for CVC investments: one at market level, the other at firm level. At the market level it is suggested that CVC investments have a positive effect on the speed of acceptance of a new technology on firm, network,
and market level. The faster acceptance increases the pace of innovation in those branches of technology focused on by corporate investors. At firm level our framework proposes a better integration by the corporate investor of those technologies which they supported. This better integration results in a more efficient operation of the corporate investor.

5.1. CVC as tool to control innovation in targeted branches

As it has been discussed, the main driver for engagement in CVC investment is the will to make certain technologies quickly available. The oil and gas producers set up their CVC units to invest in technologies developed by small entrepreneurs, to accelerate the commercialization of new technologies. Once the technology has scaled up, it can be sold to a service provider which continues the delivery and further development of the technology. Through this system of investments, the established firms in the oil and gas industry can orient the process of innovation to where they want to have it. Through their investment they speed up innovation in the branches of their interest. We argue that CVC investments positively affect the speed of acceptance of a new technology at firm, network, and market level. Through coordinated action of corporate investors we propose that an increased pace of innovation occurs in the branches focused on by CVC investors.
5.1.1. Speed of acceptance of new technology, firm level

At firm level the faster integration of technologies developed by venture entrepreneurs invested in seems to be a logic consequence. Through their investment the corporate investor gets first access to the technology and will provide its feedback and suggestions for further development. In this sense the interviewees made clear that, for a better or easier integration, diverse units of the core company get involved in the process so they can formulate suggestions for adjustments in the technology. Through this involvement, the core company already prepares for the integration of the new technology. Also, often a trial of the technology is executed on one of the wells of a corporate investor. On the one hand the corporate investor gets prepared to apply the technology as soon as it becomes available. On the other hand, the technology gets adjustment with the eye on its deployment on the corporate investor’s assets. In addition, the CVC units prepare the technology of the venture to make a smooth process of approval in the company possible. High safety and security standards need to be fulfilled before a technology can be deployed in the production process. Other oil producers will only get to know this technology when it becomes commercialized. They still need to start the process of trials, adaptation, and approval of the new technology what following our interviews easily takes months to years. Interviewee 1 stated:

“What we do see is that since we work so closely together with the start-up company, we do see that we are much faster at adopting that new technology.”

In their study on information and communication companies, Maula et al. (2013) already found that companies with a heterogeneous network of co-investors reacted faster on emerging discontinuities. These authors consider the network a crucial element in the capacity of timely attention to deviating technologies. It is worth mentioning that our interviewees confirmed almost unanimously that those technologies in which they
invest do not form a threat to their core company. The only potential threat they see comes from alternative energies or from those technologies disrupting the demand for oil and gas (e.g. the electric car). Not all companies of our sample invest in potential disruptive technologies, but those who do cite the idea that they must be aware of those developments, to forecast future evolutions of their market. Interviewee 5 characterized the process as one of ‘keep your friends close, but your enemies closer’. Discussing this type of investments with interviewee 11 it was commented that “it gives you a much earlier indicator or warning of some things, as to the pace of change, and some of these disruptive technologies”. Although Maula et al. (2013) considered this ‘awareness’ a consequence of the network structure the corporate investor operates, we suggest that companies that invest in CVC are in general paying more attention to changes. Direct CVC investments help the board to be aware of new technologies potentially creating a demand disruption in the oil industry. It allows them to have first-hand knowledge on these technologies. This knowledge can be of special interest when renewable energies become a real alternative in the energy market (Petkova et al., 2014). Maula et al. (2013) assumed but did not empirically test if companies where the boards pays earlier attention to technology discontinuities, also accept these technologies faster. We argue that the earlier the board pays attention to the new technology, the earlier the technology will get accepted. Therefore our framework proposes that on firm level the relation between CVC investments and speed of acceptance of a new technology is partially mediated by the time it takes the board to pay attention to this technology. Therefore we suggest the following propositions:

Proposition 1: Oil producers integrate new technologies in which they have invested through their CVC program faster than other externally developed technologies.
Proposition 2: CVC investments make the board of directors pay earlier attention to technological changes invested in, what positively affects the speed of acceptance of new technologies invested in through the company’s CVC program.

5.1.2. Speed of acceptance of new technology, network level

To be able to affect the pace of innovation, technologies will need more than acceptance by one or a couple more companies to come to a viable scale of production. This will in the first place happen through the network the oil and gas CVC investors have established.

The formation of inter- and intra-industry strategic alliances and network formation is a widespread phenomenon (Ahuja, 2000) that extensively has been studied (e.g. Ahuja, 2000; Gulati, 1998; Liyanage, 1995; Schilling & Phelps, 2007). When these alliances or networks are formed between competitors it is considered to be a case of co-opetition (Gnyawali et al., 2006). This simultaneous process of collaboration and competition also occurs in the oil and gas industry. To share the costs of innovation and aggregate knowledge, the oil and gas producing companies have organized themselves in Joint Industry Projects (JIPs). Also, because of the complexity and scale that comes together with the drilling of unconventional oil and gas fields, oil and gas producers work together to get the oil to the surface. As such, strategic alliances between actual competitors are no rarity for the oil and gas industry. The collaboration through co-investments in venture technologies is another area of collaboration between oil and gas producers.

Research on co-opetition mainly studied this phenomenon through the game-theory (Gnyawali & Park, 2011; Loebecke, Van Fenema & Powell, 1999; Ritala & Hurmelinna-Laukkanen, 2009). We can apply this theory to the collaboration between oil producers in the context of CVC investments. The different companies have made the comparative exercise of what they can win by investing on their own, or by
investing together. The market and individual firm benefits are much higher when co-investments in new technologies take place. By co-investing the investors share risk, increase the venture entrepreneur’s credibility towards the market and potential buyers, and can accelerate the innovation process by injecting more cash than they each could do on their own. The opportunistic behavior that could be a threat in such type of alliances (Bengtsson & Kock, 2000; Gnyawali & Park, 2011) is minimalized by all of our interviewees. Just as in vertical networks, opportunistic behavior of a member will be sanctioned by the other members (Gulati, 1998; Liyanage, 1995). Because oil and gas producers frequently work together, their closed networks make sanctions for deviant behavior easily imposed (Ahuja, 2000). In addition, when oil and gas producers invest in a venture technology, they avoid any type of opportunistic behavior, knowing that their reputation will be damaged. For the corporate investors, it is the venture’s growth and viability that is of main importance. Through repeated collaboration between the oil and gas producers in the field of CVC investments, a social network between the co-investing companies has been established (Gulati, 1998; Dushnitsky & Lavie, 2010). This network is formalized as the Oiltech Investment Network. The positive consequences of being part of a network have broadly been studied (Ahuja, 2000; Gulati, 2008; Liyanage, 1995; Schilling & Phelps, 2007). Networks provide the benefit of resource sharing, allow firms to combine knowledge, skills, and physical assets. Also, collaborative linkages can provide access to knowledge spillovers, serving as information conduits through which news of technical break-throughs, new insights to problems, or failed approaches travels from one firm to another (Ahuja, 2000; Gulati, 2008). If we transpose the ideas of traditional networks to the co-opetitive network for CVC in the oil and gas industry, we see that this network creates direct benefits for the core companies as well for the market. The links the CVC units create between them and with independent investors give them
access to new technologies, allow them to learn with and from the other producers, and makes them aware of ongoing trends. The regular meetings and personal contact between the members of the CVC units increase trust and extent cooperation between the units (Gulati, 1998). The interviewees gave the impression to know each other well and to maintain warm relations. Because of this trust and intense collaboration, we may expect that even when an oil producer has no direct investment in a new technology he is sooner informed about the technology than do network outsiders. As such, the adoption of this new technology should be faster for the network members. Therefore we propose:

Proposition 3: Members of the investor network will accept new technologies supported by a member of the network faster.

5.1.3. Speed of acceptance of new technology, market level

At market level the credibility of the technology will be positively affected by the support of corporate investors. Oil producers will have more trust in technologies developed with the expertise of a renowned competitor. The approval of the technology by major oil producers, and their belief in the potential of it, is a clear sign to other players in the market. Also, the knowledge of the market the corporate investor brings together with its investment helps the process of commercialization significantly. The venture will be able to present a ‘ready-to-use’ product that actually fulfills the needs of the oil producing companies. It has repeatedly been stated during the interviews: the corporate investor helps qualifying the technology, and makes that it attends to all safety and security standards. The presence of an investor with profound market expertise will make that the process of approval in other companies can go significantly faster as at least the market standards for the technology will be met. In addition, the venture
entrepreneur can take advantage of the channels of commercialization the corporate investors already have. If an entrepreneur and its technology get the support of several CVC units, these effects will be strengthened. A venture entrepreneur that has no experience or expertise in the oil and gas sector will need significantly more time to prepare its technology for the market and to find a channel for commercialization.

In addition, technologies supported by corporate investors will be integrated in their production process. These corporate investors will be able to produce more efficient, and as such gain a competitive advantage. Consequently, other oil and gas producers can feel obliged to accept the technology. If they do not, they could lose competitive advantage in benefit of the corporate investor exploiting the new technology.

Corporate investors will work together to promote a fast acceptance of the technologies invested in. Interviewee 19 noted:

“Having other oil and gas companies with you will probably drive that commercialization faster because it is a signal to maybe the people we might exit to, like (names of service providers), we are serious about getting this technology developed. Ultimately you are going to want this in your toolbox to serve back to us. And if that technology is scaled up than it lowers our costs and improves our performance.”

We also may not forget that the main driver of CVC investments is the will to increase the pace of innovation in the market. Therefore, we suggest that the speed of acceptance of a new technology in the market will be positively affected by the presence of a corporate investor.

Proposition 4: Technologies supported by one or more corporate investors will be faster accepted by other producers than technologies that lack corporate support.
5.2. Pace of innovation in targeted branches of technology

Kortum & Lerner (2000) already demonstrated that industries with high VC investments show higher innovation rates than others. Their study measured for VC in general, so with no specific focus on corporate investors. During the interviews it was often stated that, because of the very specific character of the oil and gas industry, if the oil producers do not invest in new technologies nobody does. Service providers have no direct interest in the development of cost reducing technologies as this disrupts their own business models. Remembering that one of the drivers to set up a CVC program was to speed up the level of innovation in certain technologies, we proposed that these investments have a positive effect on the acceptance of new technologies by corporate investors, their network members, and the market in general.

Our interviewees did not consider it impossible but very difficult for a new technology to become successful without back up from the major oil and gas companies. Park and Steensma (2012) have already demonstrated that ventures backed by corporate investors generally do better than others. We suggest that the corporate investors of the oil and gas industry, taking advantage of their scale (Ahuja, 2000) have a big impact on the pace of innovation of the market in which they operate. Through their CVC investments they increase the speed of acceptance of those technologies they invest in. This increased speed of acceptance will positively affect the pace of innovation in the branches where CVC investors are active. As mentioned previously, CVC investors focus on technologies that solve a given problem. The sharing of common problems and knowledge in their network of corporate investors supposedly results in an orientation of investments towards the same types of technologies. This idea is confirmed by the fact that the oil and gas producers often co-invest in the same technology. Therefore, we expect that the pace of innovation is higher in these branches of the production process where CVC investments are focused at. We propose:
Proposition 5: These branches of the technology where CVC investors are active demonstrate a higher pace of innovation than the branches where this type of investment is absent.

5.2.1. CVC and corporate investor efficiency

The resource-based view (RBV) on competition assumes that firms are constituted of bundles of heterogeneous resources (Barney, 1991; Wernerfelt, 1984). Those resources allow the company to implement value-adding strategies that create competitive advantages (Barney, 1991, 2001). A firm’s competitive advantage is defined by the value its resources have under certain environmental circumstances (Barney, 2001; Kotabe et al., 2007; Priem & Buttler, 2001). In other words, the resource’s value is defined by its effectiveness to create a value-adding strategy for the company in a particular industrial context. For resources to create a competitive advantage, Barney (1991) defined that they should be valuable, rare, inimitable, and imperfectly substitutable. Consequently, a company looking to create competitive advantage should look for this type of resources, internally or externally (Kotabe et al., 2007).

Analyzing CVC in the oil and gas sector, the RBV cannot explain the value created for the corporate investors by these investments. From the RBV perspective, the technologies acquired through CVC are not creating a sustained competitive advantage, if a competitive advantage at all. The technologies developed by the venture entrepreneur are available on the market, so they are mobile and equally available to all players. To optimize commercialization and growth of the venture, the corporate investors do not want exclusivity, as this would limit the entrepreneur’s sales possibilities significantly. Even if exclusivity was installed, co-investing producers would have equal access to the new technology. The traditional RBV on competition allows to explain the competitive advantage created through the core capabilities of the
companies, but is not able to do so for CVC activities. Core capabilities are those technologies developed in-house and considered too valuable to share whatsoever. When asked if CVC was directed at a certain type of technologies interviewee 12 answered: “we will not put our differentiating factors at risk”. Our qualitative data confirm that there exist certain core technologies, e.g. seismic and oil reservoir measurement technologies, creating a direct competitive advantage for the oil producers. It is not here that CVC investments happen. Those strategic important core technologies are developed by the oil producer’s internal R&D, and eventually through collaborations with university research centers. Through the perspective of the resource-based theory the oil producers can only have a competitive advantage from these difficult-to-imitate resources (Teece, Pisano & Shuen, 1997).

A better understanding of the competitive advantage of CVC investments is brought by the dynamic capabilities approach (Eisenhardt & Martin, 2000; Leonard-Barton, 1992; Teece et al., 1997). Dynamic capabilities are those processes a company uses to manipulate its resources (Eisenhardt & Martin, 2000). It is the ability to reconfigure its internal competences despite of its history (Teece et al., 1997). RBV authors defend a path-dependent evolution of resources, dynamic capabilities focus on the ability to avoid ‘core rigidities’ (Leonard-Barton, 1992), and the ability to create path-breaking development (Eisenhardt & Martin, 2000; Teece et al., 1997). It is the process of looking for improvement of the current production process, the current way of how things are done. Exactly what the oil producers try to do through their CVC program. Although dynamic capabilities are sometimes considered to be only present in highly dynamic industries, with rapid technology changes (Eisenhardt & Martin, 2000), there is no reason to deny their presence in a less dynamic place. The oil and gas industry is conservative, but we note a need for breakthroughs to quickly solve unresolved problems. We can even presume a desire to create a more dynamic market. The
interviewees confirm what Eisenhardt & Martin (2000) state: it is not the dynamic capability itself that creates the advantage. In this context it is not the investment itself, the access to the technology, but it is the ability to create, integrate, recombine, and release resources. Several major oil producers have their CVC program, and even invest in the same companies, but they see the competitive advantage in the ability of the CVC unit to “sell the technology internally”. One interviewee called himself the ‘technology broker inside the company’. Interviewee 18 formulated it as follows:

“The competitive advantage of the technologies lies in the application and wide spread performance within the corporations that are doing the funding. That is the challenge. Bringing new technology in to a big corporation that has a pretty fixed way of doing things. And if you want to do something new that is going to disrupt work flows, you should be pretty smart... the strategic benefit, the use of the technology will come to the companies that have the best technology transfer inside and were able to promote and find ways to adopt the technologies internally”.

Despite of it not being the dynamic capability itself creating the competitive advantage, it gives the potential to create advantage. Through the creation of a CVC program, the oil producers have installed a formal way to address the changing environment, and to make the integration of new technologies possible. For these big multinational companies there are no other tools available to work directly together with small venture entrepreneurs. CVC investments are a unique tool to get early access to new technologies developed in these small external units. As discussed before, it gives companies the opportunity to direct the technology development to where they want it. As such, corporate investors will understand the technology sooner and better. They will be able to integrate it better and faster than their competitors can (Eisenhardt & Martin, 2000). And this is following interviewee 7 the competitive advantage for oil and gas companies:
“I think the oil and gas sector is a sector in which the competition is not really on the technology, it is on the capacity to deliver a very large project, very fast and on budget. That is where the competition is.”

Therefore, we presume that having a CVC program creates a competitive advantage towards those companies that do not engage in this type of investments. Companies with a CVC program can co-develop these new technologies and because of that the integration of the technologies they have invested will be faster and better than their competitors. The company with the most experienced and effective CVC unit, will be able to create an advantage even towards other companies who also engage in CVC investments by investing in the most valuable technologies, getting the best deals, being able to direct the technology’s development, and ‘sell the technology’ inside. Also, innovation is considered to be performance-improving (Tusman and Anderson, 1986). A better and faster integration of a performance-improving technology increases a company’s cost efficiency. To quote interviewee 19:

“The time of adoption is very hard. Every company has its own qualification process. So, in my world I actually build that in, in my investment process in a sense that I want to drive that. So, the reality is that you will be able to commercialize that technology already available and I can start using it. It could still take years for other people to actually believe that it is working, right?”

During the interviews it was also mentioned the corporate investors negotiate discounts and geographic preferences with the venture entrepreneur. Depending on the conditions negotiated the newly developed technology can be used cheaper than their non-investing competitors do. Therefore our framework proposes mediation between CVC investments, the integration of a new technology, and efficiency of the corporate investor:
Proposition 6: Oil producers engaging in CVC investments have a better integration of new technologies they co-developed with the venture entrepreneur.

Proposition 7: The better integration of a new technology increases the efficiency of the corporate investor.

Proposition 8: The faster integration of a new technology increases the efficiency of the corporate investor.

6. DISCUSSION

Considering the absence of strong theoretical and empirical evidence that established firms actually learn through their investments in venture entrepreneurs, we felt the need to better understand and explain the phenomenon of corporate venture capital. Because of a lack of literature on the drivers of CVC we considered an inductive qualitative research appropriate. Using the guidelines for qualitative research from Charmez (2006) and Eisenhardt (1989), we conducted 20 interviews with people actively engaged in CVC activities in the oil and gas sector. To help the design of our research and the theory building we created a clear research question (Eisenhardt, 1989): what drives corporate venture capital in the oil and gas sector? To offer a more complete theory this paper presented a model of CVC and a theoretical framework. This model and framework provide the groundwork for a more nuanced understanding of the phenomenon (Charmez, 2006).

The model of CVC presented in this paper is significantly different from the traditional model used in CVC research. Our data on CVC in the oil and gas sector did not result in the expected dyadic relation between the corporate investor and venture entrepreneur. Instead, we observe a triangular composition where the corporate investor co-invests in the venture entrepreneur with competitors and independent venture capitalists. In the
majority of cases the technology invented by the venture entrepreneur is co-developed and commercialized with the investing oil producers. Contrary to what has been predicted in former research (Benson & Ziedonis, 2009; Lantz et al., 2011), oil producers do not see CVC as a ‘try before you buy’ tool. Once the technology is scaled up and its commercial value is close to guaranteed, service providers step in to buy the technology. Afterwards, the service provider on his turn offers the technology to the oil producers. The oil producers become buyers of the technology they co-developed. These new insights make clear that the process is more complex than it has been presented in former studies.

Not only the model of CVC in the oil and gas industry differs from former interpretations, also the drivers we found are not congruent with extant literature. Authors in the field of CVC conceptualized these investments as an attempt of established firms to learn from new technologies (Dusnitsky & Lenox, 2005; Wadhwa & Kotha, 2006) or to get access to new markets (Siegel et al., 1988). It is assumed that corporate investors use CVC as a tool to increase their innovative capability. This increase should be a consequence of the learning process inherent to CVC investments. Our qualitative data uncovered other drivers for corporate venture capital than the often cited organizational learning. We found that the oil and gas producers set up their CVC programs to get more control on the innovation process in the market they operate. Dissatisfied with the existing process of open innovation, the oil and gas producers created CVC programs to surpass the service providers and create the technologies they wanted. Through these investments, the oil and gas companies get access to those performance-improving technologies that would never be developed if it was not with their support. The collaboration with the venture entrepreneur permits the corporate investor to guide the technology’s development. This ‘guidance’ gives a certain control
to the investor in the innovation process. It must be reiterated however, that the corporate investor rarely is alone. He must take the other investors into account, as well as the venture entrepreneur itself. The control discussed in this paper might not be understood as a free ride. It is more a gentle manipulation of the disruptive technology towards the direction the corporate investor thinks it is most useful. Corporate investors have shown their interest in technologies that improve their production process. In addition, oil and gas producers keep an eye on potential substitutes, e.g. alternative energies, and on demand-disrupting technologies like the electric car.

Based on our data and extant literature we constructed a framework and developed propositions for outcomes of CVC at firm and market level. We suggest other outcomes than organizational learning of the corporate investor.

A first set of propositions predicts that corporate venture capital indeed is a tool to control pace and direction of innovation. In this process, the speed of acceptance of new technologies will be a mediator. We have argued that the corporate investor as well as the members of the investor’s network and other oil and gas producers will accept technologies supported by a corporate investor faster than they accept other externally developed technologies. At firm level this faster acceptance is a logic consequence of the co-development of the technology. The venture entrepreneur and the core company prepare themselves for a smooth integration as soon as the technology becomes commercially available. For members of the investor’s network we assume a privileged access to information on new technologies invested in by network members. In this sense the technology will benefit of the trust that exists between the members. A faster acceptance of these technologies supported by network members seems to be the consequence. At market level the increased credibility of the technology due to the acceptance by a major oil producer positively affects the speed of acceptance by other players in the market, resulting in an increased pace of innovation in the branches of
technology where CVC focuses at. We noted the existence of a very close network of investors. In this network member exchange information and knowledge on the common problems they face. Consequently, these members can define the areas where CVC investments are interesting. The network orients corporate investments to similar technologies and creates a higher pace of innovation in these targeted branches. This is exactly what drives oil producers to engage in CVC activities.

At firm level we conceptualized corporate venture capital programs as a dynamic capability of the corporate investor (Eisenhardt & Martin, 2000; Teece et al., 1997). It is not the presence of a CVC unit or the investment itself that will create the competitive advantage for the oil and gas producer. The advantage is hidden in the potential of the unit to get the new –performance improving- technology integrated in the existing production process. The unit must be able to convince the core company to reorganize its routines and procedures in such a way that it maximizes the profit of the new technology. When the unit does this better than its competitors, a competitive advantage is established. The collaboration between the corporate investor and the entrepreneur during the process of innovation allows a faster and more profound integration of the new technology, compared to its non-investing competitors. This integration will allow the corporate investors to benefit in greater extent of the performance-improving technology. Therefore the corporate investor becomes more efficient.

The propositions we developed throughout this paper create new insights on the potential of CVC. It must be clear that CVC can have an impact beyond organizational learning.

Former research on CVC investments has been undertaken under the main proposition that companies engage in this explorative process to learn. Without denying this objective, our paper shed a new light on CVC by presenting a new model and
theoretical framework. This model and framework increase the understanding of corporate venture capital through a systematized structure capable of both explaining the phenomenon, as well as predicting some outcomes. This nuanced view on CVC should incentivize further research on the topic. It must be clear that the research on the ‘when’ and ‘why’ of CVC is still far from saturated. We hope that the model and framework presented in this paper inspire other researchers to conduct more studies in this sense. We also hope to motivate researchers to empirically test the here developed framework, as well as other potential outcomes of corporate venture capital, and this on different levels.

Another aspect of the process of CVC that requires more research: what happens with the venture entrepreneur after the investment? Studies have proven that entrepreneurs receiving corporate investments tend to do better, although it is not clear if these ventures become independent firms or are acquired by the investor (Benson & Ziedonis, 2009) or a third party, and under what circumstances this happens. For the full understanding of CVC and its consequences future research on this topic is desirable.

Through explaining the drivers and developing a model and framework of CVC, this paper brings significant progress for the field of CVC research, however it does not only contribute to the field of corporate venture capital studies. The model of CVC presented creates some challenges to the market model as conceptualized by neo-Schumpeterians (e.g. Nelson & Winter, 1982). The dynamic and complementary collaboration between the established firm and venture entrepreneur challenges the strict dichotomy evolutionary economists uphold. In the oil and gas sector, corporate support is almost a conditio sine que non for survival of the venture. By not supporting those technologies that are not understood, corporate investors define the direction of innovation in the market they operate. As such the question can be posed: is there still a possibility for
real disruptive technologies to achieve ‘constructive destruction’ as it was understood by Schumpeter (1950). Another challenge for evolutionary economists is the fact that the venture entrepreneur is acquired by a big service provider once the potential its technology is less uncertain. The company that could be threatened by the further development of the venture acquires the technology, and ends the threat instantaneously. A last challenge we mention here is the question if the Schumpeterian entrepreneur still exist if he does not demonstrate a desire to become an ‘established firm’? Entrepreneurs seem to be interested in the cheque they can receive. Contributions are also made to the field of co-opetition and network studies more in general. We presented other drivers for competitors to collaborate, as well as potential consequences from the network build up on this collaboration between competitors.

For managers it is interesting to comprehend the potential effects corporate venture capital investments can have beyond ‘learning’. We proposed consequences on firm and market level. This potential should be taken into consideration when the set up or closure of a corporate venture capital program is on the agenda. Based on our findings, evaluation criteria for CVC programs could be reconsidered, or investment policies adjusted. Contrary to what has been prevailed in former research based on the idea of organizational learning, our study demonstrates to the entrepreneur that this conflict is not inherent to CVC investments. Companies can have other than learning motives to engage with the venture entrepreneur. With this knowledge, the venture entrepreneur can now better align his expectations with the market reality.

Convinced of the important contributions our research makes, we must also recognize the limitations of our study. As all readers already will have remarked, this study is a single-industry study. Considering this, we must be very careful with potential
generalizations of our findings and propositions. The oil and gas industry is a very specific industry with a special market dynamic. However, the interesting findings we did allow us to challenge current models on CVC and market competition. They do not apply on the oil and gas industry. This vice versa implies that our models may not simply be implemented in other contexts. Let this study be the start of a more profound research on CVC and its specificities.

Other limitation to our findings is that the share of innovation developed through CVC investments is small compared to what is developed by in-house R&D sections or through joint-ventures and joint industry projects. CVC investments is just one tool in the innovation toolbox of the oil and gas producers. Although the share of innovation brought by venture entrepreneurs may not be overestimated it neither may be underestimated. Several examples of significant cost reduction and process optimization by virtue of entrepreneurial technologies have been cited by our interviewees.

A last remark in this regard is that not all innovations should be understood as being technical innovations. Several times we have been reminded by our interviewees that besides of technical improvements, venture entrepreneurs are also interesting for the new business models they sometimes present to the corporate investor.

We have presented a new model and framework for the study of corporate venture capital. We look forward to see colleagues working further on this model and framework, or surprising us using a different approach and perspective studying CVC. For us, to learn more about CVC it is necessary to go beyond the theory of organizational learning.
7. REFERENCES


Araújo, L. & Gava, R. 2012. Proactive companies – How to anticipate market changes, New York: Palgrave Macmillan


Brown, B. 2014. Innovation in the oil and gas space, working paper


