Relationship between CVC and R&D expenses in the high-tech industry an exploratory study

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Relationship between CVC and R&D expenses in the high-tech industry; an exploratory study

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Summary

In earlier days, companies in the high-tech sector mainly followed a principle labeled as the closed innovation approach in search for innovations. This approach entailed that companies followed certain unwritten rules when striving to discover and develop innovations. One of these convictions, according to Chesbrough (2003), was that a critical success factor for the innovative performance of the company was to hire the best and brightest people in the business. It was believed that having the best and brightest people in the business working for you also meant that you would invent the best products and would become market leader. Another conviction was that to get good products to the market, the company would have to develop it themselves. It was firmly believed that other companies could not achieve the same quality standards as the own company could. Therefore, companies wanted to do everything themselves, from idea generation to market launch. They also believed that when investing a lot in R&D compared to competitors, the best and most ideas would be discovered. The last important conviction of the closed innovation approach was that companies should protect their intellectual property at all cost. As explained earlier, companies tried to control every aspect of pursuing innovations from idea generation to market launch. It could occur that somewhere in that process it became clear that the product did not meet expectations. However, by that time the company already invested a lot in the development of the product and most likely these investments had produced some new knowledge to the firm. In the old innovation approach, these gathered pieces of knowledge were put on a shelf doing nothing. It was considered top priority to not share these pieces of knowledge with competitors and therefore it was simply stored and not discussed again. These convictions part of the closed innovation approach highlight the focus on control. As was then believed, companies should be in full control over every aspect of pursuing innovations.

However, more recently it is the above mentioned focus on control that becomes difficult to sustain. Scientists are getting increasingly mobile; they change employers much more often than before. A result of this is that the notion of focusing on controlling your innovation efforts and protecting your intellectual property becomes increasingly difficult. When scientists change jobs, they also take a lot of know-how with them to their new employer from their old employer. The focus on control suffers from this. Another point that facilitates a shift to a new paradigm is the increasing demands of the customers. Customers want better products and faster than before. Also, these products become increasingly more complex as time progresses. To understand all the changes in the external world and to meet customer expectations, relying solely on R&D for your innovations becomes a possible detriment to the innovative performance of your company. The R&D lab (usually cut-off from the outside world) has a difficult time keeping up with all the external developments.

To counter all these problems, Chesbrough (2003) introduced a new paradigm called open innovation. The main thought of open innovation is that it is not very important anymore from what party ideas originate. The competitive advantage is not achieved by having some particular hard-to-copy resource but by combining ideas from different parties into a new value-added strategy. Ideas and knowledge can flow into the company at any given time, but also vice versa. Referring back to the case mentioned earlier; suppose a company develops a new product and concludes during development that it does not meet up to expectations. In the old innovation approach, this idea would be put on the shelf. In the open innovation approach, this idea can be for example sold to an external party or developed further in a spin-off of the parent company. Therefore, one can see the focus is not so much anymore on developing knowledge yourself; it does not matter from what source the resources/knowledge comes from. What matters is creatively combining resources (and thus knowledge) into new value-added strategies.

A particular part of the new open innovation approach is corporate venture capital. CVC is defined by Sahaym et al. (2009) as a minority equity investment by established firms in entrepreneurial ventures. It resembles the independent venture capital market but mainly differs on the goal of the investment. In CVC, the main goal is acquiring strategic benefits through investing in a start-up while the main goal of independent venture capital is financial gain. Strategic benefits can be acquiring useful information about

potential markets, learning about pitfalls in certain markets, alerting R&D to new promising technologies etc. The companies that use CVC as a way to scan for new external technologies, usually still have an internal research and development lab.
According to Cohen and Levinthal (1990) the R&D department has two main functions:

- Producing innovations.
- Building up absorptive capacity as this facilitates learning.

The last point is especially important in light of the emerging corporate venture capital market and thus this research. This point highlights, that although CVC is another way of pursuing innovation, internal R&D efforts can never totally disappear. The R&D department will be necessary to have some in-house knowledge needed to evaluate and assimilate external knowledge.
Above, it is explained that corporate venture capital is a particular mode of the in popularity increasing paradigm called open innovation. However, with the use of Cohen and Levinthal (1990) it has also become clear that R&D will never vanish completely. Therefore, the question arises what the exact relationship between corporate venture capital and R&D is. The CVC program can help the R&D department by alerting them to new promising external technologies (Chesbrough and Tucci, 2004; MacMillan et al., 2008). The reasoning also works the other way; R&D can list their priorities and help in the screening of external ventures. If CVC activity therefore increases, so will the R&D activity because they would have to assist in the screening, evaluating and possibly assimilating knowledge from the external venture. This (R&D helps CVC and vice versa) would imply the two concepts have a complementary relationship. Chesbrough and Tucci (2004) however also argue from a different view and mention that the type of innovation mode (CVC or R&D) a company uses depends on the relationship between the internal knowledge base and the external technology. For technologies familiar to the company, Chesbrough and Tucci (2004) suggest using R&D while for unfamiliar technologies CVC would be preferred. Also, CVC and R&D basically come from the same pool namely money for innovation activities. It could be argued, that if one of these modes takes a larger percentage of these funds, the other mode receives less funds. The previous reasoning would imply a substitution effect.
It is clear that not a lot of empirical evidence exists on what the relationship between corporate venture capital and R&D is. Also, why this relation is as it is remains unclear. In other words, it is rather vague how R&D and CVC coexist in practice. This leads to the two research questions of this master thesis.

Research Question 1: *What is the relationship between corporate venture capital and internal R&D expenditure?*

Research Question 2: *Why does corporate venture capital have a certain relationship with R&D expenditure in certain companies?*

The first research question was investigated using Thomson ONE Banker Analytics, VentureXpert and several annual reports from companies. A database was constructed on which a multiple regression analysis was performed. The companies in the database mainly come from high-tech sectors based on OECD 1997 and OECD 2005 guidelines. The multiple regression analysis indicates that the relationship between corporate venture capital investments and R&D expenses, accounting for several control variables, is positive and significant. Referring back to literature, this means that for a large part the reasoning of Chesbrough and Tucci (2004) and Sahaym et al. (2009) is supported.
Now that it is known that the relationship is positive and significant it is interesting to get a more in depth view on why this relationship is positive in certain companies. Two interviews were held, one with COMPANY A and one with COMPANY B. Unfortunately, COMPANY B uses a different kind of corporate venture capital than used in this research and therefore in order to answer RQ2 I mainly had to rely on the feedback from COMPANY A. In COMPANY A, the CVC department needs the R&D department for mainly four reasons:

- Scouting for start-ups.

- Screening of new start-ups.
- Assessing the technical/scientific/IP position of the start-up.
- Absorbing and using the relevant information from start-ups.

COMPANY A venturing in turn helps the R&D department by alerting them on new technologies that might be of use to them. This is a good example of how R&D and CVC departments can help each other in practice.

COMPANY A allocates funds to the total innovation activities of the company. Then each year, in light of the strategic goals it is determined how much funds each innovation mode receives. Therefore, the choice for a particular mode of innovation depends on what specific strategic goal the company aims for. Prof. Dr. Ard-Pieter de Man underlines this reasoning and emphasizes that companies should look at their total innovation portfolio. For each strategic objective, you need to determine what innovation mode can achieve the goal the best. Sadly, Prof. Dr. Tom Elfring indicates that such an overall innovation strategy is not often implemented in practice.

In conclusion, this master thesis project shows that the relationship between corporate venture capital investments and R&D expenses is significant and positive. Furthermore, the COMPANY A case gives us an interesting view of why this relationship is positive in a practical setting. The first main contribution of this research therefore is to solve or contribute to the controversy in literature whether the two concepts are complements or substitutes. Based on my research I can conclude they are complements. The second contribution this research makes is an indication that the traditional role of the R&D department might be changing with the emerging of open innovation and more in particular corporate venture capital. As Cohen and Levinthal (1990) state, R&D has two functions being providing innovations and building up absorptive capacity to facilitate learning. This master thesis indicates that the second role of R&D, building up absorptive capacity to facilitate learning, might become more important than providing all innovations. R&D should focus on providing incremental innovations because this is what R&D is traditionally good at (Yin and Zuscovitch, 1998). Striving for radical innovations should be left to new emerging modes of pursuing innovation like corporate venture capital. R&D is however still important in this process because the venturing department needs a strong internal knowledge base (provided by R&D investments) to screen, evaluate and possibly assimilate external technologies and ventures. In light of this finding, it is important that companies look at their R&D department and perhaps redefine their goals. The overall aim should not be to maximize R&D or CVC performance, but to maximize the total innovation performance of a company. The only way to achieve that is to clearly identify and recognize the relationship between the different modes and setting goals accordingly.

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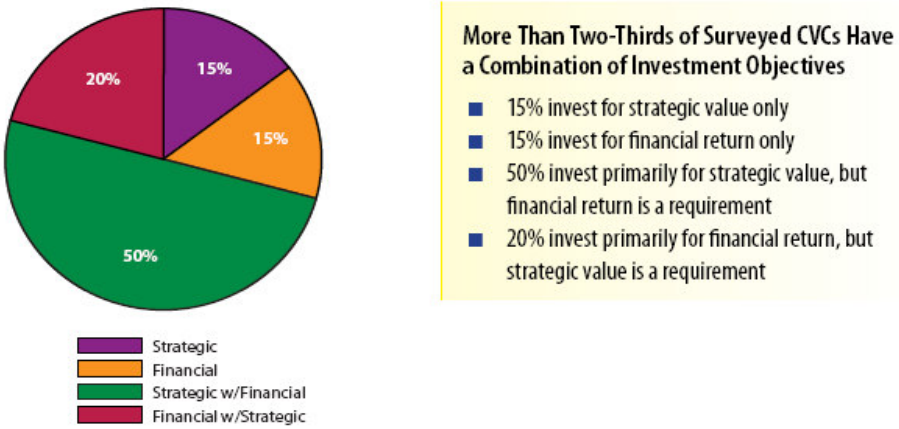
1. Introduction

In the past, the closed innovation approach was generally thought to be the best way of producing innovations for a company. According to Chesbrough (2003) the main focus in this closed innovation approach was on control. Companies believed that external parties could not achieve the same quality levels as they could internally so they wanted to control the whole innovation process from idea generation to market launch. Firms were also convinced that if they would hire the smartest people and would invest the most in R&D relative to other competitors, they would outcompete them. The goal for these people working internally in R&D labs was to produce new innovations that would be first to the market as it was thought that being first to the market was essential to success.
This main focus on internal R&D efforts like described above however poses some impediments. According to Yin and Zuscovitch (1998), large companies that invest heavily in internal R&D efforts mainly focus on cost-reducing (incremental) innovations that target the already existing product-market mix. This indicates that large companies are mainly occupied with satisfying their existing customers when searching for new innovations. Following Yin and Zuscovitch (1998), the result of this is that the large company will remain dominant in the post-innovation market of the product. On the other hand, new start-ups do not have an existing customer base they have to satisfy and tend to focus more on radical innovations. Chesbrough et al. (2006) acknowledge the reasoning of Yin and Zuscovitch (1998) and conclude that this inability of large companies to pursue radical innovations poses a serious threat to their survival in the long run. According to Chesbrough et al. (2006), even though large companies might not be optimally suited to pursue radical innovations, they are in fact dependent on them for their survival. As existing markets become saturated and profits decline, companies need to find new products and related markets to find new customers that are less price sensitive than in the old markets where competition from other firms is severe.
Besides evidence indicating that large companies might be unable or have a hard time pursuing radical innovations there are other factors which might complicate solely focusing on internal R&D efforts and trying to control the whole process from idea generation to market launch. As described earlier, the closed innovation belief was mainly based on the conviction that it was essential to have the best people in the field working for your company. In the past, it was indeed a competitive advantage to have the best people working for you since the mobility of the highly skilled workers was low. However, mainly because of the emerging venture capital market, highly skilled scientists became much more mobile. Since they take a lot of internal knowledge with them when they leave a company, it is very difficult to pursue an innovation strategy that is centered so much on having control. Besides losing control over the innovation process, the external development of the market also makes it increasingly difficult for a company to solely rely on internal R&D efforts. The development in the external market (especially in the high-tech sector) is becoming faster and more complex. Because R&D is a relatively slow method of developing innovations, the combination of being slow to develop new innovations while the market demands faster innovation development (that are also more complex) becomes a real impediment to success.

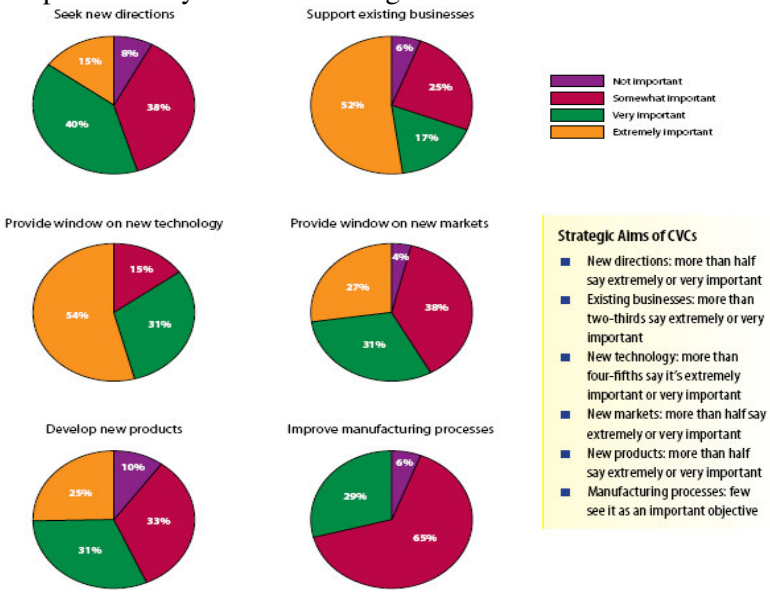
In the past, the dominant belief in pursuing innovations was called closed innovation which mainly focused on control. Above, several reasons are mentioned why this focus on control is becoming increasingly more difficult. This all resulted in a new paradigm called open innovation introduced by Chesbrough (2003). *Open Innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively* (Chesbrough et al., 2006 p.1). This meant that compared to the closed innovation approach, it was not essential anymore to control your whole innovation process. The focus in the open innovation approach is recombining existing knowledge and information into a successful innovation as opposed to developing everything yourself. In the open innovation approach, companies realize its naïve to assume that the best people in the field work internally for the company and that the focus should not lie on controlling your

innovation efforts but on finding creative ways of recombining knowledge, both internal and external. Open innovation can be a good way for large companies (previously unable or finding it difficult to pursue radical innovations) to actively pursue radical innovations by developing them outside the own firm boundaries.
Companies adopting the open innovation principle can do so in various ways. One possible way is the use of corporate venture capital. Chesbrough and Tucci (2004) define corporate venture capital as an equity investment in a startup company that the corporation does not own. In other words, corporate venture capital is when a large corporation takes a minority stake in a start-up not only focusing on financial goals but (perhaps even more importantly) also on strategic goals. Figure 1.1 and 1.2 illustrate this.



(Figure 1.1, Strategic and Financial goals CVC programs, MacMillan et al. (2008))

Figure 1.1 shows that 50% primarily invest for strategic reasons but that the financial aspect is a condition as well. In other words, the investment is motivated by strategic reasons although the financial requirements are certainly important too and even a requirement for investment. Also 15% of the companies solely invest for strategic reasons no matter what the financial prospects are.



(Figure 1.2, Strategic reasons CVC programs, MacMillan et al. (2008))
Figure 1.2 shows the strategic reasons to pursue CVC mentioned in figure 1.1. As can be seen, the reasons seek new directions, support existing businesses, provide window on new technology, provide window on new market's and develop new products are all labeled as very or extremely important in

more than 50% of the cases. The strategic reason improve manufacturing processes is not seen as a very important objective of CVC.

Corporate venture capital programs face both inward as outward. Outward they focus on investing in entrepreneurial ventures, developing relationships with other parties and learning about new opportunities and possible future directions for the company. Inward they interact with the internal R&D department (MacMillan et al., 2008). It is this interaction, that is the subject of investigation in this master thesis project.
The CVC program can help the internal R&D department by identifying trends and opportunities outside the own firm boundaries (Chesbrough and Tucci, 2004; MacMillan et al., 2008). By alerting and communicating with the internal R&D department concerning new external possibilities the company can take action by for example investing in an external venture or adapting the internal R&D efforts. The R&D department can also list their priorities and needs for technology and pass this on to the CVC department. The CVC department can then look externally if there are technologies in start-ups available that fit the needs of the R&D department (Chesbrough and Tucci, 2004; MacMillan et al., 2008). The above reasoning would imply that R&D and CVC are positively related, in other words, they are complements of each other. CVC scans for new opportunities and ideas which in turn increase R&D activity while R&D indicates which priorities it has and which technologies it needs after which CVC looks externally to find them. One can however also argue from another perspective. Chesbrough and Tucci (2004) reason that which mode of pursuing innovation (in this thesis R&D or CVC) a company uses depends on the type of technology one desires. For familiar technologies, Chesbrough and Tucci (2004) propose that R&D is the preferred method while for unfamiliar technologies some sort of CVC is needed. This implies that R&D and CVC could be substitutes of each other since their use depends on the relationship between the external technology and the available internal technology base. At one end (compared to the internal technology base the external technology is unfamiliar) CVC is preferred while at the other end (compared to the internal technology base the external technology is familiar) R&D is preferred. The linear relationship and total substitutability of the two concepts can however be questioned (Gilsing et al. (2008); Nooteboom et al. (2007)) although the reasoning of Chesbrough and Tucci (2004) certainly remains interesting. Another reason why the two concepts could be substitutes arises when it is assumed that the two modes of pursuing innovation receive funds from the same pool. In other words, assume a company has funds available for the total innovation efforts of the company. These innovation efforts could then be directed towards R&D or CVC which would diminish the funds available for CVC and R&D respectively.

It has become clear thus far that the way companies pursued innovation years ago can best be labeled as closed innovation. Because of increasing mobility of highly skilled people and fast technological development (amongst other reasons) this paradigm seized to function adequately. A shift to a new paradigm called open innovation appeared which changed the focus from control to recombining both internal and external knowledge into new successful innovations. Also described is that a particular part of open innovation is corporate venture capital in which a company takes a minority stake in a start-up often primarily aiming for strategic benefits. Internal R&D has however not seized to exist in most companies and is perhaps even necessary to evaluate external technologies. The relationship between internal R&D expenses and external CVC investments is however not totally clear in literature as there are multiple arguments for the two concepts being complements or substitutes. Because there is such a huge lack of empirical evidence in literature concerning the relationship between an internal mode of pursuing innovation (R&D) and an external one (CVC), this will be empirically investigated in this paper. This all leads to the two research questions of this master thesis paper namely:

Research Question 1: *What is the relationship between corporate venture capital and internal R&D expenditure?*

Research Question 2: *Why does corporate venture capital have a certain relationship with R&D expenditure in certain companies?*

The first research question aims to solve the controversy in literature whether R&D expenses and CVC investments are complements or substitutes of each other.
The second research question aims to get some more in depth knowledge on the specific relationship that follows from the first research question. If for example it turns out that the two concepts are complementary, it could be very insightful to get a practical example of a company actively employing CVC to see how they deal with the balance between CVC and R&D and how they support each other.

The two research questions (and thus my master thesis project) are important for three reasons. The first reason is aiding in the theory development on this topic. As described earlier, Chesbrough and Tucci (2004) give some reasons why the two concepts might be complements and why they might be substitutes. They however do not empirically investigate the relationship and reason from there on. It can therefore be very insightful to empirically investigate the relationship between CVC and R&D and from there on find explanations for the relationship being as it is. The second research question could provide some lead way in search for reasons for a particular relationship and can possibly identify best-practices.
The second reason why this research is important is the practical relevance of the subject. Around 10% on average of the total venturing activity consists of corporate venturing capital. In 2000, which was a peak in venturing activity, more than $100 billion was invested in venture capital (MacMillan et al., 2008). At that time, 16% of those investments came from the corporate venture capital market which equals $16 billion in the year 2000 alone. In the years after 2002 the venture capital market stabilized again at around $20 to $25 billion per year of which around 6% to 8% comes from corporate venture capital activity (MacMillan et al., 2008). This equals at a minimum $1.2 billion and at a maximum $2 billion of corporate venture capital being invested every year. As described earlier, in the peak periods this has risen to $16 billion in corporate venture capital investments. Because so much money is being invested in the corporate venture capital market, it is important to get a clear view as to what the relationship with R&D is.
The third reason is that the goals of R&D might have changed in the light of the emerging venture capital market. It was previously aimed at providing both radical and incremental innovations. At the moment though, companies (partly because of CVC) have new methods available to pursue radical innovations. The emerging of these new innovation modes might have altered the goals and importance of the R&D department.

The relationship between CVC and R&D is first explored using a database which contains 76 companies and their respective R&D expenses and CVC investments for several years with a maximum of five. Several other variables like number of employees are accounted for to minimize their influence on the relationship subject of investigation. The second part of this research concerns interviews with practitioners active in the field of corporate venture capital to shed their light on the relationship.
This relationship subject of investigation has hardly been empirically investigated in previous literature; therefore no specific model could be developed serving as a basis for the regression analysis. In stead, the difference in opinion between authors on the relationship will be discussed and serve as background information for the analysis.
In the following, I will first discuss the concept of Open Innovation, Closed Innovation, R&D, CVC and the relationship between CVC and R&D in chapter 2. The next section, chapter 3, describes the sample, data gathering method and the scales of measurement amongst other topics. In chapter 4 the multiple regression analysis is performed and the results are shown and shortly discussed. Then in chapter 5, we turn to the interview part of this research and highlight important aspect of each held interview. Chapter 6 culminates the earlier chapters by discussing the results and providing conclusions that can be drawn.

2. Theoretical Framework

Open Innovation is a term that has first been introduced by Chesbrough (2003). To fully grasp this concept and afterwards a particular part of it, corporate venture capital, the first part of this master thesis will elaborate on the old innovation approaches and why those approaches get abandoned more and more in certain industries.

2.1 Shift from closed innovation to open innovation

In the old closed innovation approach the concepts innovation and control were tightly related. The general consensus was that in order for a company to successfully pursue innovation the company needed to be in full control over all aspects concerning the innovation (Chesbrough, 2003). *Companies must generate their own ideas and then develop them, build them, market them, distribute them, service them, finance them, and support them on their own* (Chesbrough, 2003 p. xx Introduction). One of the reasons why companies focused so much on having control was the mindset that external parties could not achieve the same quality levels as the own company could. Because companies did not trust external parties, and thought it was cheaper and better to control all aspects of the innovation themselves, they focused on acquiring the best and smartest people in the industry. Besides having the best people in the industry, having the largest R&D budget was also considered key to success. Having the best people plus the largest R&D budget available would mean discovering a lot of innovations and beating the competition in terms of time to market. Being first on the market was essential because this, as was the general consensus, almost guaranteed that the firm would be more profitable than competitors. If innovation development did not go as expected, and the company could not use the innovation for their current markets, it was essential to hide the innovation from competitors and put it somewhere where external parties could not benefit from it. These lines of thought are summarized in some implicit rules of the closed innovation approach (see Table 2.1) as formulated by Chesbrough (2003).

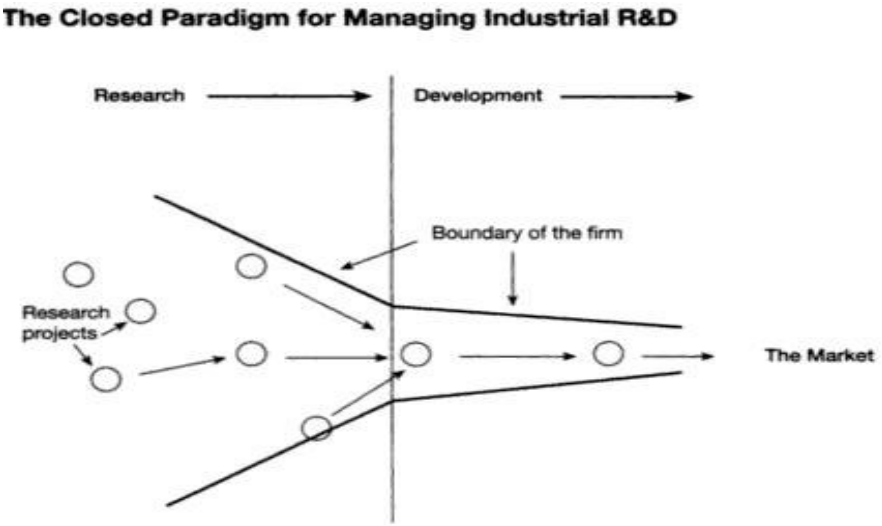
We should hire the best and the brightest people, so that the smartest people in the industry work for us.
In order to bring new products and services to the market, we must discover and develop them ourselves.
If we discover it ourselves, we will get to the market first.
The company that gets an innovation to the market first will usually win.
If we lead the industry in making investments in R&D, we will discover the best and most ideas and will come to lead the market as well.
We should control our intellectual property, so that our competitors don't profit from our ideas.

(Table 2.1, Implicit rules closed innovation approach, Chesbrough (2003))

With the implicit rules, described in table 2.1, in mind the vicious circle of the closed innovation approach can be described as identified by Chesbrough (2003). An important aspect in the closed innovation approach was getting more and more new products, which were developed internally, to the market. These new products caused sales to increase. The extra profit that resulted from this increase in sales was spent by increasing internal R&D spending. As the fifth implicit rule in table 2.1 of the closed innovation approach already indicates, this increase in R&D spending then meant more new (successful) products. The increase in quantity and quality of the products then again resulted in increased sales after which the cycle repeats itself.

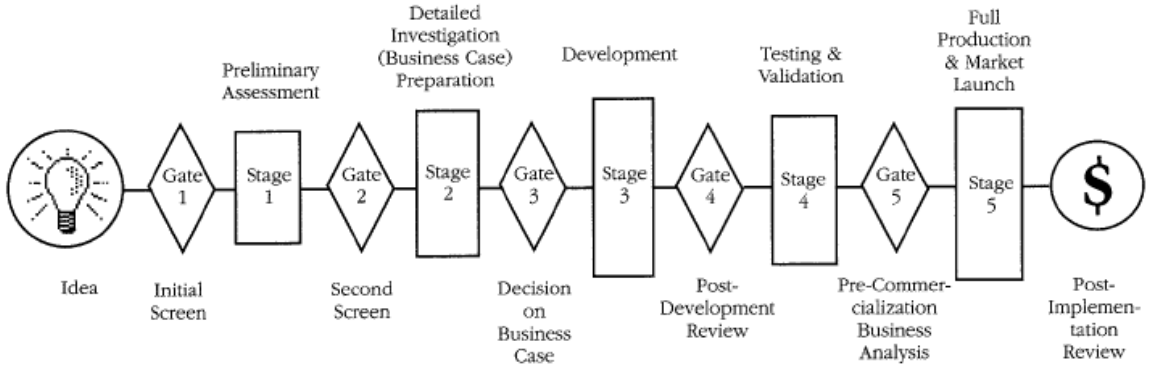
Stated as the third implicit rule in table 2.1, companies wanted to develop everything internally in the old innovation approach. Ideas entered the organization at one point, and then traveled through the company with the goal of bringing a successful product to the market. Not every idea makes it to the market

though; a lot of ideas are considered not promising enough and are cancelled somewhere in the development funnel.



(Figure 2.1, The Closed Paradigm for Managing Industrial R&D, Chesbrough (2003))

Figure 2.1 clearly depicts the principle of closed innovation in managing industrial R&D. A lot of ideas enter the funnel and only a few make it all the way to the other end where they are being brought to the market. Also notice that no ideas enter or leave through the boundary of the firm further highlighting the internal focus of the closed innovation approach. Ideas can enter the organization in one way, and also leave the organization in one way. Picture 2.1 is a very general picture of the closed innovation approach, showing research and development more as a black-box in which a lot of research projects enter, but only a few of these projects making it to the market in the form of a tangible product. It could be insightful to open this black-box to get a good idea of how the closed innovation approach worked in practice. Therefore, let us focus on one particular example of the closed innovation model namely the stage-gate model described by Cooper (1990).



(Figure 2.2, Stage-Gate Model, Cooper (1990))

In figure 2.2 the stage-gate model as described by Cooper (1990) is depicted. One can clearly see the different stages of the model and after each stage a gate (hence the stage-gate model). This means that after each stage, there is a Go/Kill/Hold/Recycle decision made by senior managers (Cooper, 1990). As described in the beginning of paragraph 2.1, the focus in the old innovation approach was on controlling

your innovation. This stage-gate model is an excellent example of an effort to control the innovation by evaluating each stage. As Cooper (1990) states, these gates control the process and by this control, assure that the delivered product is of high quality. This control however also means that a lot of ideas that enter the R&D funnel are cancelled at some stage and disappear on the shelf. To really grasp the old innovation approach and the shift to the newer open innovation approach, below two frameworks will be introduced that provide some perspective on this.

The frameworks that will be used throughout the following chapters are the resource based model and the dynamic capabilities model (Barney, 1991; Teece et al., 1997; Eisenhardt and Martin, 2000). The resource based model depends on the assumption that resources are spread heterogeneous over firms and investigates the link between these resources and sustainable competitive advantage (Barney, 1991). Firm resources is a broad concept encompassing all assets, capabilities, organizational processes, firm attributes, information, knowledge etc. controlled by a firm that enable it to work more efficient and effective (Barney, 1991). In the paper of Barney (1991) these variety of resources are classified in three different categories namely physical capital resources, human capital resources and organizational capital resources. Since the focus in this master thesis will mainly be on knowledge, ideas, information etc. the two categories that mainly concern us are human capital resources and to some extent organizational capital resources.
As explained earlier, the resource based model investigates the link between having certain resources and sustained competitive advantage. Sustained competitive advantage is when a firm implements a value creating strategy that is not also being used by any current or potential competitors and when these other competitors are unable to duplicate this strategy (Barney, 1991). Knowledge that is residing in the minds of scientists working internal in the R&D department of a company can certainly be a resource that leads to a sustainable competitive advantage. The old innovation was mainly based on this conviction (see Table 2.1.), if you had the best scientist working for you (knowledge as a resource) your products would be first on the market and you would beat other competitors. This old innovation approach as depicted in figure 2.1, as Chesbrough (2003) notices, was not a bad model. In fact, it was quite successful for multiple decades primarily since the environment facilitated such a model because of slow technological development. After the closed innovation approach had been successful for multiple years, a shift to a new paradigm called open innovation became apparent. According to Chesbrough (2003) this shift was caused by multiple factors.

Growing mobility of highly experienced and skilled people.
Burgeoning amount of college and post-college training that many people obtained.
Growing presence of private venture capital (VC), which specialized in creating new firms that commercialized external research and converting these firms into growing, valuable companies.
Increasingly fast time to market.
Presense of an outside path for internal R&D researchers.

(Table 2.2, Factors (partly) causing the shift from the closed innovation approach to the open innovation approach, Chesbrough (2003))

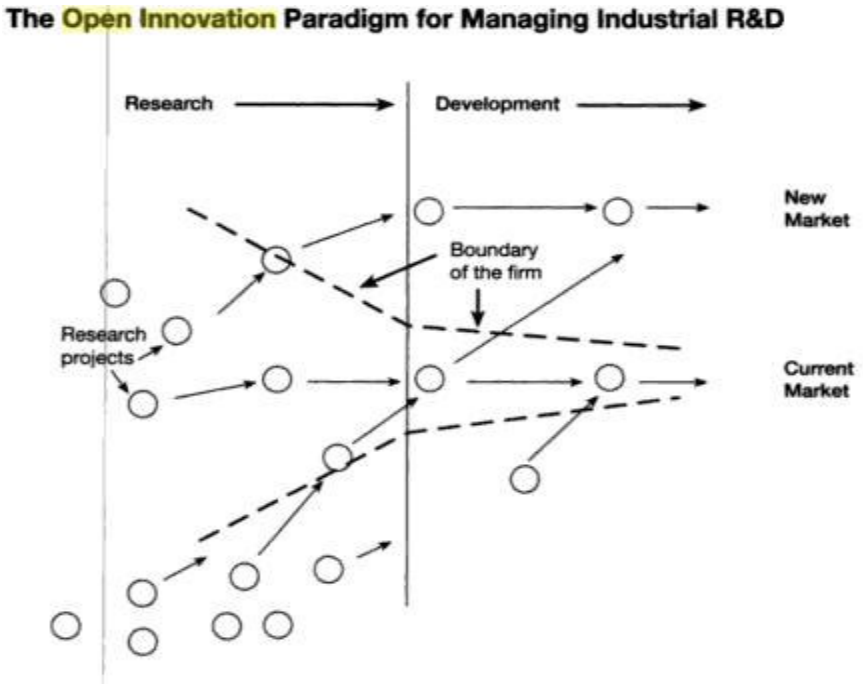
In table 2.2, the first factor that caused the shift from the closed innovation approach to the open innovation approach is the growing mobility of highly experienced and skilled people. In the past, it was often so that highly skilled employees worked their entire life at one company. However, this trend has changed as many employees switch employers multiple times.
When experienced employees leave an organization, they take a lot of knowledge with them to another employer who can benefit from this experience. This severely undermines the implicit rules of the closed innovation approach as mentioned in table 2.1. Since employees change employers so often it is very hard to exercise control and keep all scientists on board from idea generation to development. And it is this control, which is so important in the old closed innovation approach (Chesbrough, 2003; Cooper 1990).
The second factor concerns the growing number of highly educated people causing inability on the side of large companies to accommodate them all. This resulted in a lot of highly educated people to pursue a

career elsewhere in, for example, a smaller company (the implicit rule of the closed innovation approach that all smart people work for us does not hold anymore).
The growing presence of private venture capital caused that the number of smaller, growing companies increased. Often these smaller companies became strong competitors of the old and large existing companies (Chesbrough, 2003).
The fourth factor concerns the increased demands of the customer. The customers want better products than before and also faster. This causes an increased pressure on large, existing firms to shorten the length between idea generation and market launch. Moreover, solely relying on internal R&D efforts to shorten the length between idea generation and product launch can prove to be nearly impossible since internal R&D is relatively slow and inflexible (Sahaym et al., 2009).
The last factor that facilitated the shift from a closed to an open innovation approach is that researchers realized they did not have to work at the same company all their lives. If they had full confidence in a certain idea but management decided not to pursue that idea further, they now had the possibility to abandon the company and develop it externally possibly leading to an IPO. This possibility emerged through the growing presence (as presented in Table 2.2) of venture capital as another way to spur innovation.

When applying the resource based model one can see that this model worked in the closed innovation approach, but that a shift to another model was imminent. An assumption not mentioned earlier of the resource based model, is that the differences between firms in terms of their resources are stable over time (Barney, 1991). It assumes that resources can not be transferred in a timely manner from one company to another. As stated in Table 2.2, this condition does not hold anymore, the mobility of talented scientists is increasing. Because of this increasing mobility of scientists (and thus knowledge), knowledge as previously defined is not a sustainable firm advantage anymore.
The dynamic capabilities model however, does account for the fact that division of resources across firms are not ever lasting (Teece et al., 1997; Eisenhardt and Martin, 2000). The paper of Teece et al. (1997) defines dynamic capabilities by explaining each word separately. *Dynamic refers to the capacity to renew competences so as to achieve congruence with the changing business environment; certain innovation responses are required when time-to-market and timing are critical, the rate of technological change is rapid, and the nature of future competitions and markets difficult to determine* (Teece et al., 1997 p. 515). According to the paper of Teece et al. (1990), capabilities refer to the role of strategic management to adapt the organizational processes, resources and skills to match the requirements of the changing environment.
The paper of Eisenhardt and Martin (2000) acknowledges that in rapidly changing environments the resource based model does not suffice. In rapidly changing environments it is not the current resources that a firm possesses that brings competitive advantage. The way in which managers adapt the competencies of the firm in the face of the rapidly changing environment is what differentiates a firm from competitors and gives an advantage (Eisenhardt and Martin, 2000). According to Eisenhardt and Martin (2000) especially management of the knowledge resources is vital in such markets. In the dynamic capabilities model it is all about managing your current resource base and adapting and recombining resources to generate new value-creating strategies (Eisenhardt and Martin, 2000).
In the old innovation approach the resource based model explained competitive advantages accurately. The companies that had the best and most talented scientists held a difficult to imitate resource that led to a competitive advantage. These top scientists possessed unique knowledge that researchers in other companies did not have and were thus able to beat competitors because of their unique resource. However, Table 2.2 shows that scientists change employer much more often then before. By leaving their employer, they also take knowledge gathered at their previous employer to their new company. Further, in sectors where technological development is fast, current knowledge resources become rapidly obsolete (Sahaym, 2009). These two reasons cause the resource base model to be unable to fully explain the new innovation approaches. It is not about having the best scientists anymore; it is about acquiring knowledge

from different angles and recombining them into new value-creating strategies (Eisenhardt and Martin, 2000).

All the above factors let to a concept that Chesbrough (2003) called Open Innovation. *Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology* (Chesbrough, 2003 p. xxiv Introduction).
Defined otherwise, *Open Innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively* (Chesbrough et al., 2006 p.1).
This new innovation approach can be understood accurately by the dynamic capabilities model. The way to achieve a competitive advantage over other firms is not to hire the best scientists and focusing on controlling the innovation funnel. A competitive advantage is achieved when firms actively seek to recombine resources, knowledge, into new value-added strategies. The issue is not whether or not this knowledge comes from inside our outside the firm, but whether companies can find adequate ways of dealing with all these sources of knowledge and combine them into a new product/service.



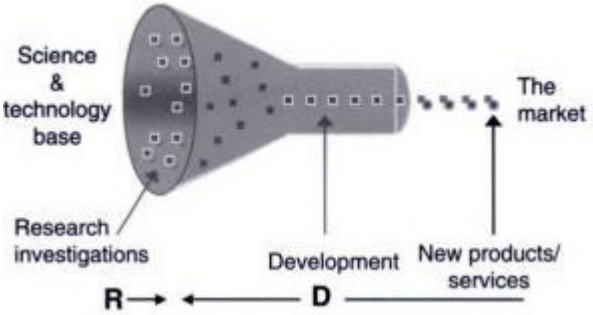
(Figure 2.3, The Open Innovation Paradigm for Managing Industrial R&D, Chesbrough (2003))
When comparing figure 2.3 to figure 2.1, a lot of differences become visible. The old closed innovation approach was clearly internally focused with no external information flows going in or out. In the open innovation approach however, knowledge can enter the organization from the outside but also vice versa. Some ideas enter the funnel later than others, and some ideas leave the funnel after spending some time there. This can for example be the case when the organization develops a promising new idea, but it does not match with the current market. Creating a spin-off focused around this technology is then a way to reap the possible benefits of this idea without the company having to develop it themselves or adjusting the targeted existing markets.
Also notice that the boundaries of the firm in figure 2.2 are dotted indicating that the boundaries of the firm are beginning to fade.
Figure 2.3 shows that the mindset when talking about innovation has changed when comparing it with figure 2.1. By accepting ideas from external parties, companies are starting to realize that it is false to

assume that the best people in the industry work internally in the company, which was an assumption in the old innovation approach (see Table 2.1). In the new innovation approach, the focus is not so much on developing everything yourself and exercising control but more on finding the best use of internal and external ideas to gain a competitive advantage. Also shown in figure 2.3 is that companies are not afraid anymore to share ideas they do not need anyway. Sharing ideas with other companies can be a cheap way of getting access to new innovations compared to internal R&D. This change in the mindset of companies from the old to the new innovation approach is shown in Table 2.3.

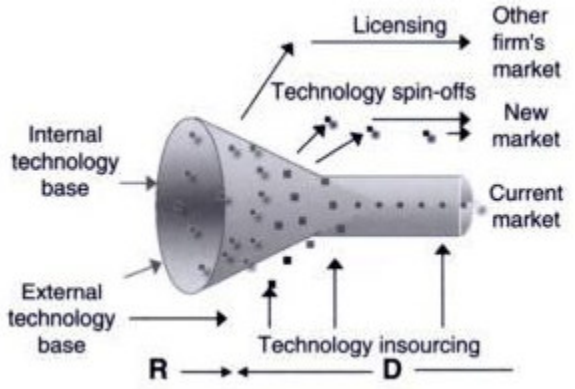
Not all the smart people work for us. We need to work with smart people inside and outside our company.
External R&D can create significant value: internal R&D is needed to claim some portion of that value.
We don't have to originate the research to profit from it.
Building a better business model is better than getting to market first.
If we make the best use of internal and external ideas, we will win.
We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

(Table 2.3, Implicit rules open innovation approach, Chesbrough (2003))

When comparing table 2.3 with table 2.1, one sees that the closed innovation approach is all about protecting your own ideas, not sharing/talking with other companies, developing everything yourself and the conviction that first to the market will become market leader. The open innovation approach however acknowledges that too much knowledge resides in the outside world for a company to believe they have the best researchers. Companies must be able to use external ideas from other companies but also share their own. Also being the first on a market does not guarantee in any way a sustainable competitive advantage in the long run. In the open innovation approach companies need to abandon the thought that the best way to use an idea which does not fit with the current target markets is to put it on the shelf and do nothing with it all in the light of "If we can not use it, we will keep it a secret, so our competitors will not be able to use it either". Companies need to exchange ideas because an idea that a certain company might have been keeping on the shelf can be very valuable information for another company and vice versa.



(Figure 2.4, closed innovation model, Chesbrough et al. (2006))



(Figure 2.5, open innovation model, Chesbrough et al. (2006))

Figures 2.4 and 2.5 visually summarize the difference between closed and open innovation. In the closed innovation approach ideas can enter the organization at one entry (hence "closed" innovation) and either make it to the market or end up on the shelf of the company. In the open innovation approach ideas can flow in the company from several angles. Knowledge can also leave the organization and be, for example, licensed to another firm. This might enable a firm that first saw no use in the idea because it did not target current markets to still reap some financial benefits by licensing it. In the old innovation approach, these ideas would have been put on the shelf.

Above the shift from traditional closed innovation to the newer open innovation has been described. It is however wrong to conclude that this shift has occurred in all industries. The shift from closed to open innovation has mainly been observed in the high-tech industry. But even in the high-tech industry there are differences. Nuclear reactors and aircraft engines are two industries that Chesbrough (2003) mentions that remain in the closed innovation paradigm. The Personal Computer industry on the other hand is an example of an industry that has mainly switched from a closed to an open approach to innovation. There are also a lot of industries (automotive, biotechnology, pharmaceuticals, health care, software etc.) that are in transition between the two paradigms (Chesbrough, 2003).

Obviously, companies can use open innovation in a variety of ways. Corporate venture capital is such a way that falls under the concept open innovation. It is a way to abandon the internal R&D focus and broaden the search to external ideas and companies. In the next paragraph this particular concept will be explained.

2.2 Corporate venture capital as part of Open Innovation

Existing markets are constantly changing and new markets are rapidly emerging. In such an environment, it is vital to adapt to changes and constantly search for new opportunities. Firms should develop strategic tools that facilitate strategic renewal and enable the capturing of opportunities arising from various changes (Keil, 2002). Firms can use incremental changes to adapt to their changing environments and try to keep up. The results of Yin and Zuscovitch (1998) indicate that large firms indeed tend to focus their R&D efforts on already existing markets thereby dominating the already existing product market. Recently though, firms have increasingly chosen more radical transformation paths (Keil, 2002). This however poses a problem since Yin and Zuscovitch (1998) clearly show that in a new product market, the smaller firm is superior to the larger one.
Chesbrough et al. (2006) however state that even though, according to Yin and Zuscovitch (1998), large firms have difficulty pursuing radical innovations, they are in fact dependent on radical innovations for their survival. According to Chesbrough et al. (2006) large firms depend on breakthrough innovations as current markets become commoditized and the profits decline. These innovations can open up new

markets with new customers where the amount of competitors is lower compared to the old saturated market giving rise to the possibility of increasing the profit.
Chesbrough et al. (2006) indicate that large firms often lack the patience to pursue radical innovations in an effective manner because it can take up to a decade before any financial returns are seen which is often too long for mature firms. The open innovation model gives these large companies however an enormous help by providing an opportunity for developing radical innovations outside the boundary of the company. This will result in the life cycle of radical innovations being substantially shorter than before for larger firms (Chesbrough et al., 2006).

One way large companies can deal with the inability to effectively pursue radical innovations is corporate venturing. Corporate venturing can be understood as the overall activity of building new businesses in an established organization. A new business may involve new markets, new technology, products or service (Keil, 2002). In other words, this encompasses large organizations (an established organization) getting involved in new markets, technologies, products or services. Following from this is the definition used by Chesbrough and Tucci (2004) who define corporate venture capital as an equity investment in a startup company that the corporation does not own. Sahaym et al. (2009) gives yet another, but almost the same, definition by explaining corporate venture capital investments as minority equity investments by established firms in entrepreneurial ventures. These days, as will be elaborated on later, the goals of such equity investments are not merely financial but largely strategic. Corporate venture capital can help large established firms overcome the problem of being unable to effectively develop radical innovations themselves by providing a different way of pursuing radical innovations than through internal R&D efforts.

To really grasp the essence of the concept corporate venture capital, the topics history of CVC, reasons to pursue CVC and conditions of investment will be discussed hereafter.

2.2.1 History of corporate venture capital

The history of corporate venture capital knows three periods in which the subject was booming, and consequently three periods of decline. The corporate venture capital market imitated more or less the development of the independent venture capital market. So when that market showed signs of success, the corporate venture capital market started to expand (Gompers, 2002).
As stated above, there were three major cycles of corporate venture capital; each will be discussed below to get a good grip on factors influencing the usage of corporate venture capital. The main focus hereby is on the United States where CVC first emerged.

In the late 1960s and early 1970s the independent venture capital market booked large successes. Other companies took notice of this success and wanted to enter this market, they tried to do so by various means. One way was investing in companies that already received funds from independent capital funds. A huge advantage of this approach was that the investor could choose to invest in firms whose business focus aligned with their own. For example, they could choose to invest in a company that targeted the same market. The other way was to stimulate innovation internally. Companies motivated and stimulated their own engineers to pursue innovations and provided legal and financial support for them.
The decline of the corporate venture capital market in that period came however very fast. Some of the companies in which the independent venture capital funds had invested experienced very poor returns on investment. This was for many a reason to reduce commitment to this sort of financing. As said above, the corporate venture capital market closely follows the independent market. Hence, the corporations began scaling back their venture programs very rapidly (Gompers, 2002).

The venture capital market bloomed again in the late 1970s and early 1980s. Three reasons for this emergence can be identified: (Gompers, 2002)

1) Top capital gains tax rate was reduced in 1978.
2) Department of Labor eased pension investment restrictions in 1979.
3) Technology made a large leap forward, and the emergence of the personal computer opened new markets and thus new opportunities.

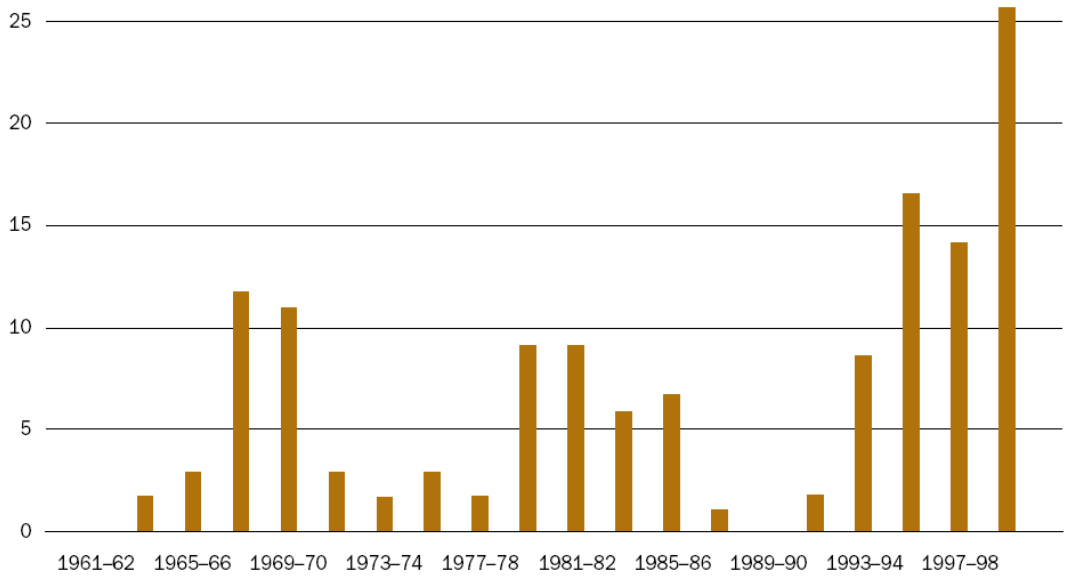
These three factors above caused the venture capital market to grow rapidly. Compared to the previous boom period much more cash was being invested.

Rind (1981) acknowledges the above factors and gives some more detail. Rind (1981) identifies capital gains tax reduction, improved liquidity from changes in SEC regulations, attractive acquisition prices for small technological companies, and a revitalized public market for high-growth companies as the main reasons for the growth. The attractive acquisition prices for small technological companies meant that new companies were cheaper per share then previously, hence larger companies were more inclined to pursue CVC.

The great expansion of the venture capital market came to a halt in 1987 when the stock market crashed. This was a bigger decline than the previous one.

In the late 1990s the venture capital industry started growing again, this because the telecommunications and internet-related companies showed remarkable good results (Gompers, 2002). Internet related companies and telecommunications demanded a great deal of knowledge before one could enter these markets. Because large companies often did not have this knowledge, corporate venture capital was an ideal way out. They could invest in companies that showed great promise without really knowing all the details about the specific products. Also a re-focus of objectives took place during this period. Previously, companies invested in startup firms purely for financial gains. However, the strategic benefits became more and more clear and firms wanted not only to benefit financially, but also strategically.

Number of Fortune 100 Venturing Programs Announced



(Figure 2.6, number of fortune 100 venturing programs announced, Gompers (2002))

In figure 2.6 one can clearly distinguish the three boom periods and following the periods of rapid decline for reasons stated above. Figure 2.6 also shows that the amount of companies engaging in corporate venture funding is increasing. Especially the late 1990s shows an increase in numbers of Fortune 100 companies entering the corporate venture funding market.
Figure 2.7 below gives a more recent picture of the amount of (corporate) venture capital being invested.

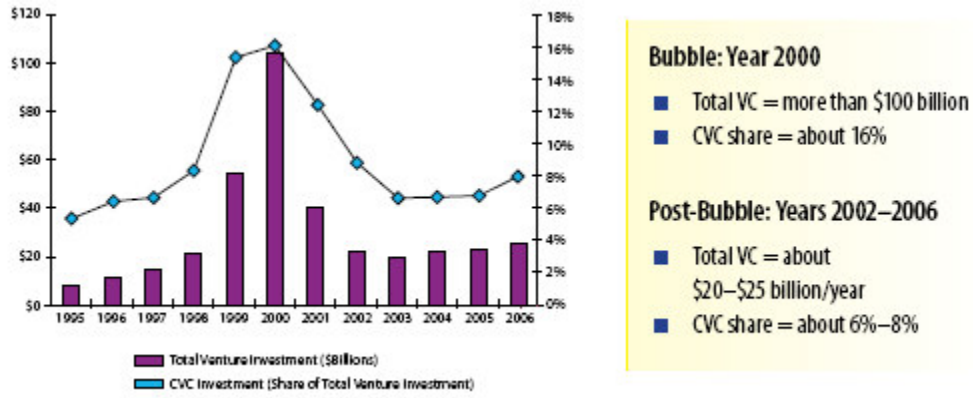


Figure 2.7, recent (corporate) venture capital activity, MacMillan et al. (2008))

In figure 2.7 one can clearly see the venture capital bubble in the late 1990's. As described earlier, this bubble mainly followed from increasing possibilities in the internet-related market. After 2001, the amount of (corporate) venture capital invested stabilized again although one can see a slightly positive trend from year 2003 till 2006.

2.2.2 Reasons to pursue CVC

When talking about the reasons why to pursue and use corporate venture capital, one can look from the firm that is investing in other firms, or from the company that is being invested in. The focus of the first part is on the latter, the second part is about the reasons to pursue corporate venture capital from the investor's point of view.

From the perspective of the invested firm

Not so much research has been done in this particular field, most research has looked from the perspective of the firm that is investing. However, Chesbrough and Tucci (2004) notice that results for firms with corporate backing are better.
Benefits for small start-ups can be that they receive cash to continue operations and research, get specific knowledge, can get legal and marketing assistance and benefit from the good name of the parent company etc. Because other companies see that a well established company is investing in a certain start-up, they might be more inclined to offer their services since they trust on the continuity of the well established company. Chesbrough and Tucci (2004) also mention benefits like reducing the under pricing of an IPO stock and better long-run rates of return.

In the paper of Ernst et al. (2005) some clear attention points why start-ups can benefit from CVC come forward. One reason can be a clear advantage in the cost of capital; basically this means cheaper funds for the start-up.

A second reason is the value of the strategic synergies between the start-up and the investing company. Strategic synergies can take the form of combining top management talent, sharing customer relationships, cost savings through combined purchasing power, combined branding etc.
Another reason could be knowledge that the corporate investor has. The investing firm could provide guidance to the young start-up and help him maneuver his business effectively. As stated above, the young start-up can benefit greatly from the well known brand and connections of the large investor. Also, the market knowledge that the large firm can provide to the start-up is valuable since this information is usually not easy to get and relatively expensive.

Besides reasons to pursue CVC from the perspective of the firm that is being invested in as mentioned above, Ernst et al. (2005) also mention some potential pitfalls. One of these problems is the fact that start-ups are afraid investors will steal their ideas and use them for their own good. Clear contracts and agreements have to be made concerning this subject in order not to be an obstacle for success. Also, the time aspect is important from a start-up perspective. Corporations should try and make sure they do not take much longer over an investment decision than independent venture funds. Most start-ups need financial resources in a timely manner because they want to make investments in the near future. When it takes much longer to acquire CVC than normal venture funds the firm in need of funds might look elsewhere, especially when the benefits of having CVC are not clear to them.
Last important point is clear communication between the two parties. Investors should make clear what they expect of the start-up and vice versa, this to try and exclude the possibility of (expensive) miscommunication.

From the perspective of the investor

A lot of research has been done from this perspective. In a classical paper, Rind (1981) notices that there are several reasons for a company to pursue corporate venture capital, namely:

1) Financial reasons. In the paper it is claimed that when the funds are operated by professionals, even when not aiming for financial winnings as objective, corporate venture capital will produce the same good results as independent venture capital. He claims that it is impossible for an investor to find a firm that strategically matches their own operations, and not make good financial returns when managed properly.
2) Corporate venture capital could be a way to come into contact with companies whose technologies might play an important role in the future line of business of the investor.
3) A method for better understanding the management strengths or weaknesses of possible acquisitions.
4) It could help the parent company to produce products at a lower cost than by normal operations; the firm in which the company invests might for example have technology available that enables the parent firm to produce the same products at a lower cost. Following this line of reasoning, CVC could be a way to reduce costs, hence get more margin on the products which, when keeping the price the same, would create greater profit.
5) It could provide some first mover advantages. By identifying an attractive startup in a relatively new market, the parent company could be first to reap the benefits of being first with a certain technology or having first mover advantages by tapping into a new market.
6) CVC can almost guarantee that on the supply side there is never a shortage. By having ownership over suppliers a company can guarantee that his own needed resources are always fulfilled.
7) A way to study new methods, like for example TQM. This because CVC can give an investor access to a new company that has adopted a new method like TQM. The investor can learn from this and implement such a method perhaps in his own organization if it appears successful.
8) A mechanism for helping customers.

When investigating the eight reasons mentioned by Rind (1981) to pursue CVC, innovation reasons are not clearly mentioned. Although Rind (1981) does acknowledge that corporate venture capital can be used for this, he remains rather vague about it. In her dissertation paper, van de Vrande (2007) however clearly states that CVC could be a way to spur innovation. The paper of Sahaym et al. (2009) identifies two reasons why CVC investments have become popular. The first reason is that CVC provides an excellent way of spreading your investments across a multitude of different technologies; it can be used as a screening device to scan for useful innovations and strategic opportunities in different markets. CVC investments allow a company to pursue different innovations in perhaps different industries at a relatively low cost compared to internal R&D. The second reason why CVC has become so popular according to Sahaym et al. (2009) is that also investments in markets the business already targets can pay off. It can open the doors to new technologies that can further improve the process and methods currently used at the parent firm.
While Rind (1981) focuses more on financial gains, van de Vrande (2007) and Sahaym (2009) clearly focus on CVC as a way of pursuing external innovation, thus focusing more on strategic benefits.

2.2.3 Conditions of investment

As stated above in paragraph 2.2.2, van de Vrande (2007) and Sahaym et al. (2009) state that CVC could be a way to spur innovation. The question that arises is: what conditions enhance the probability of a company employing corporate venture capital as a way of securing external innovation?

In the article of Dushnitsky and Lenox (2005) these conditions are investigated. They find that firms are more likely to invest in sectors with weak intellectual property rights, rich technological opportunities and complementary capabilities. Also greater absorptive capacity increases the willingness to invest.

Rich technological opportunities

In industries with rich technological opportunities more new ventures will emerge because there are more opportunities. Entrepreneurs will identify these opportunities and start new ventures. Also, since there are a lot of opportunities “out there”, people working internally at R&D departments of large corporations are more likely to leave the company and start on their own to exploit an opportunity. In order for a parent company to keep these scientists they have to provide more monetary compensation which increases the cost of internal R&D. Thus under conditions of rich technological opportunities, incumbents are more likely to use corporate venture capital in order to keep the talented scientists (although not in internal R&D but in a new start-up) who would leave, or kept at a very high internal R&D price, otherwise.

Weak intellectual property rights

If new ventures have a hard time getting their innovations patented, they have to rely on secrecy to try and make sure competitors won’t use the innovation for their own gains. CVC can be a way of circumventing this secrecy for the investor and getting direct access to the innovation of the invested firm. Even if a new start-up would have the possibility of protecting their innovation with a patent, this is often not possible because of financial restrictions. CVC can help the company by offering financial means to secure the protection of the innovation.

Complementary capabilities

It is, from a financial point of view, more difficult to start a company in some industries then in others. Some industries require large initial investments which can not be made by start-up alone; hence they

require assistance from other (large) companies that have the needed facilities. Take for example a beta test site for a new chemical product. It can be assumed that a start-up does not have the means to build such an expensive test site. Therefore, a solution for this start-up can be receiving an investment from a large chemical company that is willing to supply the start-up with the much needed test site. However, if the start-up company is an internet company that builds websites for companies, the need for complementary capabilities like a test site is much less important. A computer with internet connection and some software is enough to get the company started. This illustrates that in industries where complementary capabilities are important, corporate venture capital is more likely to be used.

Absorptive capacity

Firms that are strongly orientated towards innovation (who have a lot of absorptive capacity) are more likely to learn from investments in start-ups. An investing company needs to have the internal skills and capabilities to understand the technologies and knowledge the start-ups are giving them. They need not only to understand it, but also recognize how to use this in a successful way. In the paper of Dushnitsky and Lenox (2006) this condition is confirmed. They state that the results of an investment are better when a firm uses CVC specifically to harness novel technology. So in order to maximize returns the investing firm should specifically invest with innovation in mind. Sahaym et al. (2009) acknowledge that absorptive capacity in the investing firm (flowing from accumulated R&D investments) reduces the difficulty of evaluating CVC investments.
The paper of Cohen and Levinthal (1990) acknowledges the above and stresses the importance of absorptive capacity to recognize the value of new information and to assimilate it effectively. R&D might therefore have a two folded goal; the first goal (which was the focus in the old innovation approach) is producing innovations while the second goal is building up absorptive capacity. Cohen and Levinthal (1990) argue that, perhaps somewhat ironically, for a firm to fully grasp available external knowledge it needs to have a strong present (internal) knowledge base. This knowledge base flows from previous investments made in R&D. According to Cohen and Levinthal (1990) the prior knowledge developed by internal R&D should have some overlap with the new external information. The information that overlaps between the present knowledge residing in the R&D department and the new external knowledge facilitates assimilation (Cohen and Levinthal, 1990). The knowledge that does not overlap, that is new for the organization, is also important to facilitate effective and creative utilization of the new knowledge (Cohen and Levinthal, 1990).
Cohen and Levinthal (1990) suggest two features of absorptive capacity that have an influence on innovative performance of organizations in a high pace environment. The first is that accumulated knowledge in one period (t-1) makes it easier to accumulate knowledge in the next period (t). Second is that the accumulated knowledge in a certain period (t) makes it easier for a firm to predict future technological trends (t+1). It enables the firm to predict the usability of technological advances more accurately. This reasoning highlights, that although the open innovation approach might be a significant step forward in dealing with the changing environments, companies should not seize to invest in corporate R&D because this builds up their absorptive capacity needed to fully understand and implement external innovations. Seizing to invest in R&D now might harm the innovative performance of firms in future periods.

2.3 Research and Development (R&D)

There are several definitions available of what exactly is research and development. Of these definitions, the definition by the OECD is widely used and recognized. *Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge including knowledge of man, culture and society and the use of knowledge to device new*

applications.[1] R&D covers three different activities namely basic research, applied research, and experimental development.[2] Basic research deals with investigating certain phenomenon of interest without any specific application in mind. The main goal of this type of research is to increase knowledge in a certain area. Applied research also has the goal of increasing knowledge; however the research is conducted with a specific application or use in mind. Experimental development is systematic work that uses the knowledge gathered in research to develop or improve products, processes or systems. The current use of R&D is twofold according to Cohen and Levinthal (1990), the primary focus of research and development is to produce innovations. Especially in the old innovation approach as described in paragraph 2.1, a company was dependent on the output of the R&D department for its innovations. The second use of R&D that Cohen and Levinthal (1990) mention is that R&D facilitates learning. It makes it easier to evaluate new information and use it accordingly. For a further discussion concerning this last topic, I refer to subsection 2.2.3 "absorptive capacity".

In section 2.2 the concept of corporate venture capital was explained followed by a brief explanation of R&D in paragraph 2.3. The relationship between these two different ways of pursuing innovation will be the subject of the next paragraph.

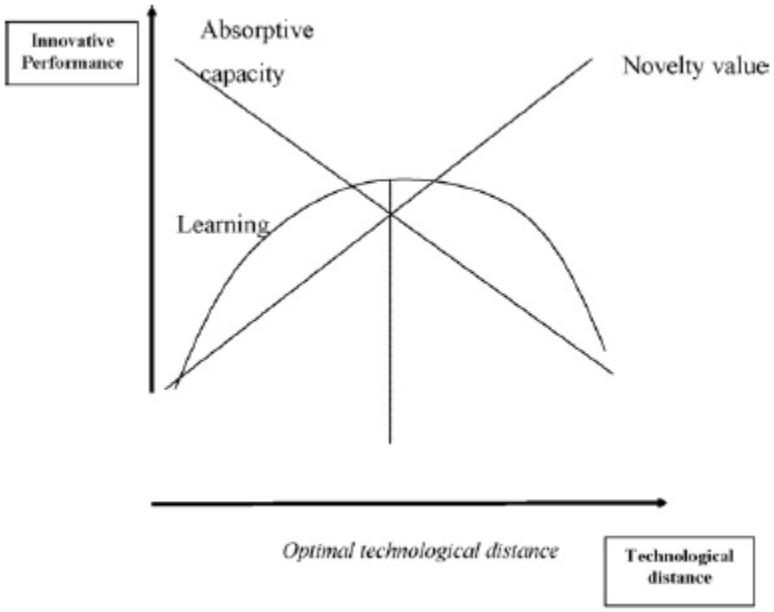
2.4 The balance between internal R&D and external CVC

In her paper, Van de Vrande (2007) notes that companies are increasingly looking outside their boundaries when striving for innovation. In the beginning, companies mainly relied on internal R&D efforts to supply them with innovations they could bring to the market. However, as Yin and Zuscovitch (1998) note, the R&D of large companies might be better suited for incremental innovations while start-ups might be better for radical innovations.
The inability of large firms to pursue radical innovations could be the reason why companies are increasingly looking outside their own firm, in line with the open innovation thought. One way of looking outside ones own firm boundaries in search for innovation is CVC.

In order for CVC to be good way of looking outside ones own firm boundaries in search for innovation, there has to be a relationship between CVC and innovation. Kortum and Lerner (2000) define innovation in terms of number and quality of patents. In their paper, they show a positive correlation between venture capital and patented innovations. An implication of the study is that for every dollar of venture capital, the parent company has to use around three dollar of traditional corporate R&D to receive the same number and quality of patents. This result could be a strong indication that corporate venture capital could not only substitute internal R&D, but even be more effective when looking at dollars spent. In the article the question is raised if the fact that venture capital has a more positive correlation with patenting than internal R&D means that venture capital is more positively correlated with innovation than internal R&D. It could be for example that venture backed firms are more likely to patent every new innovation they have because they are afraid the investor will steal their idea. Another reason could be that firms want to patent more because they believe this will enhance their attractiveness to other investors. By patenting more they would appear to be more successful and with this hope to attract extra venture capital.
However, the results show that this is not the case in this specific research setting. Venture backed firms do not only patent more, their patents are also of no less quality than other non venture capital backed firms. To sum up, this means that venture capital is more positively correlated with innovation than internal R&D and therefore more suited to pursue innovations. A shortcoming of the study of Kortum and Lerner (2000) however has to be mentioned in the sense that they define innovation in terms of quantity

[1] http://www.cbs.gov.il/www/publications/mop1190/definit.pdf (consulted at March 24, 2009)
[2] http://puck.sourceoecd.org/vl=3580946/cl=25/nw=1/rpsv/factbook/070101.htm (consulted at March 24, 2009)

and quality of patented innovations. It might be questioned whether a relationship between corporate venture capital and patented innovations is indicative of the relationship between corporate venture capital and innovation (Kortum and Lerner, 2000).
Besides Kortum and Lerner (2000), Chesbrough and Tucci (2004) also give an argument why CVC and R&D might be substitutes. In the paper of Chesbrough et al. (2004) it is stated that for technologies familiar to the core business of a company, R&D would be the favorable method. For unfamiliar technologies some sort of CVC could be employed. This would mean that the method of pursuing innovations depends on the technological relationship between the company and the invested firm. This however also implies, that CVC and R&D are perfect substitutes because at one end (familiar technologies) the company should use R&D while at the other end (unfamiliar technologies) the company should use CVC and some combination of R&D and CVC should be used for companies not totally familiar to the company but also not unfamiliar. Below the concept of technological overlap will be elaborated on somewhat more to give some background information on the argument of Chesbrough and Tucci (2004).
Gilsing et al. (2008) and Nooteboom et al. (2007) deal with technological overlap and focus mainly on the relationship between technological distance and innovative performance. Their proposed model is shown in figure 2.8.



(Figure 2.8, relation technological distance and innovative performance, Gilsing et al. (2008))

Following from figure 2.8 one can see there is an optimal technological distance. People do not need to agree on every subject, but some basic beliefs need to be shared in order to align their competencies and motives (Nooteboom et al., 2007). As the paper of Nooteboom et al. (2007) indicates, at first instance (as the distance increases) more distance has a positive effect on the learning process. They use their different backgrounds and knowledge to form creative solutions/ideas which would be difficult to create alone. However, as the distance keeps on increasing, the shared knowledge base becomes smaller and smaller resulting in the fact that companies find it hard to understand each other. There has to be some sort of mutual understanding in order to facilitate communication and create bridges between different pools of knowledge. This means that there has to be a sort of familiarity in the relationship to enable effective communication, but not too much since that might be detrimental to the performance (Gilsing et al., 2008).
The reasoning of Gilsing et al. (2008) and Nooteboom et al. (2007) is not detrimental to the argument of Chesbrough and Tucci (2004) that CVC and R&D are substitutes because they are used for pursuing

different types of technologies (familiar and unfamiliar). It does however shed some more light on the concept of technological distance and the consequences on the innovation performance of a firm.

Chesbrough and Tucci (2004) also argue from a different angle that investing more in CVC efforts will increase a firm's R&D spending. In other words, they are complements of each other. Corporate venture capital could be a way to explore new markets, products and knowledge. This because the locus of innovation has shifted, it is moving from being internally focused in the corporations R&D department to being more diffused and spread across universities and companies. A result of using CVC to explore new markets, products and knowledge is that a company receives more information and opportunities. To investigate all this information the company' internal R&D spending will go up.
The argument also works the other way, companies heavily investing in R&D might learn about external opportunities sooner than others. They then might choose to pursue these external possibilities by starting a venture activity. The article of Cohen and Levinthal (1990) is concerned with the dual function of R&D; first being producing innovations and second building up the absorptive capacity of a firm. They mention that if firms want to use and pursue knowledge unrelated to current activities, they need to focus more on the goal of building up absorptive capacity through R&D. For companies really trying to look for opportunities outside the current knowledge base of the firm, absorptive capacity is not just a by-product of R&D but the most important one. Just like Chesbrough and Tucci (2004) the paper of Cohen and Levinthal (1990) underlines that R&D intensity is positively related to the amount of absorptive capacity and that a firm with more absorptive capacity finds it easier to recognize and assimilate external knowledge.
The paper of Sahaym et al. (2009) acknowledges the reasoning above by stating that industry R&D investments create a capacity to identify and use CVC. *Firms in industries that typically have high levels of R&D investment tend to be quite familiar with the latest developments in the field due to their association with universities, academies, dedicated R&D labs and new ventures in the market that are engaged in the cutting edge research. Industry knowledge gained through R&D activity reduces the difficulty in evaluating relatively unfamiliar technology within the CVC target* (Sahaym et al., 2009 p. 3)
This means that according to Sahaym et al. (2009) firms with large R&D investments are not only better suited to identify the latest trends and promising new ventures, but also have much less difficulty in evaluating unfamiliar technology.
Also the paper of Dushnitsky and Lenox (2005) finds a complementary relationship between external CVC and internal R&D spending. This finding is however an empirical byproduct of their research and no real explanation for this relationship is given.

2.4.1 Factor influencing the relationship between R&D and CVC

The paper of Sahaym et al. (2009) focuses on the influence of industry characteristics on the relationship between CVC investments and R&D expenses. According to this paper industries with a higher technological pace find a stronger relationship between R&D investments and CVC. This because when the technological pace is high, companies run the risk of its core technologies becoming obsolete, therefore they put more emphasis on knowledge from R&D which is then used to discover and exploit CVC opportunities. This relates again to the paper of Cohen and Levinthal (1990) which states that companies investing more in R&D build up more absorptive capacity and that this is needed to fully understand and implement external innovations.
This means that a firm has to look for a promising new external technology before its own technologies become obsolete. Using a portfolio approach to CVC investments can protect a company against high risks (risks concerning not finding a new technology before the own core technology becomes obsolete) by providing multiple directions for possible future core technologies. Furthermore, developing a

portfolio approach using internal R&D efforts is relatively difficult because it is so expensive. Using CVC can help a company discover new technologies much faster and also cheaper.

3. Research Design

Summarizing the discussion of chapter 2 there are two ways of thinking about the (possible) relationship between CVC and R&D. One stream believes that they are complements, the other believes they are substitutes. For the reasons behind those convictions, see chapter 2.
This controversy in literature leads to the following two research questions:

What is the relationship between corporate venture capital and internal R&D expenditure?

Why does corporate venture capital have a certain relationship with R&D expenditure in certain companies?

The goal of this research is:

To help develop the theory around the (possible) relationship between R&D expenditure and corporate venture capital, since this has proven to be a literature gap.

3.1 Type of research

The research itself is exploratory of nature. The reason for this is that there are no empirical results available that really give a conclusive answer to the research questions thus far. Therefore the aim is to help develop the theory around the possible relationship between R&D expenditures and corporate venture capital, not to provide a conclusive causal relationship. Since the goal is more about exploring the relationship between R&D and CVC, the study is also not really descriptive of nature. If it was descriptive, hypotheses like "The relationship between CVC and R&D is positive" would have to be formed. However, since literature provides no conclusive evidence of whether there is a positive/negative/no relationship between CVC and R&D, this will be the subject of investigation.
Since the type of research is exploratory, this will influence the procedures followed in a sense that they can be more widely interpreted than in a causal/descriptive research setting.
"Within each phase, the researcher must make decisions about how to develop the research. The decisions may be fairly general, leaving the ideas, questions, and procedures relatively unrefined – as in some of the exploratory research undertaken early in the investigation of some phenomenon." (Graziano and Raulin, 1997, page 45 and 46)
"Exploratory research makes relatively few demands for structure or precision on the procedures in each phase." (Graziano and Raulin, 1997, page 46)

3.2 Research strategy

The first strategy that will be used in my master thesis project is desk research, which is research based on material that others produced (Verschuren and Doorewaard, 1995). This research strategy will be used to answer the first research question.
Desk research encompasses secondary research, which is the use of already existing data and restructuring that from another viewpoint. A perquisite of using this method is that the sources from which the secondary data are gathered are reliable. It is also very important to realize, that the data has not been collected in the first place for your research and that the data could give a wrong image of reality.
Also, every step in this desk research process has to be carefully documented.
"The correlational level of constraint requires much greater constraint on the procedures used to measure…" (Graziano and Raulin, 1997, page 49).

This means that the first research part of the master thesis should be documented much more precisely than the case study that accounts for the second part.

The second strategy is the use of case studies. This is used to get some in depth information on high-tech companies as a second part of my research. With using the first strategy, it is hoped some relation between corporate venture capital and R&D expenditure is found. With using case studies, I hope to find why in high-tech companies this relation is as it is.
According to Verschuren and Doorewaard (1995) it is very important which companies you select in your case studies. If the study has an exploratory nature (which this research has), they suggest to choose companies that resemble each other as much as possible (in this research this will be answered by trying to select companies in the high-tech sector), this in order to reduce as much variation as possible. If the companies differ to a large extent of each other, it is difficult to vent general statements about the sample. It is then also difficult, to find connections between certain phenomena. This thus implies that with using the case study method as part of my research, watching the external validity becomes important.
However, in choosing the sample (and other decisions that have to be made) one has more flexibility than in the first part of the research.
"Even though slightly more constrained than naturalistic observation, the case-study method still allows the researcher flexibility to shift attention to whatever behaviors seem most interesting and relevant at the time." (Graziano and Raulin, 1997, page 49)

Applying this strategy does follow the lead way set out in the book of Yin (1989); he claims that the type of research strategy to be followed should depend on the type of main research question asked. The first part of this master thesis is specifically designed to search for a relationship between the R&D expenditure and corporate venture capital expenditure. Hence, the first part of the research would be lead by the question "What is the relationship between corporate venture capital expenditure and R&D expenditure?". Yin (1989) states that when used in an exploratory research setting, the "what question" can be researched with any of the available research strategies. In this master thesis we choose desk research (or archival analysis) to look into this question further.
In the second part of the research the question changes. Now the question becomes "Why is the relationship between corporate venture capital expenditure and R&D expenditure as it is?". This means that in the first part, it is tried to find a general relationship between R&D expenditure and corporate venture capital while in the second part we zoom in on a few companies to get an in depth view as to why the relationship is as it is.
"In general, "what" questions may either be exploratory (in which case any of the strategies could be used) or about prevalence (in which surveys or the analysis of archival records would be favored). "How" and "why" questions are likely to favor the use of case studies, experiments, or histories." (Yin, 1989, page 19)

3.3 Data Sources

The first part of my master thesis project will be concerned with investigating the relationship between R&D and CVC. Because of this, I need data about how much companies spend on R&D and on CVC. The section about how much companies spend on R&D, will be gathered from the following sources:

- Thomson ONE Banker Analytics (which includes for example the database CompuStat)
  Thomson ONE Banker is a revolutionary desktop solution that flexibly delivers the critical information and analysis tools investment banking professionals need-via one complete and intuitive interface. Whether you're an information professional or investment banker, Thomson ONE Banker provides access to relevant real-time global market data, news, and authoritative

content from industry-leading sources. Thomson ONE Banker streamlines the investment banking workflow and enables you to make well-informed decisions with confidence.[3]

- Annual reports of companies of which the R&D expenditure can not be found in the aforementioned database(s).[4]

The section about how much companies spend on corporate venture capital will be gathered from:

- www.venturexpert.com (a database part of the Thomson database that specializes in venture capital data)
  VentureXpert is the single source for comprehensive information covering venture, buyouts, private equity funds, firms, executives, portfolio companies and limited partners around the world.

  With VentureXpert, you now have the basis for comprehensive analysis of:
  • fund commitments
  • portfolio company investments
  • round valuations
  • fund performance[5]

After analyzing the data that follows from the data resources mentioned above, companies will be contacted and asked to participate in this research. If the sample indicates there could be a certain relationship between corporate venture capital and R&D expenditures this relationship is investigated further by means of interviewing practitioners.

3.4 Sample

The sample includes various high-tech sectors namely:

- Aircraft and Spacecraft
- Pharmaceuticals
- Office, Accounting and computing machinery,
- Radio, Television and Communication equipment
- Medical, Precision and Optical instruments

These groups have been mentioned as high-tech according to the latest OECD 2005 classification.[6] However, the above mentioned classification has not been followed to the letter. OECD 2005 uses ISIC codes to identify different sectors while Thomson ONE Banker uses SIC codes. Hence, the sectors had to be modified a little resulting in the following sectors based heavily on the OECD 2005 and OECD 1997 classification as mentioned in the paper of Hagedoorn and Cloodt (2003):

- Aerospace and Defense (SIC-codes 372 and 376 as mentioned in OECD 1997, but also SIC-code 3812 since this group concerns itself with for example missile control systems).
- Computer and Office machinery (SIC-code 357 as mentioned in OECD 1997).
- Pharmaceuticals (SIC-code 283 as mentioned in OECD 1997).
- Electronics and Communication (SIC-code 36 as mentioned in OECD 1997).

[3] http://banker.thomsonib.com/ (consulted at December 29, 2008)
[4] For a complete overview of websites used to gather R&D expenditure data see Appendix I
[5] http://vx.thomsonib.com/NASApp/VxComponent/VXMain.jsp (consulted at December 29, 2008)
[6] http://books.google.nl/books?id=JmsjnZASypYC&pg=PA142&lpg=PA142&dq=oecd+2005+classification+high+tech&source=bl&ots=WU6I58jD7x&sig=OJM9FMdMBxep9UIM0J6GyFzcPmA&hl=nl&sa=X&oi=book_result&resnum=5&ct=result (consulted at November 20, 2008)

- Medical, Precision and Optical Instruments (SIC-code 382 and 384, because this sector is mentioned in the OECD 2005 standards which uses ISIC codes, these SIC codes are chosen in a way that reflects this category best from the viewpoint of the author of this paper)

These high-tech sectors are selected because it is known that particularly in these industries R&D expenditures, patents and new products play a role in indicating important aspects of innovative performance (Hagedoorn and Cloodt, 2003). Also as Sahaym et al. (2009) notice, in industries where the technological pace is high, companies might be more inclined to use CVC because they want to avoid the risk of their core technology becoming obsolete. CVC could be an adequate way of scanning the environment for new ideas and knowledge that might affect the future lines of business of a company.

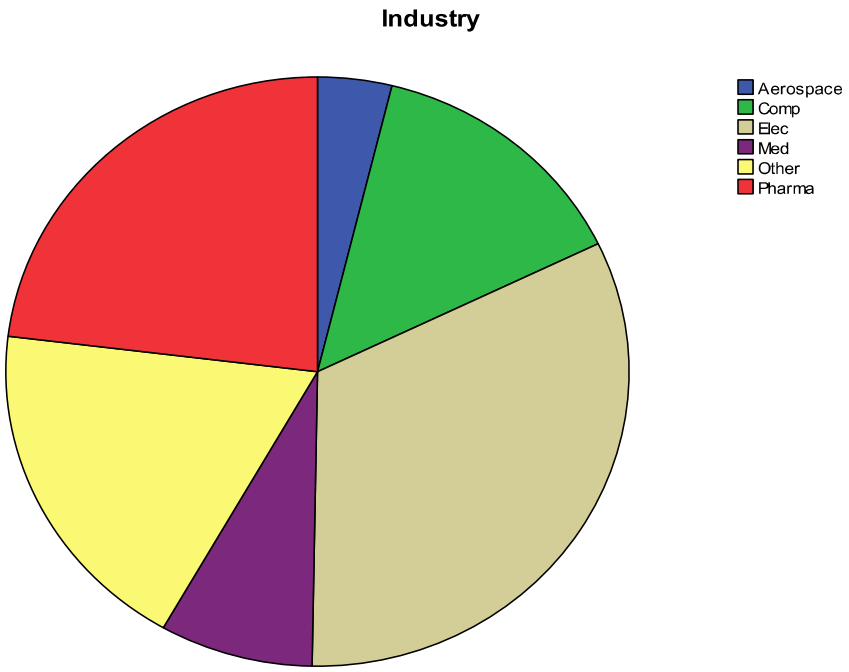
As a starting point for the selection of companies, I used the Forbes Global 2000 which depicts the 2000 largest companies across the world.[7] One can order these companies according to industry to try and select only high-tech companies. Then these high-tech companies present in the Forbes Global 2000 were entered in VentureXpert to see if this database included that particular company and if that company engaged in any venture capital investments from 2003 until 2007. If the company was not found, or the company did not engage in any venture capital activity from 2003 until 2007, the company was excluded from the analyses.

Yahoo has also been used as a way of gathering technology companies.[8] One can select different industries, in our case we choose industries that were thought to resemble high-tech industries. Then one can choose "Leaders & Laggards" followed by choosing the option order by "Market Capitalization". This way one gets a list of the 10 biggest companies in a certain industry. Again, every company was entered in the VentureXpert database to see if this company had engaged in any venture capital investments from year 2003 until 2007. If the company was not found, or the company did not engage in any venture capital activity from 2003 until 2007, the company was excluded from the analyses.

It is acknowledged that this is not a total random sample due to database constraints and perhaps chosen way of gathering companies. Since this is however an exploratory study, this need not to be a problem.

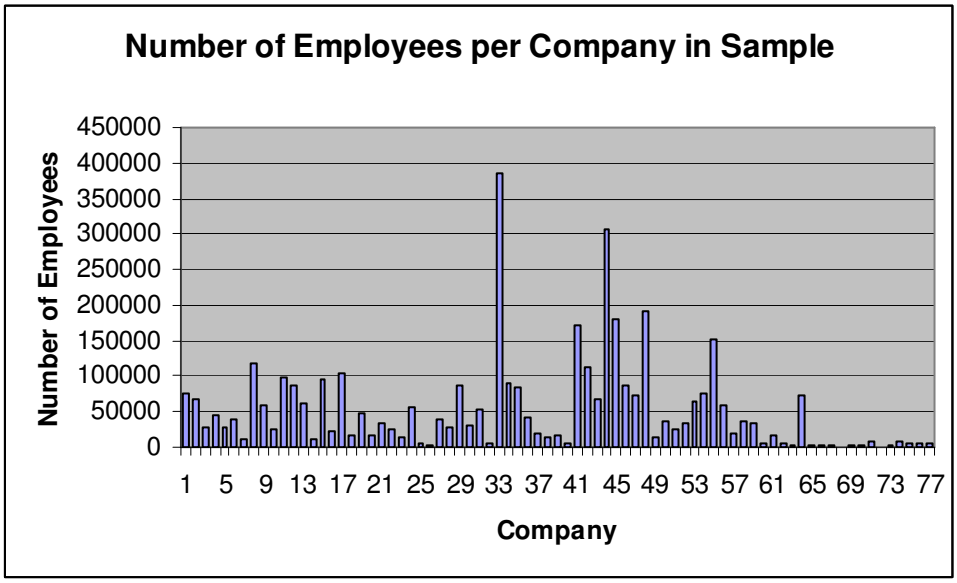
The sample consists of 86 companies of which 9 can not be used due to missing data. These 9 companies have either no R&D at all or R&D and CVC data available but from different years resulting in the fact that the differences have no use since they can not both be used in the multiple regression (e.g. having R&D available for 2003 + 2004 and CVC for 2005 + 2006 makes it impossible to measure the relationship between them).
For some other companies the dataset is also not complete, these companies can however still be used in our analyses. These companies have R&D and CVC data available in the same years (so a relationship can be investigated) but for example not for all years or missing data like stock price.
Figure 3.1 shows the sample ordered according to industry, after 9 companies have been removed because of essential data missing.

[7] http://www.forbes.com/lists/2008/18/biz_2000global08_The-Global-2000_IndName.html (consulted at December 28, 2008)
[8] http://biz.yahoo.com/ic/ind_index.html (consulted at December 28, 2008)



(Figure 3.1: Sample ordered according to industry)

One can see that some sectors are more accounted for than others. This has partly to do with the limitations the use of the database VentureXpert poses. The database has no available records of a lot of companies that were initially selected to be in the sample. Since these data entries are missing, some sectors where VentureXpert did have a lot of data available for represent a large part of the sample. Medical, Precision and Optical Instruments & Aerospace and Defense are the two sectors for which not a lot of data is available and thus represent a small portion of the sample.



(Figure 3.2: Number of employees per company in sample)

As one can see in picture 3.2, the numbers of employees range from 391 (Adaptec) to 386558 (IBM) which can be an indication that there exists large differences in company sizes in the sample. Because this can have an impact on amount of CVC spent, this data is collected and incorporated in the multiple regression analysis later on.

3.5 Scales of measurement

Part one of the research concerns performing a multiple regression analysis. For this analysis several variables will be included and extracted from the databases namely Average Investment per Company, Venture Investment per Year, R&D Investment per year, Stock price per year, country headquarters, type of industry (see paragraph 3.3) and number of employees. Below, these variables will be discussed in more depth.

3.5.1 Dependent variable

For all companies included in the data it was tried to collect the average investment and the number of investments for five consecutive years (2003-2007). Five consecutive years seems a reasonably large enough time frame. The average investment (averaged across all years a company is active in the venture capital market) was then multiplied with the number of investments per year. An example; company A has invested 3 times in the year 2004 (number of investments for year 2004 equals 3) and the company spends on average $200.000 per investment (average investment equals 200.000). The venture investment for year 2004 for company A is then 3 x $200.000= $600.000. This calculation is performed for each of the five years (if 5 years of data are available).
Because the data per company is collected for 5 consecutive years, a time effect occurs. To deal with this, the dependent variable is not venture investment per year but difference in venture investments between 2 years. An example; if company A invested $600.000 in year 2004 and $800.00 in year 2005, the dependent variable (DifferenceVC) will have the value $800.000-$600.000= $200.000. (In the database this would then have a value of “200” since it is measured in 000s Dollars)

3.5.2 Explanatory variable

Difference in R&D expenditure for two consecutive years per company over five years is the explanatory variable in this research since the aim is to investigate the relationship between CVC (dependent variable) and R&D (explanatory variable). R&D expenditure is a value that in most cases can be drawn straight from the Thomson ONE Banker Analytics database but in a few cases however, this data was not available. This data has then been obtained by visiting the internet sites of the companies and find it in their annual reports. If this last option was not possible, the company had to be excluded.
In the analysis the same method of dealing with the time effect was performed on the R&D expenditures as on the CVC investments. Not the R&D expenditure per year is included in the regression analysis, but the difference of R&D expenditures (in regression denoted as DifferenceRandD) for two consecutive years in 000s Dollars.

3.5.3 Control variables

In order to avoid bias from other effects having an influence on CVC investments, several control variables are included in the analyses. The first variable for which it is tried to control is firm size measured by the amount of employees a company has. It is expected that firms with a lot of employees are usually bigger and are more frequent users of CVC investments. Especially since CVC is a way to spur radical innovations for large companies, larger companies (measured in amount of employees) can be expected to be more active in this field than smaller ones. Large firms also often have more financial

means to be active in such a market than smaller firms. Number of employees is given in the Thomson ONE Banker Analytics database.

The second variable that is included as a control variable is the difference in stock prices for two consecutive years. It is expected that companies for which the stock prices climb are more inclined to use CVC. Companies for which stock prices drop are expected to focus more on their core activities and refrain from making CVC investments. Stock price (in US Dollars) is given in the Thomson ONE Banker Analytics database. A difficulty here however is that some stock prices are measured at December 31 while others at July 31 for example. However, it is believed that this does not pose serious problems to our dataset since a) for most companies stock data on December 31 was obtained and b) stock price is just a control variable which needs to reflects how the company was doing in that particular year. In other words, the difference between stock data is what is important (to reflect if the shares are climbing of falling) and these differences are always a year.

The third control variable is industry type. As mentioned before, Hagedoorn and Cloodt (2003) state that in high-tech sectors R&D expenditures, patents and new products play a role in indicating important aspect of innovative performance. Also, since an important goal of CVC is to scan for new technologies outside the own firm boundaries, it can be expected that high-tech sectors differ in regards to their CVC investments compared to non high-tech sectors. Industry data will also be retrieved by using Thomson ONE Banker Analytics database which gives the SIC codes of the available companies. Often a primary SIC is given which is looked at first, however if the primary SIC is none of the high-tech sectors the other SIC codes of the company are looked at. If these too do not fall into our high-tech sectors, the label "Other" is used. I refer to paragraph 3.4 for a summation of the types of high-tech industries incorporated in this research.

The fourth control variable is country headquarters. As explained in section 2.2.1 the venture capital market first emerged in the United States. It can thus be expected, that the location of a company has an influence on the amount of CVC investments. Hence, country headquarters is taken into account differentiating between "Europe", "Asia" and "United States". This variable will also be measured by using the Thomson ONE Banker Analytics database which gives the country of each company available in the database.

3.5.4 Currency

Several data was not presented in US Dollar currency and thus had to be converted using a site[9] which presents historic exchange rates in order to convert some data. Since most stock prices and R&D expenditures are given on December 31 of each year, the exchange rate on this day will be used to convert the different currencies into USD. If there is no exchange rate available for December 31, the nearest date will be used.
The exchange rates used are given in Appendix II.

3.5.5 Qualitative Part

The last part of the master thesis concerns performing interviews with practitioners in the field of corporate venture capital. The input for this questionnaire came from two directions. First, the results of the multiple regression analysis indicate a certain relationship between CVC and R&D which can be subject of qualitative questions for practitioners. Second, two interviews with academics (Prof. Dr. Ard-Pieter de Man and Prof. Dr. Tom Elfring) knowledgeable on the field of corporate venture capital were

[9] http://www.x-rates.com/cgi-bin/hlookup.cgi (consulted on November 25, 2008)

conducted to get some input regarding the already existing questions (they tried to answer and shed their light on questions I already formulated) and to brainstorm over possible additional qualitative questions for practitioners.
The result was a questionnaire (see Appendix V) with six questions that was discussed with COMPANY A and COMPANY B. As one can see, the questionnaire basically consists of closed questions. The use of closed questions is for several reasons beneficiary:[10]

- Closed questions are more easily analyzed than open questions.
- Closed questions can be more specific.
- The response rate of questionnaires using closed questions is higher than those using open questions.

From the above reasons, especially the high response rate and the fact they can be more easily analyzed than open questions were important when choosing the closed questions interview approach.
A disadvantage of using closed questions however is that interviewees might give less information because they feel they are compelled to stick to the prescribed questions. This is however countered by giving the interviewees plenty of time to give background information they deem important and not to force them to stick solely to the six questions. In other words, if participants wanted to give extra information, they were most welcome to.
A last note is that in the final version of this master thesis, the names of the companies and interview respondents have been altered on their request. Any resemblance to any existing company or person is purely coincidental.

3.6 Advantages and disadvantages of chosen data gathering methods

This research will be conducted using basically two kinds of information sources. The first sources are databases and available documents (refers to VentureXpert, Thomson ONE Banker Analytics and annual reports of several companies). The second source is conducting interview(s) with people active in the field of venture capital. In their book, Verschuren and Doorewaard (1995) describe several ways of collecting data and the associated (dis)advantages.

Documents
Advantages of using documents as a source of data are (Verschuren and Doorewaard, 1995):

- Available in large quantities and diversity.
- It is relatively not expensive to acquire this type of data.
- There is no form of provoking a person to perform a certain behavior (give certain answers) that the researcher desires, the data is just there for the use.
- In principle, the researcher can consult documents as often as he wants while for example persons usually have a limited amount of time available.

Disadvantages of using documents as a source of data are (Verschuren and Doorewaard, 1995):

- If the availability of this type of data is really enormous, it could pose difficult selection choices that have to be made. A well designed sample is then necessary.
- The researcher will have to perform a lot of effort in getting the data, since it is often hidden in a lot of documentation. In other words, it can be very time consuming.

Persons
The three largest advantages of using persons as a source of information are the following (Verschuren and Doorewaard, 1995):

- The large diversity of information available.
- The speed with which you can receive this information.

[10] http://writing.colostate.edu/guides/research/survey/com4a2a1.cfm (consulted on April 15, 2008)

- By asking specific questions and being able to adjust your line of questioning during the interview, one can steer the conversation in the desired direction such that his or her questions will be answered to the fullest extent possible.

Nonetheless, there are also some disadvantages by using persons as a source of information namely (Verschuren and Doorewaard, 1995):

- Investigating a subject which some persons will be reluctant to talk about. For instance certain company data/strategy can be very sensitive and thus may cause the informant being unable to answer the question in a desired open way.
- Persons may also answer with subjective information in stead of objective information, hoping to (for example) make themselves look better (They might give strategic answers).
- The informants could be persons that are not totally up to date on the subject matter and therefore can not give valuable information.
- Poor representativeness to persons/companies outside the persons interviewed (Graziano and Raulin, 1997).
- Poor Replicability (Graziano and Raulin, 1997).

To cope with the disadvantages of using documents a specific sample (high-tech industry) is chosen and only two databases will have to be consulted namely VentureXpert and Thomson ONE Banker Analytics reducing the effort needed to acquire the data.
The disadvantages of using persons as a data source are somewhat harder to cope with. It is acknowledged that persons might give subjective data and that some topics are considered sensitive information and thus might alter the responses. The third disadvantage will be countered by really selecting persons that are active in the field of corporate venture capital. By thoroughly selecting interview participants, the third point will not be that much of an issue. Also the fourth point, poor representativeness to persons/companies outside the persons interviewed, is acknowledged and countered by changing the goal of the interview. The goal of the interview is not generalizing the results to other settings, but to focus on one particular setting to get some more information about the relationship between CVC and R&D, although only in that particular company. Point five, poor replicability, is a given and will be tackled by documenting the questions and answers as good as possible.

3.7 Quality of the research design

In the book of Yin (1989) four tests to determine the quality of a research design are stated. Table 3.1 shows these tests but first the meanings of these tests are explained.

"Construct validity: establishing correct operational measures for the concepts being studied;

Internal validity: (for explanatory or causal studies only, and not for descriptive or exploratory): establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships;

External validity: establishing the domain to which a study's findings can be generalized; and

Reliability: demonstrating that the operations of a study – such as the data collection procedure – can be repeated, with the same results." (Yin, 1989, page 40 and 41)

Test	**Case-study Tactic**
Construct validity	*Use multiple sources of evidence

	*Establish chain of evidence *Have key informants review draft case study report
Internal validity	*Do pattern matching *Do explanation-building *Do time-series analysis
External validity	*Use replication logic in multiple-case studies *Use random selection of subjects from a population. (Graziano and Raulin, 1997)
Reliability	*use case study protocol *develop case study database

(Table 3.1, Different tests to uphold the research quality, Yin (1989))

Yin (1989) proposes four tests to uphold the research quality and states these tests are suited for all research methods. Therefore, they are applied to the first part of the research, the desk-research.

Construct validity: This mainly is a problem in case study research where researchers use subjective judgments to come to a conclusion. Since we are specifically measuring the relationship between R&D and CVC, collecting these data from mostly the same source should be highly objective and should represent what we want to measure.

Internal validity: As Yin (1989) describes; internal validity is not an issue in an exploratory study. However, in the first part of the research it is tried to find some relationship between variable x and y, but more as an indication than a strict causal relationship. By relying on literature on corporate venture capital it is tried to keep the internal validity in check (literature can guide what variables could be of importance and hence, you should include in your design), though it has to be acknowledged that not a lot of literature exists focusing on the relationship between R&D and CVC.

External validity: the companies will mostly be top technology companies over the world and the sample size will be as large as possible. This would indicate that making predictions about another large technology company not in the sample would be possible to some extent. Making predictions about companies outside the technology sector would also be possible, but should be made with much more caution and should be seen more as an indication then a certain prediction since other variables could come into play there.

Reliability: since the data on which the desk-research is based is readily available for all, this should be not an issue.

Above the four tests have been discussed in regard to the first part of the master thesis project. Yin (1989) however also discusses some actions to uphold the case study quality per test as can be seen in Table 3.1.

In Table 3.2 these four tests are applied to the case study part of my research.

Test	**Actions to uphold quality in master thesis**
Construct validity	*As recommended in the book of Yin (1989), in my master thesis I will allow an external observer. In the master thesis this will be done by two supervisors. * It will be tried to perform multiple case studies to improve the construct validity.
Internal validity	According to Yin (1989) internal validity is not

	an issue in exploratory research.
External validity	*Each case must be carefully selected so that it either a) predicts similar results or b) produces contrary results but for predictable reasons.* (Yin, 1989, page 53). However, in my research the last part of the master thesis serves the goal of identifying why in some companies a certain relationship between corporate venture capital and R&D expenditure exists. The goal of the last part is not to produce a generalized theory, but more to get an insight why a certain relationship exists in a certain company. Also, it is nearly impossible on beforehand to predict why in company A the relationship between CVC and R&D expenditure is positive while in company B negative, since there can be too many variables not accounted for. Therefore, it is acknowledged that the results from the case study (second part of the research) can not be generalized to all companies, but should be viewed more as an indication of reasons why a relationship can be as it is.
Reliability	It is tried to document all steps in the master thesis as clearly as possible making it very likely that another researcher would produce similar results if he/she would follow all steps. Also, I have regular meetings with one or two supervisors to discuss every step I have made so far, safe guarding the reliability of the research.

(Table 3.2: Dealing with the quality of the research design in the master thesis concerning case studies)

3.8 Analyses

To analyze the relationship between the R&D expenditure and the amount of corporate venture capital the following techniques will be used:

- *Regression analyses,* this method can account for other variables by including them as independent variables. Also figure 4 in appendix III show that the dependent variable is close to being normally distributed. Because we can control for other variables and because the dependent variable is close to being normally distributed using multiple regression seems logical.
  Hair et al. (2006) state that multiple regression analysis is a technique that one can use to analyze the relationship between a dependent variable and several independent variables. The independent variables are weighted to try and ensure maximal prediction of the dependent variable by the independent variables. These weights are important because, according to Hair et al. (2006), they facilitate interpretation as to the influence of each variable in the prediction of the dependent variable. Hair et al. (2006) note however, that correlation between the independent variables complicates the process.

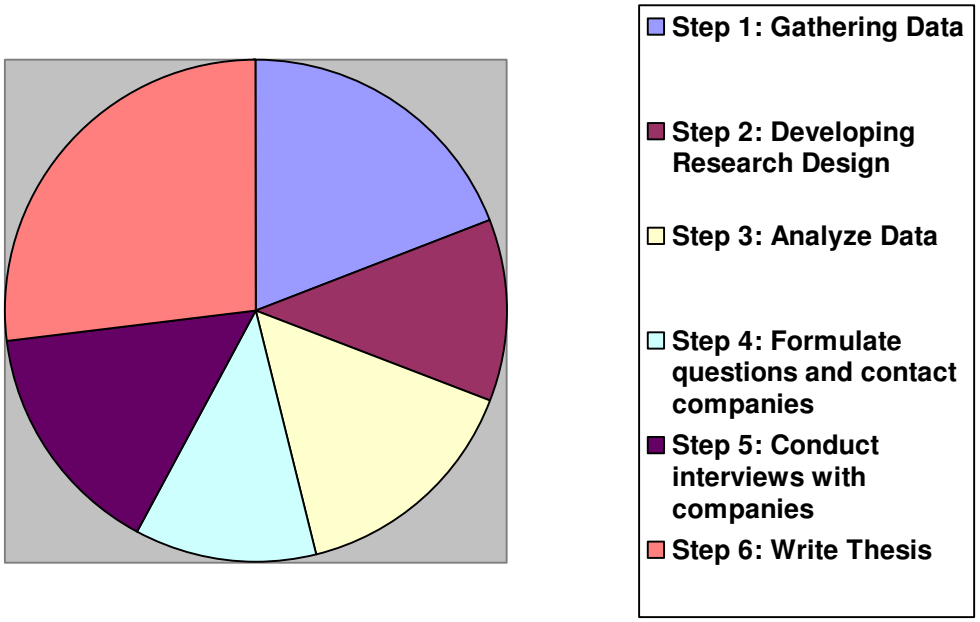
Also, several assumptions will have to be checked when using multiple regression analysis namely (These are checked and discussed in Appendix III):

a) Linearity of the phenomenon measured.
b) Constant variance of the error terms.
c) Independence of the error terms.
d) Normality of the error term distribution. (Hair et al, 2006, page 176)

- The case studies will be analyzed by firstly writing down the responses given by the person being interviewed. After the interview, several parts of the interview which were interesting will be highlighted and will be elaborated on further.

3.9 Approach and timetable

Besides some preparations (for example, the literature study), the master thesis project is spread across six months. During these six months, the planning (timetable) will be as shown in figure 3.3.



	Gathering Data	Developing Research Design	Analyze Data	Formulate questions and contact companies	Conduct interviews with companies	Write Thesis
# weeks	5	3	4	3	4	7

(Figure 3.3: Timetable)

From figure 3.3 the following approach can be derived:
November 11, 2008 – December 16, 2008 → Gathering Data
December 16, 2008 – January 6, 2009 → Developing Research Design
January 6, 2009 – February 3, 2009 → Analyze Data
February 3, 2009 – February 24, 2009 → Formulate questions and contact companies
February 24, 2009 – March 24, 2009 → Conduct interviews with companies
March 24, 2009 – May 12, 2009 → Write Thesis

4. Results Regression

To analyze the gathered data multiple regression was used. Table 4.1 shows some descriptive information about the variables in the regression. For a correlation table I refer to Appendix III figure 15.

	Minimum	**Maximum**	**Mean**	**Standard Deviation**
Difference Venture Capital Investments (in 000s Dollars)	-47970	100737	2619,33	15259,337
Difference in Research and Development Expenses (in 000s Dollar)	-3951000	4507000	148654,151	6,8*10^5
Number of Employees	391	386558	49493,99	59705,487
Medical Dummy	0	1	0,08	0,271
Pharmaceutical Dummy	0	1	0,23	0,422
Electrical Dummy	0	1	0,32	0,469
Aerospace Dummy	0	1	0,04	0,193
Computer Dummy	0	1	0,14	0,348
Other Dummy	0	1	0,19	0,390
Europe Dummy	0	1	0,18	0,381
Asia Dummy	0	1	0,11	0,317
USA Dummy	0	1	0,71	0,454
Difference in Stock Price (in Dollar)	-22,80	59,16	1,9591	9,383

(Table 4.1, descriptive table regression analysis)

As explained, the dependent variable in the regression is the difference of venture capital investments in consecutive years. The explanatory variable is the difference in research and development expenses in consecutive years. The rest of the variables in table 4.1 are control variables.
I will begin with explaining some preliminary steps before performing multiple regression analysis and then show the results.

4.1 Preliminary Steps

The first step that has to be performed when conducting a multiple regression analysis is checking for outliers. According to Hair et al. (2006) the Mahalanobis D^2 measure measures each observation in relation to the average mean of all observations in multidimensional space. Higher Mahalanobis

D^2 values represent observations that are farther removed from the general mean of all observations, indicating an outlier.

When executing the initial regression model, several observations (companies) score high on the Mahalanobis D^2 measure. The values with the highest Mahalanobis D^2 values will be investigated to see what the causes are of these deviant values.
The first company that is highlighted with the use of the Mahalanobis D^2 measure is "Panasonic" which has a Mahalanobis D^2 value of nearly 200. The problem here lies in the R&D expenditure which equals per year approximately hundred times the R&D expenditure of Intel. Since it is very unlikely that these values are correct, the company "Panasonic" will be removed, and the regression will be run again to check the Mahalanobis D^2 values once more.

Again the Mahalanobis D^2 values are checked and this time the company "Dassault" jumps out with having a value of more than 80. When investigating the data for the company it seems that the problem is the stock price which is indicated to be around 900 dollars. Since most other companies have stock prices around 50 dollars, these observations for "Dassault" are probably incorrect. However, since there is nothing wrong with "Dassault" concerning the data for R&D expenditures and VC investments, only the stock prices of this company will be removed. Since the regression is performed pairwise, this company can still be included in the regression though without values for stock prices. Another regression is run after deleting stock prices for "Dassault".

The last company that really jumps out is "GlaxoSmithKline" with stock prices around 2500 dollar. Like before, these values seem too high and thus the stock prices for "GlaxoSmithKline" will be removed and another regression is run.

The last regression still shows companies with rather high Mahalanobis D^2 measures. These values are however not as high as for the three companies above and they do not represent false data. The high Mahalanobis D^2 values represent correct, though deviant from the mean, data which will be incorporated in the regression.

4.2 Regression Results

A regression is run with the dependent variable being the difference in venture capital investments in two consecutive years, the explanatory variable being difference in research and development expenses in two consecutive years and the control variables industry (electrical, medical, aerospace, computer, pharmaceutical), country headquarters (Europe, Asia), number of employees and the difference in the stock prices for two consecutive years. Note that in the regression the dummy variables representing the country USA and the industry Other are excluded because else problems with the degrees of freedom will arise.

The results of the multiple regression analysis as described above are depicted in Table 4.2 below.

R	R Square	Adjusted R Square	Durbin-Watson	Significance Model
0,233	0,054	0,016	2,226	0,169

(Table 4.2, Regression Results)

According to Hair et al. (2006) the R Square measure represents how much variance in the dependent variable is explained by the independent variables. However, even as we add non-significant independent variables, the R Square measure will always increase. Therefore it is best to look at a measure that accounts for this problem namely the adjusted R Square measure. The adjusted R Square as shown in table 4.2 is relatively low indicating that the variables entered in the equation only account for a small percentage (1,6%) of the variance of the dependent variable. Table 4.2 also shows that the significance of the model is 0,169 which indicates that this model is not significant (p>0,01). According to Hair et al. (2006) this means that the amount of variation explained by the regression model is not more than the baseline prediction. Choosing that p<0,01 for the model to be significant provides a smaller chance of being wrong when stating the model is not significant than for example when using p<0,1.
The goal of the regression is however to get an idea of the relationship between corporate venture capital expenses and research & development expenditures. Therefore, table 4.3 as shown below will depict the significance of the independent variable and the control variables and the Standardized Beta Coefficients. Standardized Beta Coefficients with values above zero mean that the relationship between the independent and dependent variable accounting for the other independent variables is positive. Standardized Beta Coefficients under zero indicate a negative relationship.

Variable	**Standardized Beta Coefficients**	**Significance**
(Constant)		0,912
Difference research and development expenses	0,174	0,006
Medical Dummy	-0,09	0,898
Pharmaceutical Dummy	0,045	0,592
Electrical Dummy	0,094	0,283
Aerospace Dummy	-0,017	0,807
Computer Dummy	0,002	0,976
Europe Dummy	0,023	0,745
Asia Dummy	-0,094	0,169
Number of Employees	0,075	0,255
Difference stock prices	-0,032	0,610

(Table 4.3, Beta Coefficients and Significance of explanatory variable and control variables)

The relationship of interest is the relation between the difference in research and development expenses for consecutive years and the difference in venture capital investments for consecutive years. Table 4.3 shows that this relationship is positive (Standardized Beta Coefficient = 0,174) and significant (p<0,01). This means that in regard to our first research question posed in chapter 3, it can be concluded that research and development expenses and corporate venture capital investments are complements of each other.
The control variables (industry, country, difference in stock prices, and number of employees) are all not significant. For country and industry this means that Asia and Europe do not significantly differ from USA and that the high-tech sectors (Electrical, Pharmaceutical etc.) do not significantly differ from the non high-tech sector (labeled as “Other”).

5. Interviews

As described in paragraph 3.2, the second part of this master thesis will focus on the use of case studies to examine the (possible) relationship between corporate venture capital investments and research and development expenses. Two companies were selected and participated in this research. The two companies that were selected are two of the main Dutch company's active in the corporate venture capital market. Below, some more background information on these companies will be given after which the interview results will be discussed.

5.1 Background COMPANY A

COMPANY A provides materials that are being used in a variety of applications and markets. Examples of markets in which the products of COMPANY A are being used are the pharmaceutical industry, cars, coatings, paint etc. The turnover of COMPANY A equals EUR 9.3 billion and the company employs approximately 23.500 people.[11] The activities of COMPANY A are organized in five strategic clusters namely Nutrition, Pharma, Performance Materials, Polymer Intermediates and Base Chemicals & Materials.[12] COMPANY A has got a decentralized organization in which each business group is responsible for its own performance. On corporate level, each business group and the board of directors are being supported by a number of staff departments.[13]

COMPANY A Innovation Center supports all business lines and they report directly to the board of directors. Both R&D and the venturing department are situated under the COMPANY A Innovation Center. Although they are both part of the group COMPANY A Innovation Center, they do reside in geographically different locations.

According to Rijnders and Elfring (2001) COMPANY A invests in young start-ups since 1993 through a number of Speciality Venture Capital funds. The CVC activities are focused on both internal and external venturing, with an internal/external ratio of approximately 80/20. COMPANY A generally invests, according to Rijnders and Elfring (2001), in Fine Chemicals, Performance Material and Life Science products. According to their website[14] their main investment fields are Life Sciences and Material Sciences and more specifically Nutrition, Pharma and Performance Materials. For a detailed summary of the focus areas within each field mentioned above, I refer to Appendix IV.

The investment process for venturing activities, according to Kirschbaum (2005), starts with the "First Gate Deliverables". The process resembles figure 2.2 in which after each faze, a GO/NO GO decision is made after which (in the case of GO) the project continues to the next faze. The "First Gate Deliverables" means that a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis and a "5C" analysis are carried out. A "5C" analysis encompasses the following areas of attention within COMPANY A according to Kirschbaum (2005):

- Context: value chain, markets, drivers, dynamics, attractiveness and value added.
- Customers: key customers, screenings of segments, needs and values of customers.
- Competitors: competitive position is being assessed.

[11] http://www.COMPANY A.com/nl_NL/html/about/COMPANY A_company_profile.htm (consulted on April 28, 2009)
[12] http://www.COMPANY A.com/nl_NL/html/about/activities.htm (consulted on April 28, 2009)
[13] http://www.COMPANY A.com/nl_NL/html/about/organigram_2006.htm (consulted on April 28, 2009)
[14] http://www.COMPANY A.com/en_US/html/venturing/investment_fields.htm (consulted on April 6, 2009)

- Company: determination key success factors, competences and strategy, evaluation of technologies, synergy between markets.
- Costs: project financial performance, cost structure.

When the outcomes of the "First Gate Deliverables" are positive, the company can proceed to the "Second Gate". The first thing that has to be done here is that a realistic business plan has to be drawn up. This means that COMPANY A looks critically at the assumptions underlying the statements in the business plan. Before the company can start producing products however, Kirschbaum (2005) states that the company first has to deal with safety, health and patent issues. The production process has to be designed and also a marketing plan based on the 5 P's (product, promotion, personal selling, price, place) has to be implemented.
According to Vanhaverbeke and Peeters (2005), approximately 10% of the total company's R&D budget is allocated to Corporate R&D for exploration of novel technologies that do not fit the current lines of business. The remaining 90% is allocated to individual business groups R&D that use these funds mainly for incremental innovations (Vanhaverbeke and Peeters, 2005). Therefore, R&D is both organized on the corporate level and on the business group level. Vanhaverbeke and Peeters (2005) also discuss this stage-gate system, previously discussed using the article of Kirschbaum (2005), by which COMPANY A evaluates new business opportunities. They state that ideas (both internal and external) are being evaluated by a Research Council in which corporate R&D works together with the R&D directors per cluster. When the idea looks promising enough a project proposal is formulated which is past on to the Corporate Research Board. It is this board that decides over the GO/NO GO decision in light of the corporate strategy of COMPANY A. According to Rijnders and Elfring (2001) the ratio internal/external venturing within COMPANY A is approximately 80/20. Kirschbaum (2005) also highlights this focus on internal new ventures by discussing the transition from scientists to intrapreneurs. According to Kirschbaum (2005) scientists are very good in creating ideas, but turning these ideas into valuable projects requires the mindset of an intrapreneur. The main difference between an intrapreneur and a scientist is that a scientist believes that technology is everything while an intrapreneur realizes a good technology is only the starting point.

The above shows that within COMPANY A venturing there is a focus on both screening internal and external ideas. COMPANY A venturing has clearly set focus areas in which to search for new technologies and there is an almost standardized screening process. Along with screening for new promising external ventures, COMPANY A recognizes that developing an intrapreneurial mindset in the minds of the scientists can provide valuable projects in the long run. The activities of COMPANY A venturing are also in line with the corporate strategy, but at the same time also influence the corporate strategy (Vanhaverbeke and Peeters, 2005). In other words, in the light of the present strategy new technological opportunities are being evaluated. Promising ideas (internal and external) however also influence the strategy.

5.2 Background COMPANY B

COMPANY B is a company that mainly focuses on the areas healthcare and wellness aiming for improved quality of life and providing useful innovations. COMPANY B employs approximately 128.000 people divided over more than sixty countries. In the year 2007, COMPANY B realized a turnover of EUR 27 billion. The company has organized its activities around three main divisions namely COMPANY B Healthcare, COMPANY B Lightning and COMPANY B Consumer Lifestyle. The company is market leader on several areas like healthcare around the house, lightening, electrical shaving, flat TV's etc. COMPANY B employs an open innovation principle in which it works together with other companies in search for more and better innovations.[15]

[15] http://www.COMPANY B.nl/about/company/companyprofile.page (consulted on April 28, 2009)

The search for innovations at COMPANY B is centered at the business unit Corporate Technologies. The business unit works together with research institutes and other companies in search for more and better innovations with the goal of increasing the overall innovative performance of COMPANY B. Under the business unit Corporate Technologies the functions Corporate Research, COMPANY B Incubators, Intellectual Property & Standards and Applied Technologies are brought together. The function COMPANY B Incubator is the group that mainly focuses on recognizing and exploiting (mainly internal) technological ideas. Their goal is mainly to recognize new internal possibilities and develop them. [16] The result can be an addition to the COMPANY B activities but also a spin-out or technology licensing. All groups under Corporate Technologies are located in the same building giving them therefore easy access to one another which facilitates information exchange.

Before 1998, COMPANY B corporate venture activities were mainly on an ad-hoc basis. Different divisions within COMPANY B invested in promising young start-ups that they thought would contribute strategically and financially to COMPANY B. In 1998 these activities were bundled in a corporate venturing unit who started to coordinate the total venturing activity of COMPANY B.
Just like COMPANY A, COMPANY B has a clear set of areas in which it chooses to invest. These areas, according to Rijnders and Elfring (2001), are:

- Home networking
- Displays
- Storage
- Personal TV
- Audio & Wireless

It has to be noted though, that these five are based on an article from 2001. Because of the fast development in the high-tech industry it is likely that these areas have shifted. The main point however is, that COMPANY B has a clear set of areas in which it chooses to invest.
COMPANY B highlights the strategic importance of investing in new ventures, but also sets financial goals (IRR: Internal Rate of Return) that the new ventures have to meet. The logic behind this is that COMPANY B recognizes that CVC investments are mainly done for strategic reasons. However, for a start-up to meet the expectations concerning the strategic contribution to COMPANY B it has to be financially healthy and stable. Another condition in order for COMPANY B to invest, according to Rijnders and Elfring (2001), is that one of the divisions has to form a commercial relationship with the new start-up. An advantage of this is that the occurrence of the Not Invented Here Syndrome decreases if at a later stage COMPANY B chooses to integrate the company.
To chart the course and evaluate the progress of early stage ventures, COMPANY B uses the Bell-Mason framework as presented in the book of Mason and Rohner (2002).[17] The underlying assumption of the framework is that it is not necessary to understand the underlying technology to ask the right questions (Mason and Rohner, 2002). This approach is not specifically designed for COMPANY B and can be used in a variety of companies for a wide spectrum of technologies.
The approach consists of four parts:

[16] http://www.COMPANYB.com/shared/assets/Downloadablefile/Investor/COMPANYB2008_AnnualReport.pdf (consulted on April 28, 2009)
[17] http://www.bellmasongroup.com/framework/ (consulted on April 28, 2009)

- *Twelve dimensions* that each need to be analyzed during the development of the venture.

(Figure 5.2, 12 dimensions Bell-Mason model, Mason and Rohner (2002))

Each of the dimensions in figure 5.2 should be analyzed before and during the progress of development of the venture. All these dimensions relate to each other but they should be analyzed and steered independently (Mason and Rohner, 2002).

- *Four well-defined stages of development* being Venture Vision, Alpha Offering, Beta Offering and Market Calibration & Expansion (Mason and Rohner, 2002). At the end of every stage, certain milestones have to be met in order to continue to the next stage. The activities that have to be performed differentiate according to which stage the venture is in.
- *Quantification of a venture's progress* in each stage according to certain performance indicators. The Bell-Mason model provides an extensive checklist with over 1600 best practices in total ordered according to the different stages of a venture (Mason and Rohner, 2002). The model also offers a benchmark with which a venture's progress can be compared to an ideal state. This should help in determining which areas need further attention and which areas are developed satisfactory.
- *Spider graphs* which is a graphical representation of the above. It depicts the ideal situation and indicates what steps need to be taken to continue to the next stage. The areas on which the venture is compared to the ideal state are derived from the 1600 best practices mentioned earlier.

(Figure 5.3, Ideal states Bell-Mason model for each stage, Mason and Rohner (2002))

Figure 5.3 shows the spider graph of the ideal development of a venture. One can for example see that in stage 1 especially the financing, cash, CEO, business plan and platform are important attention points.

One big difference with COMPANY A (see paragraph 5.1) is that in COMPANY B, each investment has to be approved by a member of the board of directors. In COMPANY A, the venture unit can take an investment decision alone and does not need approval of a member of the board of directors. This means that the degree of autonomy for the venturing unit is much higher at COMPANY A than at COMPANY B (Rijnders and Elfring, 2001).

5.3 Results Interviews

Two interviews were held with academics knowledgeable in the field of corporate venture capital and two interviews were held with practitioners of COMPANY A and COMPANY B. Appendix V shows the final questionnaire that was used to interview the companies.
A short description of each interview participant follows:

- Prof. Dr. Ard-Pieter de Man is a professor at the University of Amsterdam and also a consultant for Atos Origin. His main interests are networks of knowledge, innovation, alliances and joint ventures.[18] For the interview, I had made an initial questionnaire consisting of four questions. Question 1, 3, 4 and 5 of Appendix were discussed with Prof. Dr. Ard-Pieter de Man.
- Prof. Dr. Tom Elfring is a professor of strategic management at the University of Amsterdam.[19] He was previously affiliated with the Wageningen University where he focused on Innovative Entrepreneurship. His main research interests are corporate entrepreneurship and venturing, networking and strategic entrepreneurship.

[18] http://www.lac2008.nl/cv-s/ard-pieter-de-man.1133.lynkx (consulted on April 16, 2009)
[19] http://www.hha.dk/man/cmsdocs/core/staff/tom_elfring.pdf (consulted on April 16, 2009)

Because of the input of Prof. Dr. Ard-Pieter de Man I asked Prof. Dr. Tom Elfring six questions namely the ones in Appendix V.

- The interviewee from COMPANY A was Mrs. PERSON A who is a senior investment manager at COMPANY A Venturing.[20] Her reply is shown in Appendix VI.
- The interview at COMPANY B was conducted with Mr. PERSON B who is a senior business development manager at COMPANY B.[21] The results of this interview should be interpreted with care, since according to Mr. PERSON B, COMPANY B is (almost) not active in the CVC market as defined in this research. According to Mr. PERSON B, COMPANY B uses internal knowledge spillovers and develops them as independent ventures possibly resulting in a spin-off or addition to COMPANY B. The department of which the interviewee at COMPANY A was part, mainly focused on external ventures.

To show the results of the four interviews, the responses are ordered according to different topics.

5.3.1 Open Innovation and innovation strategy

According to Ard-Pieter de Man, firms can not retain their internal focus when looking for innovations. The reason for this is that the technological development outside the firm boundaries simply goes too fast for internal R&D to keep up. All other participants acknowledge the reasoning of Ard-Pieter de Man and add that the world is just too big to focus solely on internal R&D. According to Tom Elfring, a way to cope with the fast technological development and the many ideas in the external world is adopting corporate venture capital. Corporate venture capital can however not be used in each stage of the venture development. Ard-Pieter de Man states that CVC is only a good way of pursuing innovations when aimed at early start-up phases. At later phases, other methods like mergers & acquisitions are available.
There are several methods available when companies are interested in actively pursuing innovations. Two of these methods are corporate venture capital and R&D. The question that rises when acknowledging that there are several methods of pursuing innovation available is whether or not companies should adopt one overall strategy or that each particular mode should work independently of one another. All participants acknowledge the value of having one overall innovation strategy because this is thought to be better and more efficient for the overall innovation performance of the company. Tom Elfring immediately added to this that although having one overall innovation strategy is preferred, this is certainly not implemented yet in a lot of companies. COMPANY A will probably be an exception to this since they really do have an overall innovation strategy. At the highest level in COMPANY A, funds are made available for several groups including Innovation. Innovation encompasses R&D budgets, CVC budgets, Corporate Licensing budgets, Internal Incubator budgets, IP budgets etc. According to PERSON A, each activity is judged on its own performance and there is no general rule of any kind that if one goes up, the other goes down. At COMPANY A, they have multiple objectives and for each objective a certain "tool" is available (R&D, CVC, licensing etc.). This means that COMPANY A looks at the overall strategy of the company, and decides which mode of pursuing innovation fits best with each particular strategic goal. Imagine for example that a strategic goal of COMPANY A is to satisfy existing customers more. Probably the best way to achieve this is to invest in R&D as opposed to CVC. Reason for this is that Yin and Zuscovitch (1998) state that R&D is better suited to serve the current product-market mix. The above would be a clear example of COMPANY A translating corporate strategy into deciding which mode of pursuing innovation to adopt. Ard-Pieter de Man supports an approach like used in COMPANY A. He states that for each strategic goal, a company needs to look at what type of pursuing innovation fits the goal best. When the goal is to get market knowledge in an area relatively unfamiliar to the company, CVC could be an excellent method. PERSON A however states that when the goal is changed into

[20] http://www.COMPANY A.com/en_US/html/venturing/contactus.htm (consulted on April 16, 2009)
[21] http://www.openinnovation.eu/download/BrochureSummerSchoolEindhovenSept2006.pdf (consulted on April 16, 2009)

coming into contact with universities, CVC will not work and another mode of pursuing innovations has to be adopted. COMPANY B uses some other methods to get external knowledge:

- Scientists can work in a certain laboratory for a maximum of seven years after which new external employees replace them to ensure a constant flow of new knowledge.
- People within COMPANY B are free and are encouraged to attend scientific conferences.
- All internal knowledge is available for COMPANY B employees and stored for future employees.

5.3.2 Relationship R&D and CVC

According to Ard-Pieter de Man, PERSON A and PERSON B the relationship between CVC and R&D is generally positive which indicates that they are complements of each other. At the highest level, COMPANY A decides each year how much to spend on each activity. However, CVC and R&D do support each other a lot and PERSON A notes that these two modes of pursuing innovation are certainly complementary to each other. In COMPANY A, CVC needs the R&D department for mainly four reasons:

- Scouting for start-ups.
- Screening of new start-ups.
- Assessing the technical/scientific/IP position of the start-up.
- Absorbing and using the relevant information from start-ups.

COMPANY A venturing helps the R&D department in turn by alerting them to new innovations that might be of use to them. This reasoning indeed implies a complementary relationship between R&D and CVC. Because of the reasons mentioned above, the more active the CVC department gets, the more is needed from the R&D department to assist the CVC department in making the decisions. If the number of start-ups that are being screened increases, the R&D department will have to allocate more resources to support this screening process because their knowledge is necessary for a thorough evaluation of the external technology. Also, when the CVC department invests in more start-ups the R&D department needs to allocate more resources to absorb and use the information. In short, the relationship between R&D and CVC is positive in COMPANY A because the R&D department needs the CVC department and vice versa.

Tom Elfring follows a reasoning however, that might indirectly advocate a substitution effect. He states that the relationship between CVC and R&D is dependent on the product. If a company needs the product developed fast, CVC would be the preferred way. If the company is in no hurry, R&D would be the best way. This could imply a substitution effect in the sense that one can use R&D for slow development at one end and use CVC at the other end for fast development. This reasoning is quite similar to the lines of reasoning in paragraph 2.4 where the familiarity of the desired technology influences which mode of pursuing innovation is chosen.

5.3.3 Factors influencing the relationship between R&D and CVC

Both Ard-Pieter de Man and PERSON B indicate that there is no causal relationship between R&D and CVC. Ard-Pieter de Man indicates that company strategy influences this relationship and PERSON B indicates that company age influences the relationship. The reasoning from Ard-Pieter de Man is underlined by Tom Elfring who states that the relationship between R&D and CVC is really influenced by how management allocates its resources to innovation activities. If a company is active in CVC and allocates funds to CVC by taking them away from the R&D department, there is a substitution effect. In the case of COMPANY A however, the management decides each year how much to invest for the total innovation activity. Then in line with the strategic goals each innovation mode gets a particular budget resulting in the fact that the relationships between the different modes are generally positive since they

need each other. In other words, the way top management looks at innovation and allocates resources to the innovation activity influences the relationship between CVC and R&D.
As indicated earlier, PERSON B states that company age influences the relationship between corporate venture capital and R&D. A reason for this might be found in the article of Nooteboom et al. (2007) who use company age as a control variable in their research. They state that as companies mature, they become increasingly capable of producing innovations. However, the novelty of these innovations decline. In other words, more mature companies patent more but focus more on older technology than younger companies. In line with Yin and Zuscovitch (1998) this could indicate that older companies are a lot more active in R&D then CVC since R&D is targeted at satisfying the existing customers. For older companies to counter only satisfying existing customers they might be more inclined to start using CVC as a way of preventing only focusing on incremental innovations. Furthermore, older companies might have more funds available to adopt CVC and invest in young start-ups.
According to PERSON A, the total spending on innovation activities is influenced by the economic situation. This does however not need to influence the relationship between corporate venture capital and R&D expenses.

5.3.4 Setting goals for external innovations

In the questionnaire a case was presented where a clear target was set that 50% of all innovations should come from outside the firm boundaries. According to Ard-Pieter de Man and PERSON A such goal should mainly be seen as a management technique when concepts like open innovation are first introduced. Setting such a goal might then highlight to employees the importance of the new direction and result in employees taking the new approach seriously. Tom Elfring states that setting such a goal might be possible, but that it should be questioned if this is desirable. As said earlier, PERSON A sees setting a goal that 50% of all innovations should come from external parties as mainly a management technique that can work in the beginning. In the long run however, such a goal could be detrimental to the innovative performance of the firm. The reason for this is that it runs the risk of making suboptimal decisions in the sense that external innovations are adopted just to reach the 50% target and not because they add something meaningful to the company. Also in COMPANY B, no such goals of any kind are present.

5.3.5 Assessing contribution CVC

According to Ard-Pieter de Man the value of having a CVC department can not be independently judged. Because they interact with a lot of other departments within a company the value should be determined by looking at the complete innovation portfolio and evaluating what CVC adds to this. It is however important to not judge the CVC department solely on financial objectives. Ard-Pieter de Man states that companies should incorporate Strategic Return on Investment when judging their CVC activities. This means that the company should look if the CVC department has increased the market position of the company by making good investments, what knowledge the investments produced, if certain risks have been minimized etc. PERSON A states that it is very hard to assess the contribution of CVC. Before venturing activities contribute to the COMPANY A's top and bottom line 5-7 years have easily passed. If you want to compare a situation where the company has not yet employed CVC with a situation a few years later where they have, it can almost not be compared since the time zones are totally different.
Like Ard-Pieter de Man states, companies should look at their total innovation portfolio. When using such a way to determine the contribution of CVC a company can calculate the percentage of turnover from products not available 3 years ago as a measure of innovative performance according to Tom Elfring and PERSON B.
Still, measuring the innovative performance of the venturing department is extremely difficult. Last year, COMPANY A venturing screened more than 600 companies and only invested in some of them. Some

ventures however that were not invested in formed joined development project with COMPANY A. Tom Elfring also follows a similar reasoning by stating that because the venturing department constantly scans markets for new opportunities they get a lot of specific market knowledge. By doing a bad financial investment in a certain company, they might therefore realize that the market is saturated or non-profitable. That would mean that purely financial, it would be a bad investment, but for the COMPANY A company in total it would be a good strategic investment.

5.3.6 Other

Some other interesting findings came forward from the interviews which will be discussed below. The first interesting result is that Ard-Pieter de Man states that large percentages of failure are imminent when using CVC investments because the amount of information when investing is low. In other words, the start-up venture is very young and several aspects are uncertain which produces a lot of risks. However, as companies get more experienced in venturing, the amount of failures will diminish although the percentage will always remain somewhat high compared to for example R&D. Tom Elfring comments on that by stating that a company should turn bad CVC investments into good learning opportunities. Companies need to reflect on the CVC investment and extract lessons for the future.

PERSON A states that it is very important for the success of the venturing department that it collaborates with several other departments in COMPANY A. COMPANY A venturing is a substantial part of the overall business innovation where it collaborates with other innovation departments. The nature of these collaborations is complementary and supporting instead of competing.

PERSON B indicates a practical reason why R&D and CVC can never have a direct relationship. According to PERSON B, R&D and CVC are posted on different sides of the balance sheet. While R&D is considered a cost, CVC is labeled as an asset. Therefore when having to make a choice, a company might perhaps be more inclined to use CVC because it remains an asset to the company.

6. Discussion and conclusions

In the past companies used to rely only on their internal R&D department to provide them with necessary innovations. And for a long time, this approach worked satisfactory. Companies focused on attracting the best people and controlling their whole innovation process from idea generation to product launch. Control was deemed essential to make sure competitors did not profit from the ideas of the company. Several changes however occurred that made the closed innovation approach increasingly difficult to sustain. An important change was that employees started changing employers much more often during their career. The result of this was that it became increasingly difficult to hide ideas from competitors and to rely on having the best R&D people in the field. Another important change was that the speed of the technological development outside the boundaries of the firm increased. This caused problems for companies solely focusing on internal R&D to really keep up with the technological developments. Furthermore, in the old innovation approach methods like the stage-gate model were very popular as depicted in figure 2.2. An advantage of this method was the control the company had over the innovation efforts of the R&D department by having a GO/NO GO decision after each stage. A drawback, especially in the light of increasing external technological development, however was that the process from idea generation to market launch took very long. The technological development was increasing and customers demanded more and better innovations. The internal R&D department simply had a hard time keeping up.
A useful framework to explain the closed innovation approach is the resource based model (Barney, 1990). The resource based model investigates the link between having certain resources in a company and competitive advantage. Knowledge in the minds of the scientists working internal in the R&D department was thought of as a source of sustainable competitive advantage. The knowledge enabled the company to produce superior products and other competitors could not copy their knowledge. As indicated earlier however, the knowledge residing in scientists working in the R&D department seized to be a sustainable competitive advantage because scientists started switching employers more often in their career. When changing employers, employees took their knowledge obtained in the previous company with them. This problem, and the fast technological development, caused that a new innovation approach was necessary and that the resource based model seized to adequately describe competitive advantage.
The problems above with the closed innovation approach led to a new paradigm called the open innovation approach first introduced by Chesbrough (2003). He defined open innovation as *a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology* (Chesbrough, 2003, xxiv Introduction). This new approach meant that the way companies could achieve competitive advantage had changed. Competitive advantage was not achieved by focusing on control but by recombining resources, knowledge, into new value-added strategies. The challenge went from hiding all ideas and innovations from competitors to sharing ideas and innovations with competitors but getting a competitive advantage by uniquely combining them into a new innovation. The change from the resource based model to the dynamic capabilities model illustrates the change from the closed innovation approach to the open innovation approach. As explained, in the resource based model competitive advantage was achieved when companies had a unique resource, knowledge for example. The dynamic capabilities model however acknowledges that such a competitive advantage is not ever lasting (Eisenhardt and Martin, 2000). A competitive advantage in the dynamic capabilities model is achieved when the management adequately changes the competencies of the firm in the face of the rapid technological development. According to Eisenhardt and Martin (2000), especially the management of knowledge resources is vital in such rapidly evolving markets.
A part of the new open innovation paradigm is the concept of corporate venture capital which is defined by Chesbrough and Tucci (2004) as an equity investment in a startup company that the corporation does not own. The motive for such an investment is not financial but primarily strategic (see figure 1.1). According to Yin and Zuscovitch (1998) large companies mainly focus on satisfying the existing product-

market mix and thus on incremental innovations. Chesbrough et al. (2006) however state that companies are dependent on radical innovations for their survival in the long run. Therefore, corporate venture capital can have the strategic goal of pursuing radical innovations by larger firms.
The above describes the transition of companies mainly focusing on internal R&D for innovations to expanding their reach with other modes of pursuing innovations like corporate venture capital. However, internal R&D has not yet disappeared in most companies and according to Ard-Pieter de Man that would not even be possible. Cohen and Levinthal (1990) mention two functions of internal R&D namely:

- Primary use of R&D is producing innovations for the company.
- The secondary use of R&D is that it facilitates learning. Cohen and Levinthal (1990) argue that the new desired technology should have some overlap with the internal knowledge base to facilitate assimilation.

Because of the second use of R&D, corporate venture capital will not be able to completely replace internal R&D efforts. The internal R&D department will be necessary to evaluate and screen external technological opportunities.
Since R&D will not totally disappear, and the use of CVC is increasing, the relationship between these two concepts is of interest. Kortum and Lerner (2000) argue in their paper that venture capital is a substitute for R&D expenses while Chesbrough and Tucci (2004) argue the two concepts might be complements of each other. This controversy in literature resulted in two research question:

RQ1: *What is the relationship between corporate venture capital and internal R&D expenditure?*

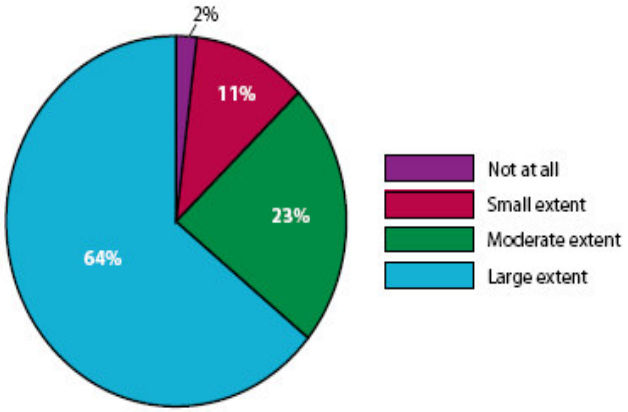
RQ2: *Why does corporate venture capital have a certain relationship with R&D expenditure in certain companies?*

In the first part of the master thesis the first research question was answered by means of performing a multiple regression analysis on a sample of 76 companies over 5 years per company (if available). The finding of the first part of the master thesis is that accounting for industry, number of employees, country and stock price the relationship between corporate venture capital investments and research and development expenses are positive and significant. Referring back to the literature, this means that in the controversy whether the two concepts are substitutes or complements this research supports the latter and thus the paper of Chesbrough and Tucci (2004). Reasons why this relationship is positive can be the following (perhaps not an exclusive list):

- Following Chesbrough and Tucci (2004), if a company uses corporate venture capital to scan the environment for useful technologies a company runs into a lot of potential innovations. Reason for this is that the market outside the firm boundaries is very large and the technological development is high. To investigate all the possible innovations, a company needs an internal R&D department. Without having the possibility of letting the R&D department screen an external idea, it gets very hard to assess the value of external innovations.
- The argument above might also work the other way. A company heavily investing in R&D might learn about external possibilities sooner than others. It might then choose to pursue these innovations by starting a venture activity. Cohen and Levinthal (1990) acknowledge that companies that invest heavily in R&D built up more absorptive capacity and find it easier to recognize and assimilate external knowledge. Sahaym et al. (2009) underline the reasoning above by stating that companies with large R&D investments are usually up to date on the latest technological developments and find it easier to recognize potential useful innovations. Besides having an easier time recognizing external ideas, Sahaym et al. (2009) also agree with Cohen and Levinthal (1990) that it is easier for a R&D intensive company to assimilate external knowledge.

The interviewees Ard-Pieter de Man, PERSON B and PERSON A acknowledge that the relationship between corporate venture capital and research and development expenses is positive in general. This finding, the significant and positive relationship between corporate venture capital and research and

development, is the first important contribution of this research to literature. It is important for two reasons. The first reason is that hardly any empirical evidence exists on the topic. The second reason is that is might indicate a changing role for the R&D department. The paper of Cohen and Levinthal (1990) indicate two goals for the internal R&D department. The first goal is producing innovations while the second goal is building up absorptive capacity which makes it easier to identify and assimilate external knowledge. I believe the emerging of other modes of pursuing innovation like corporate venture capital changed the role of the internal R&D department. The main goal of R&D is changing from producing innovations to supporting other modes of pursuing innovations like corporate venture capital. Several individuals, like Ard-Pieter de Man and Tom Elfring, acknowledge the fast technological development outside the boundaries of firms. To benefit from all the available external ideas, companies are increasingly looking outside the own boundaries in search for innovation. Corporate venture capital can be a good way of targeting especially young start-ups but it needs the backing of a good internal R&D department.



More than four-fifths of CVCs report that technical or business personnel from the parent company are used to a large or moderate extent in screening investment proposals.

(Figure 6.1, Parent company personnel in due diligence investment proposals, MacMillan et al. (2008))

Figure 6.1 shows that more than 80% of the CVC's in the study of MacMillan et al. (2008) indicate that personnel from the parent company are used to a large or moderate extent in the screening process. Tom Elfring also indicates in the interview that having R&D people involved counters any not invented here syndromes and helps with a careful screening of the external idea.
Therefore, the finding that this research presents (R&D expenses and CVC investments are complementary) is an important contribution to research and can indicate that the role R&D plays in companies has changed accordingly.

The second research question was designed to investigate why the relationship is positive or negative in certain companies. Because COMPANY B used a different type of CVC then defined in this research, the case of COMPANY A will be used to answer this question. In COMPANY A top management decides each year how much funds the innovation activity of the company receives. The innovation activity is composed of R&D budgets, CVC budgets, Corporate Licensing budgets, Internal Incubator budgets, IP budgets etc. According to PERSON A, the venturing department has a supportive and complementary relationship with other departments. A success for COMPANY A venturing is not per se a screening ending up in an investment. Success is significantly contributing to the overall innovative performance of COMPANY A. According to Vanhaverbeke and Peeters (2005) in COMPANY A, the technology influences the strategy and vice versa. This means that the venturing department screen for external technologies in line with the strategy of COMPANY A. It might however occur that COMPANY A venturing finds an interesting possibility not in line with the current strategy of COMPANY A. If the technology looks really promising COMPANY A discusses this on corporate level and the strategy might be altered in response. This way strategy influences technology and the other way around. The strategy

that is being set out influences the whole innovation department (so also the R&D department). According to PERSON A, COMPANY A venturing needs the R&D department for the following reasons:

- Scouting for start-ups.
- Screening of new start-ups.
- Asessing the technical/scientific/IP position of the start-up.
- Absorbing and using the relevant innovations from start-ups.

COMPANY A venturing helps the R&D department in turn by alerting them to new innovations that might be of use. The way innovation is organized in COMPANY A and the relationship between R&D and CVC is in line with Cohen and Levinthal (1990) and Chesbrough and Tucci (2004). It is also in line with comments by Ard-Pieter de Man and Tom Elfring who state that the way in which management allocates resources to both R&D and CVC influences their relationship.
Cohen and Levinthal (1990) indicate that an important function of the R&D department is to build up absorptive capacity which makes it easy to recognize and assimilate external knowledge. This function might have been less important in the closed innovation approach where R&D was responsible for producing innovations and not for supporting other modes of pursing innovations. However, as the technological development increases companies are increasingly looking outside the boundaries of the own firm. To understand the ideas and innovation the venture department provides them, they need to have build up absorptive capacity by R&D investments. The interview with PERSON A clearly shows that the R&D department supports the venturing department by giving them advice on external technological development and assisting in the evaluation procedure. The other way around the venture department helps the R&D department by alerting them to external technologies that might assist in current R&D projects. Figure 6.1 shows that in more than 80% of the cases personnel from the parent company are involved to a large or moderate extent in screening investment proposals. This could indicate a more supportive function for the R&D department as opposed to being mainly responsible for producing innovations.

Summarizing the above, with regards to research question 1 it can be concluded that the relationship between R&D expenses and CVC investments is positive. Concerning question 2 COMPANY A is a good example of a company where the two departments are complements of each other. The respondent from COMPANY A clearly indicated why the relationship is positive at COMPANY A. The venturing departments assists the R&D department and vice versa. Furthermore, the funds for the CVC department are not taken from the R&D department in line with the supportive innovation character of COMPANY A. Combining Chesbrough and Tucci (2004), Cohen and Levinthal (1990) and Sahaym et al. (2009) provides us with an indication of why R&D and CVC should work together in theory in a supportive relationship. The venturing department of COMPANY A is very close to this. It alerts the R&D department to new technologies that might aid current processes. The R&D department in turn helps the venturing department with screening and assimilating the knowledge coming from external ventures.

I believe my research contributes to existing literature in a variety of ways. The first way is that it tries to solve to controversy in literature about whether CVC and R&D are complements or substitutes of each other. Thus far not a lot of empirical research has been conducted in this area and this research might be a first step to understand the relationship between an old and a newer mode of pursing innovation. The second contribution evolves from the first. Because the relationship between corporate venture capital and R&D expenses is positive this will influence the role R&D will play in the near future. In the past R&D was responsible for producing all innovations. It seems that R&D is becoming a more supportive function of other modes of pursuing innovation that aim for external technologies. To understand and assimilate all this external knowledge, R&D should refocus on building up absorptive capacity to easily and effectively being able to use external knowledge. With the amount of knowledge available in the external environment, being able to quickly and effectively transform external knowledge seems to be a new

competitive advantage. R&D will play an important, though different, part in this. The third contribution of my research is that it gives some information about the relationship between CVC and R&D in a practical setting at COMPANY A. One can see that COMPANY A is a good example of a supportive relationship between the two concepts and that COMPANY A is close to developing an overall innovation strategy where technology responds to strategy and vice versa.

6.2 Limitations

One drawback of the study (highlighted by PERSON B of COMPANY B) is that the concepts of research and development expenses and corporate venture capital investments are very hard to compare. Reason for this is that R&D is seen as an expense on the balance sheet, while CVC investments appear as assets. Further, the amount companies usually spend on CVC is negligible compared to R&D investments. And last, the concept of corporate venture capital is a very difficult one. According to PERSON B (COMPANY B) there are 16 different types of corporate venture capital currently being used in practice. That makes it very hard to generalize unless one focuses on one specific form of corporate venture capital.
Another drawback of the study (again highlighted by PERSON B) is that the age of the companies involved has not been taken into account. According to the respondent, this however does influence the relationship. A reason for this can be that older firms have more capital available to invest in new start-ups as opposed to relatively new companies.
Also a drawback of the study is that only two interviews with practitioners, of which only one used a definition of CVC as in this study, were conducted due to time constraints. These two interviews did however provide interesting attention points and as long as we do not generalize from these findings, this needs not to be a problem.
The last drawback of the study is the way the amount of venture capital per year per company was calculated. The sum off all venture capital investments by a company was divided by the amount of investments giving an average venture capital investment per start-up. Figure 2.6 and 2.7 illustrate this point. In those figures one can clearly see certain boom periods in which the amount of venture capital invested increases when compared to “normal” years. Since venture capital investments show a cyclical trend, averaging across all years might give a distorted figure. Also seen in figure 2.6 and 2.7 is that the amount of venture capital invested increases, also during normal years. Therefore averaging across all years and using this as an estimate for the years 2003-2007 might not give a fully accurate picture of reality.

6.3 Future research

The first potential future research direction follows directly from the study drawbacks as mentioned in paragraph 6.2. Using the average venture investment over all years of a company might give a distorted figure as to the real venture capital investment per year. The reason why this however was used in this study is the time constraint. In future research however, one could do three things:

- Summate the actual investments over a certain period, this method would give the most accurate figure but is also very time consuming.
- Average investments over multiple years but account for certain boom periods by using methods to normalize investments made during boom periods. This could be done by for example multiplying investments made in boom periods by a reduction factor.
- Average investments made in periods that are not in a boom period.

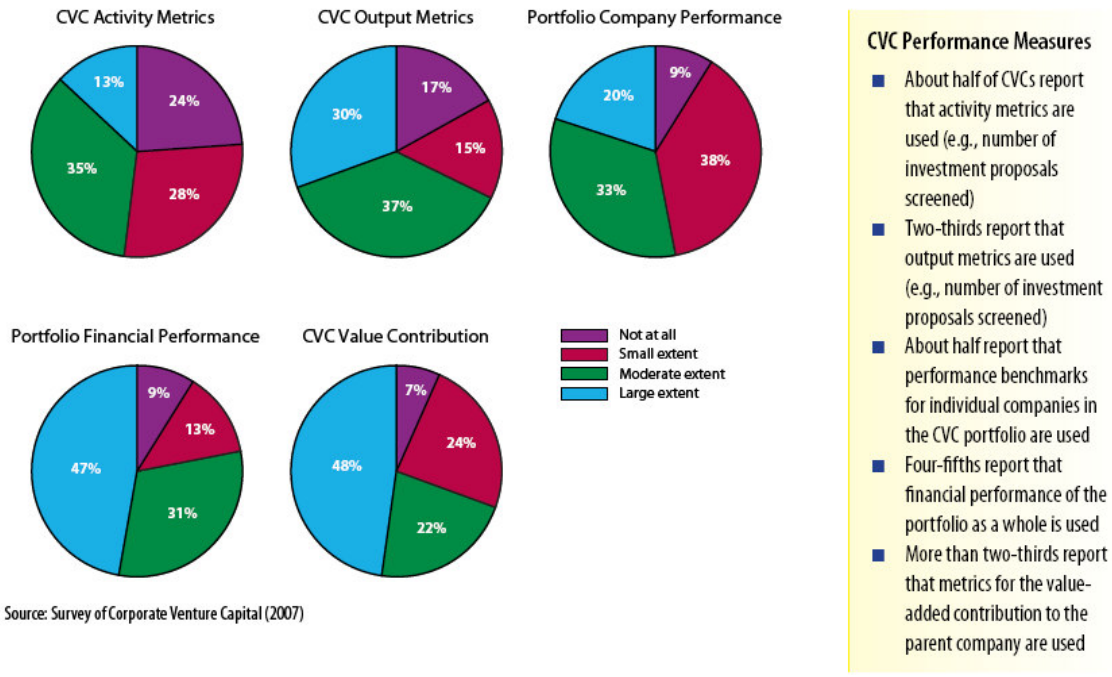
Another potential avenue for future research could be the use of case studies. In this research, especially the COMPANY A case was used to get an insight on how corporate venture capital relates to research and development in practice. A more in depth study, at for example COMPANY A, on how funds are made

available for different modes of innovation could be insightful. Also attending meetings between the venture department and the R&D department could have added value to see how the departments support each other in practice.
The third potential avenue for further research is performing a similar analysis as in the first part of this research only with other indicators for certain variables. In this research, R&D was measured in absolute figures in 000s dollars. Using a variable called R&D intensity by dividing the R&D expenses by the turnover of the company might give useful additional information.
The last recommendation for future research relates to the location of the companies in the sample. In this research, most companies were located in the USA. That is logical, since that was the place where the venture capital market first emerged. It could therefore be interesting to investigate the development of the corporate venture capital market in for example Europe and look for differences with the USA counterpart.

6.4 Recommendations to practitioners

A main finding of this research is that the relationship between corporate venture capital and R&D expenses is significant and positive. According to Cohen and Levinthal (1990) the R&D department has two functions; the first function is providing the company with innovations and the second function is building up absorptive capacity to better understand and potentially assimilate external knowledge. Chesbrough and Tucci (2004) mention that the locus of innovation has shifted from being centered in the internal R&D department in the past to being more diffused across companies and universities currently. Also according to Chesbrough (2003) and the interview respondents in this research, the technological development outside the firm boundaries goes too fast for any R&D department to keep up. Yin and Zuscovitch (1998) state that the R&D of large companies might be more suited to satisfy the current product-market mix with incremental innovations while small companies are better capable of providing radical innovations, perhaps because they do not have an existing market to satisfy.
All the above indicates to me, that the R&D function of large companies is changing. First the R&D department was solely responsible of providing all innovations. However, the R&D department is too slow to keep up with the fast technological pace in the high-tech sector and has a lot of difficulty with producing radical innovations. I believe the conviction that the R&D department should provide radical innovations should be abandoned because it is not suited for this. In stead, the R&D should aim at what it is best in namely producing incremental innovations to satisfy existing customers. Secondly the R&D department should be transformed in a supportive department for aiding departments using modes of pursuing external innovations. These departments need the R&D department (see the COMPANY A case) to help them with screening, evaluating and assimilating external knowledge. I believe it is wrong to still think solely relying on a strong internal R&D (mainly occupied with pursuing all kinds of innovations) creates a competitive advantage. Since the relationship of CVC and R&D is positive and the locus of innovation is shifting, practitioners should account for a change in objectives of the R&D department.
I believe such a refinement of R&D goals is one step closer to companies wanting to have an overall innovation strategy. Having such a strategy, according to the interview respondents, could be beneficiary to the company as a whole. Letting R&D do what it does best will certainly be a good first step in this process. Thus, R&D should focus on satisfying existing customers and building up absorptive capacity while other departments that search for external innovations should focus on radical innovations. The R&D department should be involved in the whole process of a venturing department from screening the external technology to assimilating it.

The second recommendation for practitioners concerns performance of the CVC department. Measuring the performance of a corporate venturing department might be a difficult task. The reason for this is that the objective of the department is not solely financial but also encompasses strategic goals.



(Figure 6.2, CVC performance measures, MacMillan et al. (2008))

According to MacMillan et al. (2008) output metrics and activity metrics are most easily measured, but do not directly relate to the ultimate outcomes for the parent company. Portfolio company performance and portfolio financial performance are metrics that independent venture capital funds use to measure the performance. I however urge managers to use CVC value contribution as a metric to evaluate the performance of the venturing department. According to MacMillan et al. (2008), these contributions may be technology insights presented to the R&D department, referrals to external contract to assist R&D and other business units, relationships facilitated by the CVC, strategic impact of ventures that were invested in on the company etc. When focusing on these objectives, I believe managers will be less inclined to abandon CVC when the downswing in the venture capital cycle comes. This is also in line with the interview I have held with Ard-Pieter de Man who stated that you can not judge a venturing department's innovative performance independently of other departments. Of course companies need to look at the financial quality of the investments that are being made. But what is also important is the information the venturing department gives the R&D department and the quality of the external knowledge that is being assimilated. Since the venturing department is such an interactive department, solely focusing on financial objectives or not taking into account information flows to other departments could result in loosing top managers support for CVC activity for all the wrong reasons.

Appendix I

Websites used to gather R&D expenditures data because the data was unavailable in Thomson ONE Banker Analytics:

Thales;
http://www.thalesgroup.com/Investors/Financial-releases.html

Dassault Aviation;
http://www.dassault-aviation.com/en/aviation/finance.html?L=1

BASF;
http://www.corporate.basf.com/en/investor/news/berichte/?jahr=2007&id=FdKnwDFtWbcp0P_

COMPANY A;
http://www.COMPANY A.com/en_US/html/invest/ar_2007.htm

Takeda Pharmaceutical;
http://www.takeda.com/investor-information/financial-highlights/article_908.html

Astellas Pharma;
http://www.astellas.com/en/ir/finance/

Softbank;
http://www.softbank.co.jp/en/irlibrary/results/index.html

Sony;
http://www.sony.net/SonyInfo/IR/financial/ar/Archive.html

NEC;
http://www.nec.co.jp/ir/en/material/annual/index.html

TDK;
http://www.tdk.co.jp/ir_e/finan/fin07000.htm

HOYA;
http://www.hoya.co.jp/english/investor/d0h4dj0000000dbq-att/annual_e2007.pdf

ACER;
http://global.acer.com/about/investor/reports.htm

All of these websites were consulted in November 2008.

Appendix II

	Year	2003	2004	2005	2006	2007
Base Currency						
Euro		1,2485 USD	1,3538 USD	1,1842 USD	1,3197 USD	1,4603 USD
British Pound		1,7842 USD	1,916 USD	1,7188 USD	1,9586 USD	1,9843 USD
Japanese Yen		0,00933445 USD	0,00973899 USD	0,0084832 USD	0,00840195 USD	0,00895175 USD
Danish Krone		0,169062 USD	0,182017 USD	0,158768 USD	0,177057 USD	0,195902 USD
Swedish Krona		0,138985 USD	0,149954 USD	0,125992 USD	0,146323 USD	0,154875 USD
Taiwan Dollar		0,0294204 USD	0,031506 USD	0,0304878 USD	0,0306843 USD	0,0308356 USD
Canadian Dollar		0,773814 USD	0,830979 USD	0,857927 USD	0,858222 USD	1,01204 USD

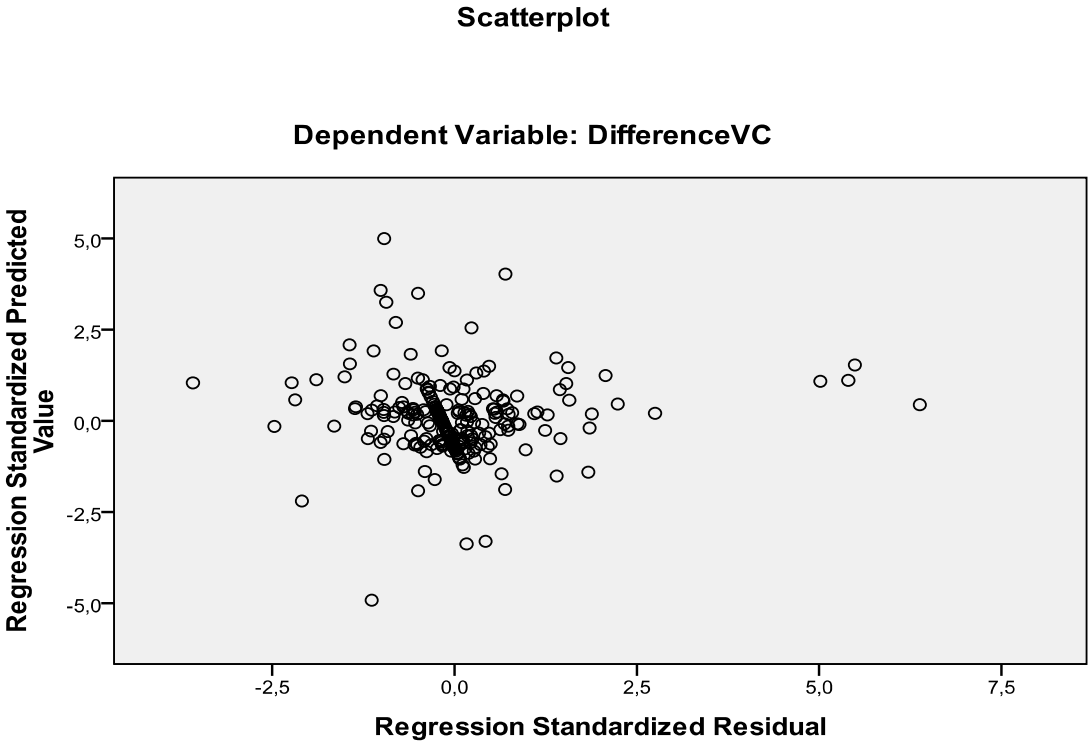
If for example a company spends 1000000 euro on R&D in 2003, the R&D spending in USD will be 1000000*1,2485=1248500

Appendix III

According to Hair et al. (2006) several assumptions have to be met in order to produce a valid regression model namely:

- Linearity.
- Homoscedasticity.
- Independence of the residuals.
- Normality.

According to Norušis (1982) the assumptions of linearity and homogeneity of variance can be checked, by plotting the residual values versus the predicted values. Any patterns should be considered suspicious. If the assumption is met, the residuals should be randomly distributed in a band about the horizontal straight line through 0 (Norušis, 1982). The plot that Norušis (1982) proposes is shown in figure 1.



(Figure 1, residual values versus predicted values)

Figure 1 shows that the plot does not give a randomly distributed pattern in a band around 0. The residuals cluster somewhere in the middle with a few outliers to the left and right.

Norušis (1982) also describes that if the above picture would show a ◄ shape for example, there might be a problem with the constant variance assumption of Y for all X. However in this case such pattern is not discovered. So the problem will probably be with the linearity between the dependent and independent variables.

According to Norušis (1982) the independence of error assumption can be checked with the Durbin-Watson statistic. Checking this assumption with our dataset is deemed important since we use panel data and thus, time is incorporated in the model. We tried to collect data for 5 years per company in our dataset. Hence, this might cause the errors terms to not be independent. As the Durbin-Watson statistic approaches 2, it is more likely that the residuals are independent of each other.[22]
Huizingh (1989) also highlights that checking the Durbin-Watson statistic when time is an issue is important. According to Huizingh (1989), a statistic near 2 indicates there is no auto correlation.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,233[a]	,054	,016	15135,029	2,226

a. Predictors: (Constant), DifferenceRandD, ElecDummy, EuropeDummy, NumberofEmployees, DifferenceStockPrice, MedDummy, AeroDummy, AsiaDummy, CompDummy, PharmaDummy

b. Dependent Variable: DifferenceVC

(Figure 2, Model Summary)

Figure 2 shows that in our case the Durbin-Watson statistic equals 2,226, so it can be safely assumed the error terms are relatively independent.

One of the best ways to check the normality assumption is to construct a histogram of the standardized residuals (Norušis, 1982).

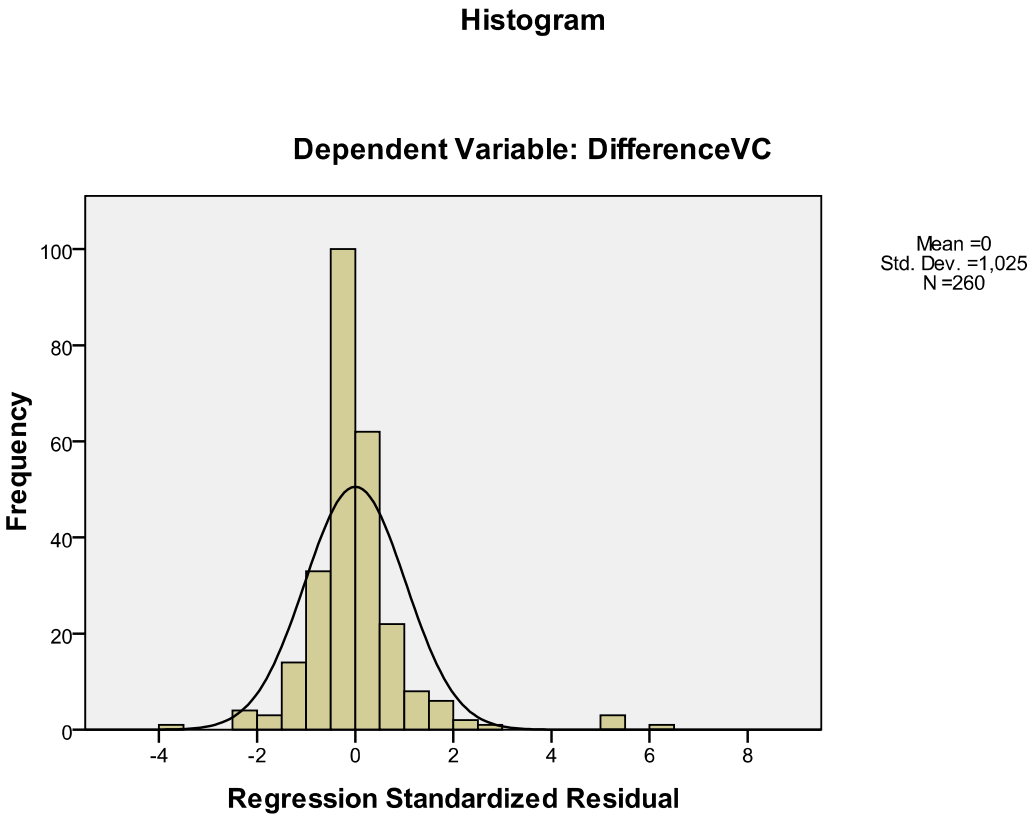
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	,175	260	,000	,777	260	,000

a. Lilliefors Significance Correction

(Figure 3, Test of Normality)

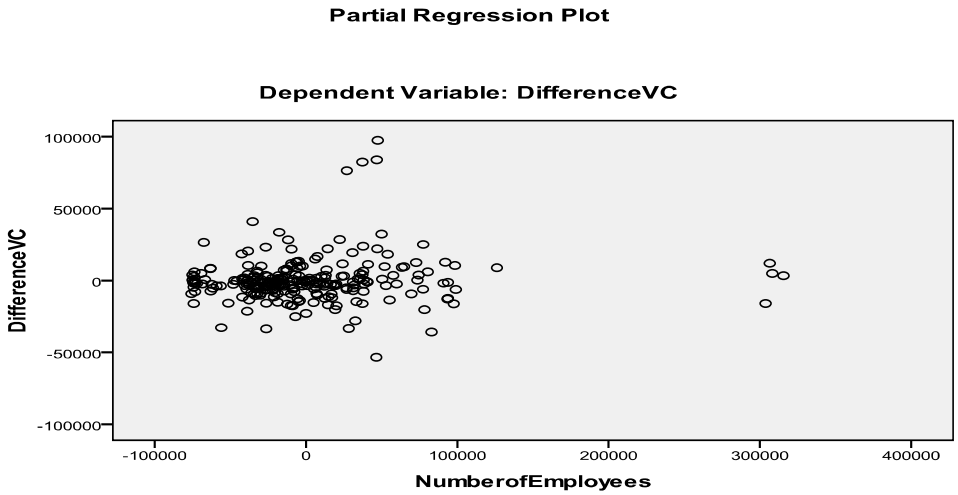
[22] http://riskinstitute.ch/00011233.htm (consulted on 13 May, 2009)



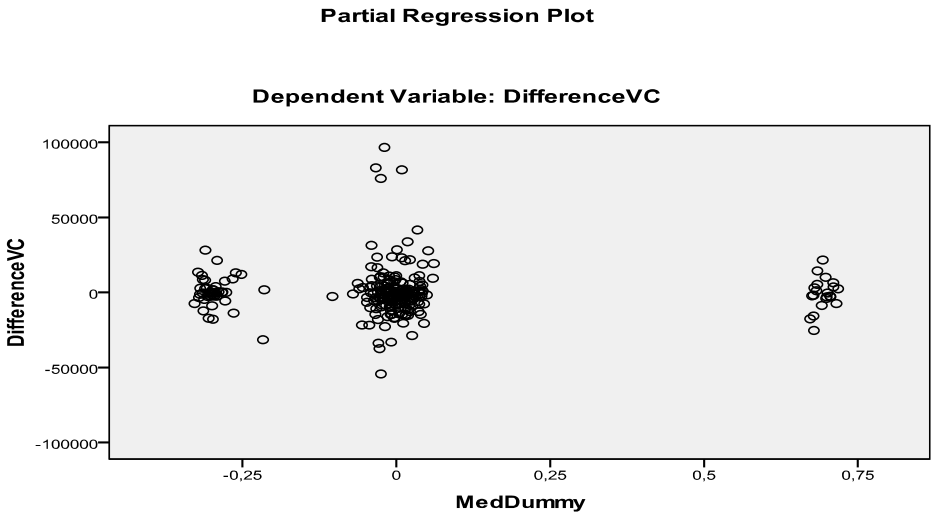
(Figure 4, histogram of standardized residuals)

The histogram shown in figure 4 does show a pattern that appears normal. However the Kurtosis statistic shown in figure 3 is too high. However, according to Green and Salkind (2003), in many applications with a moderate or larger sample size, the test of a multiple correlation coefficient may yield reasonably accurate p values even when the normality assumption is violated.

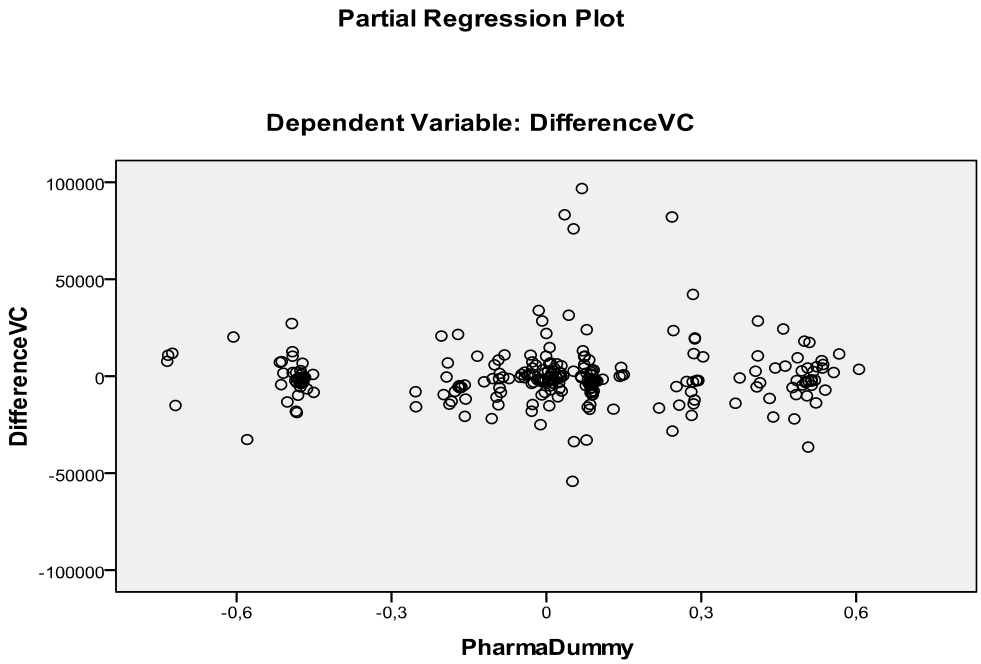
As indicated earlier, linearity might be a problem, below the partial regression plots of all independent variables against the dependent variable illustrate this problem.



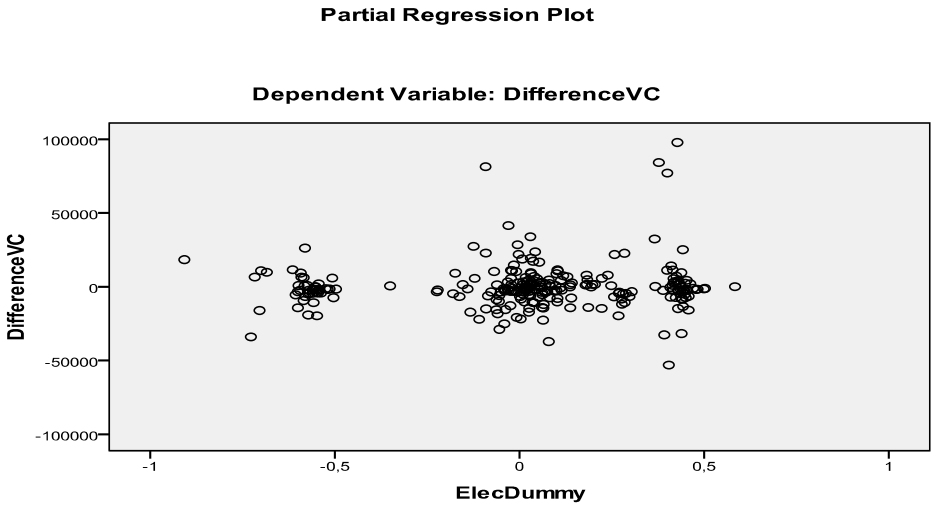
(Figure 5, regression plot of NumberofEmployees against DifferenceVC)



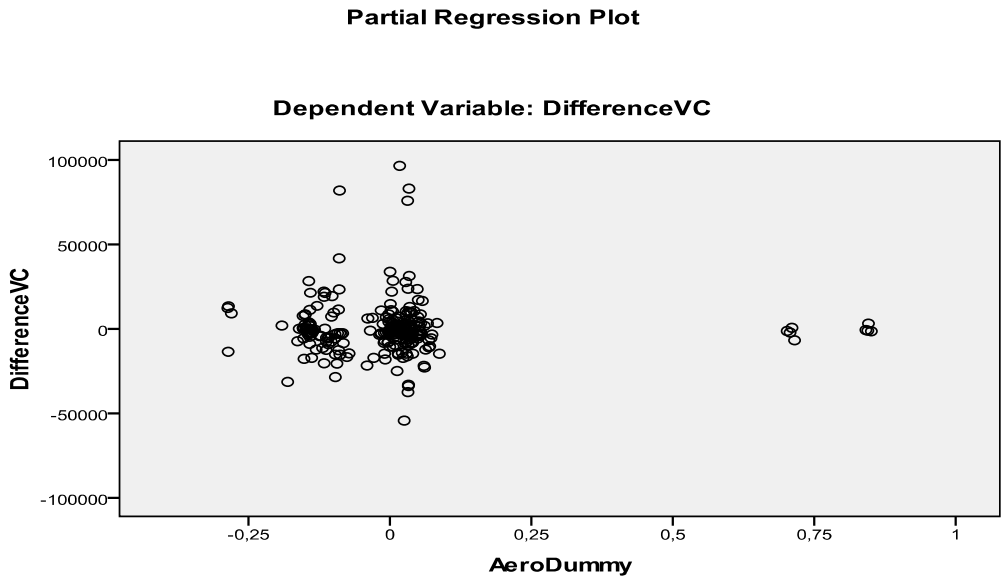
(Figure 6, regression plot of MedDummy against DifferenceVC)



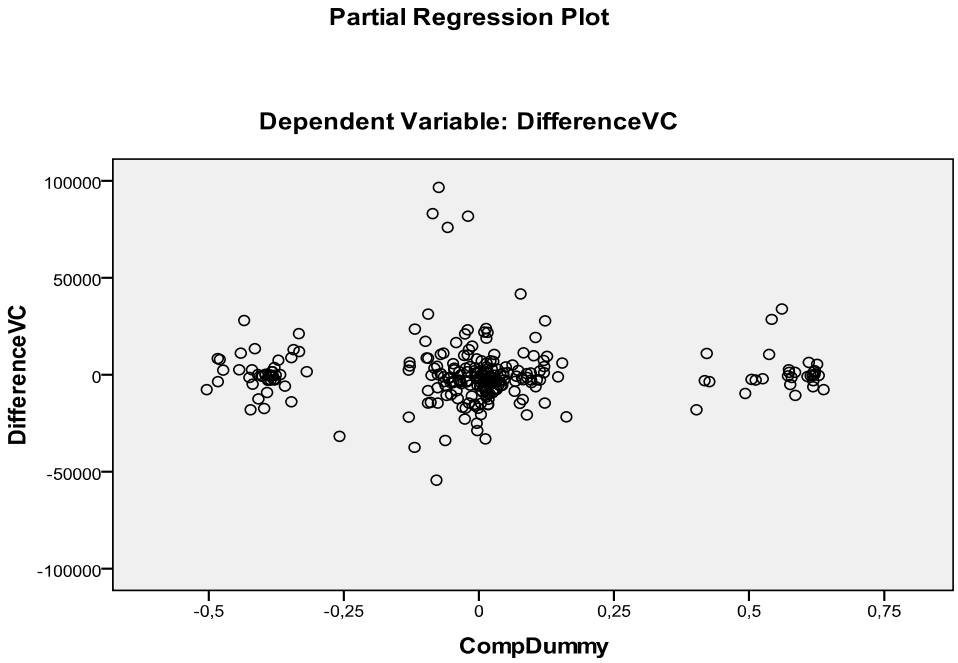
(Figure 7, regression plot of PharmaDummy against DifferenceVC)



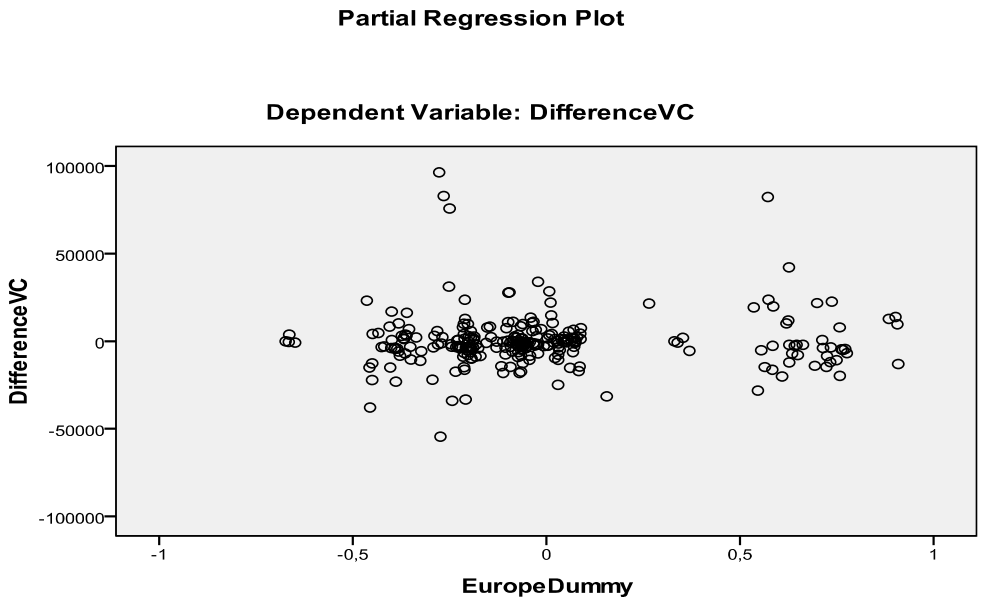
(Figure 8, regression plot of ElecDummy against DifferenceVC)



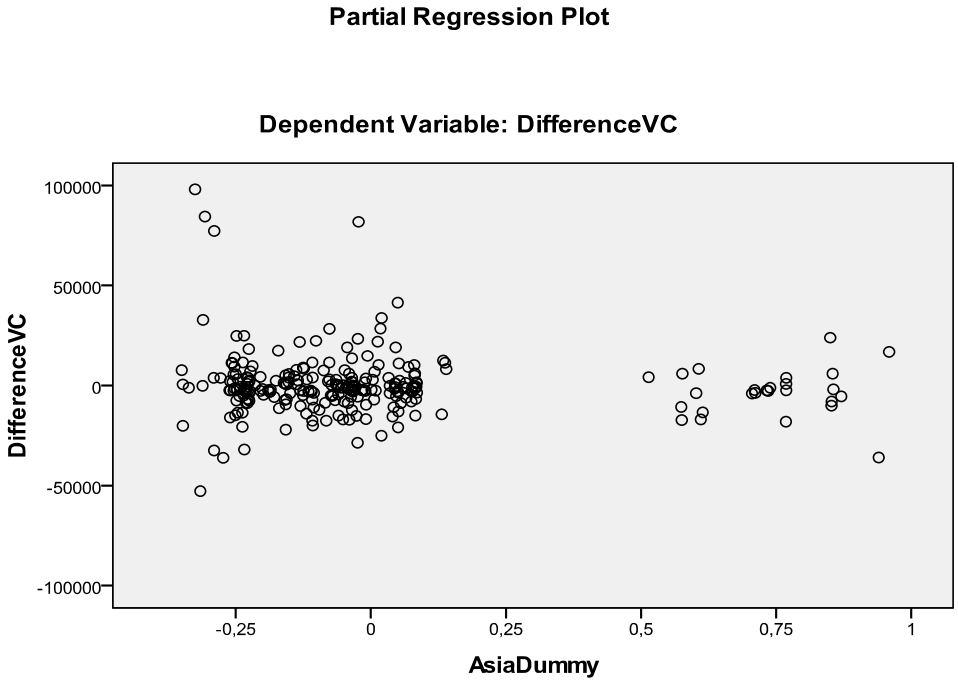
(Figure 9, regression plot of AeroDummy against DifferenceVC)



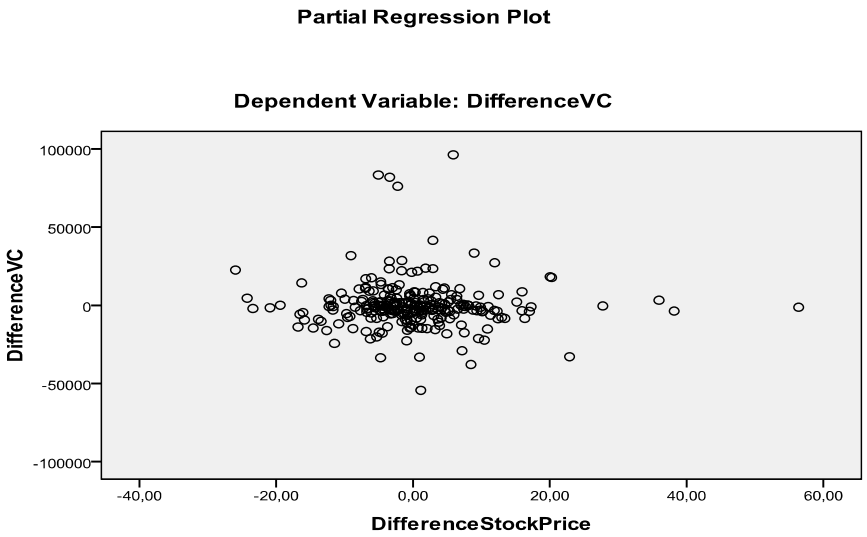
(Figure 10, regression plot of CompDummy against DifferenceVC)



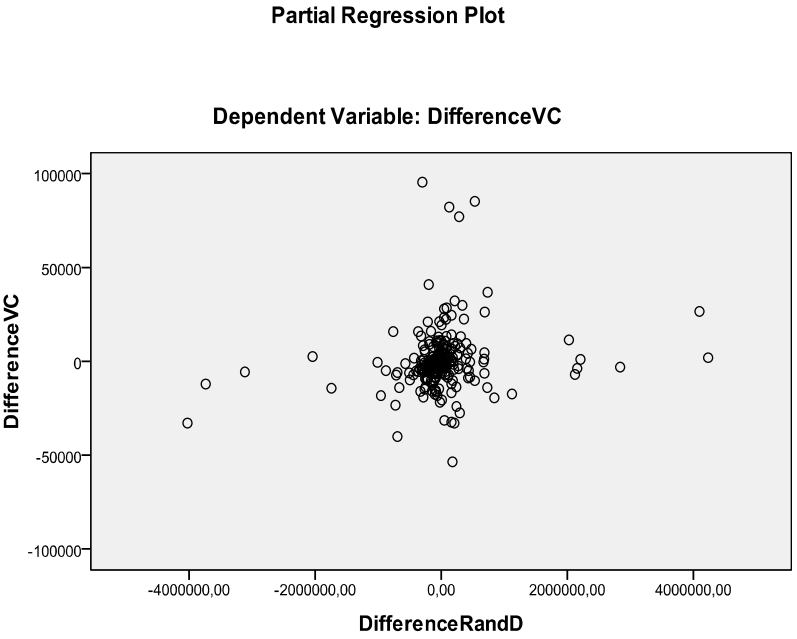
(Figure 11, regression plot of EuropeDummy against DifferenceVC)



(Figure 12, regression plot of AsiaDummy against DifferenceVC)



(Figure 13, regression plot of DifferenceStockPrice against DifferenceVC)



(Figure 14, regression plot of DifferenceRandD against DifferenceVC)

Figure 5 t/m 14 depict the regression plots of independent variables against the dependent variable. The only figure remotely resembling linearity is the relationship between DifferenceVC and DifferenceRandD shown in figure 14 that has a slightly positive slope. Since DifferenceVC and DifferenceRandD have both negative values, normal transformations in order to achieve linearity like SQRT and LN can not be used.

However, following Norušis (1982) comments on linearity, not every assumption has to hold but one should also highlight assumptions that do not hold so people interpret the results with care and do not extrapolate beyond the sample. Therefore, it is stressed again here (like in the main text) to not extrapolate these findings beyond the observations present in the dataset.

An important assumption according to Morgan et al. (2006) is checking for multicollinearity. Multicollinearity occurs when there are high intercorrelations among some set of the predictor variables. In other words, multicollinearity happens when two or more predictors contain overlapping information. (Morgan et al., 2006)

Correlations

		DifferenceVC	Numberof Employees	MedDummy	Pharma Dummy	ElecDummy	AeroDummy	CompDummy	Europe Dummy	AsiaDummy	Difference StockPrice	Difference RandD
Pearson Correlation	DifferenceVC	1,000	,074	-,037	,035	,059	-,032	-,014	,061	-,059	-,033	,188
	NumberofEmployees	,074	1,000	-,060	,002	,038	,005	,185	,086	,180	,056	,062
	MedDummy	-,037	-,060	1,000	-,161	-,204	-,059	-,119	-,136	-,105	-,044	-,032
	PharmaDummy	,035	,002	-,161	1,000	-,379	-,110	-,221	,261	-,010	,069	,104
	ElecDummy	,059	,038	-,204	-,379	1,000	-,139	-,280	-,012	,292	-,105	,000
	AeroDummy	-,032	,005	-,059	-,110	-,139	1,000	-,081	,245	-,071	,098	-,040
	CompDummy	-,014	,185	-,119	-,221	-,280	-,081	1,000	-,186	-,144	-,019	-,034
	EuropeDummy	,061	,086	-,136	,261	-,012	,245	-,186	1,000	-,165	,100	,067
	AsiaDummy	-,059	,180	-,105	-,010	,292	-,071	-,144	-,165	1,000	-,015	-,020
	DifferenceStockPrice	-,033	,056	-,044	,069	-,105	,098	-,019	,100	-,015	1,000	-,006
	DifferenceRandD	,188	,062	-,032	,104	,000	-,040	-,034	,067	-,020	-,006	1,000
Sig. (1-tailed)	DifferenceVC	.	,106	,266	,275	,159	,294	,408	,152	,161	,296	,001
	NumberofEmployees	,106	.	,127	,481	,233	,460	,000	,051	,000	,183	,146
	MedDummy	,266	,127	.	,001	,000	,131	,012	,005	,023	,241	,293
	PharmaDummy	,275	,481	,001	.	,000	,018	,000	,000	,428	,135	,039
	ElecDummy	,159	,233	,000	,000	.	,004	,000	,413	,000	,045	,498
	AeroDummy	,294	,460	,131	,018	,004	.	,062	,000	,087	,057	,250
	CompDummy	,408	,000	,012	,000	,000	,062	.	,000	,003	,383	,281
	EuropeDummy	,152	,051	,005	,000	,413	,000	,000	.	,001	,053	,127
	AsiaDummy	,161	,000	,023	,428	,000	,087	,003	,001	.	,405	,370
	DifferenceStockPrice	,296	,183	,241	,135	,045	,057	,383	,053	,405	.	,459
	DifferenceRandD	,001	,146	,293	,039	,498	,250	,281	,127	,370	,459	.
N	DifferenceVC	288	288	288	288	288	288	288	288	288	260	288
	NumberofEmployees	288	364	364	364	364	364	364	364	364	260	288
	MedDummy	288	364	364	364	364	364	364	364	364	260	288
	PharmaDummy	288	364	364	364	364	364	364	364	364	260	288
	ElecDummy	288	364	364	364	364	364	364	364	364	260	288
	AeroDummy	288	364	364	364	364	364	364	364	364	260	288
	CompDummy	288	364	364	364	364	364	364	364	364	260	288
	EuropeDummy	288	364	364	364	364	364	364	364	364	260	288
	AsiaDummy	288	364	364	364	364	364	364	364	364	260	288
	DifferenceStockPrice	260	260	260	260	260	260	260	260	260	260	260
	DifferenceRandD	288	288	288	288	288	288	288	288	288	260	288

(Figure 15, Correlation amonst independent variables)

Morgan et al. (2006) indicate problems with multicollinearity when the Pearson correlation exceeds a value of 0,60. Figure 15 shows that this is certainly not the case rejecting the hypotheses that multicollinearity exists in our regression model.

Criteria for reliable regression model

The following criteria are taken from George and Mallery (2003):

- Your research must be thoughtfully crafted and carefully designed.
  The research questions flow from already available academic literature and the investigated relationship between Research and Development expenses and Corporate Venture Capital

Investment has also already been mentioned in academic literature giving power to our belief the research (and the following relationships) are meaningful.

- The sample size should be large enough to create meaningful correlations.
  As N drops below 50, your results become increasingly questionable (George and Mallery, 2003). In our sample, the N exceeds 300 for all variables (both dependent as independent) so this criterion will be satisfied.
- Your data should be examined carefully for outliers or other abnormalities. As described earlier, the Mahalanobis D^2 measure has been used to investigate the dataset for errors. Some values that had a higher Mahalanobis D^2 measure but were correct are however not removed.
- The relation between the dependent variable and the independent variables should be linear.
  Sadly, this assumption does not hold in all cases.

Appendix IV

On the website http://www.COMPANY_A.com/en_US/html/venturing/investment_fields.htm (consulted April 6, 2009) a detailed overview of focus areas within the fields Nutrition, Pharmaceuticals and Materials are given.

Nutrition

Products / markets:

- Enzymes, preservation systems, starter cultures, probiotics and tests for the dairy industry
- Enzymes and nutritional ingredients for the animal feed industry
- Enzymes, yeast and starter cultures for the beverage industry
- Yeast extracts, processed flavors and other flavorings for the savory industry
- Nutritional ingredients (Nutraceuticals) for use in functional food
- Beta-carotene, probiotics, enzymes and other nutritional ingredients for dietary supplements
- Preservation systems, savory flavors and cultures for the meat industry
- Yeast extracts for the fermentation industry
- UV-filters and sunscreen systems for the personal care industry
- Active ingredients for skin, hair and oral care application for the personal care, cosmeceutical and OTC industry
- Personalized nutrition, including genetic testing and biomarker diagnostics

Technologies:

- Enzyme
- Biocatalysis
- Fermentation
- Organic chemistry
- Extraction
- Encapsulation / Delivery systems

Pharmaceuticals

Core Technologies and processes:

- Biocatalysis / biotransformation (bioprocessing)
- Chiral technologies
- Homogeneous catalysis
- Oxydation technologies
- Amino-acids
- Process technology
- Fermentation
- Manufacturing for pre-clinical development
- Chemical process development
- General Intermediates
- Advanced intermediates
- Active pharmaceutical ingredients
- Sterile dosage formulation

- Orals and topicals formulation
- Reformulation technology
- Pharmaceutical development

Materials

- Ultimate Property Materials
- Life Science technologies in Performance Materials
- Biomedical Materials and Applications
- Nano Technology and applications in Life Science products and Performance Materials
- Specialty Packaging
- White Biotechnology

Other specific areas:

- Fiber Optic Materials
  (coatings, inks and matrix, splicing materials, adhesives, security/identification technology)
- Rapid Prototyping Materials
  (stereolithography resins, selective laser sintering particles)
- Super Strong Fibers and their application fields
  (uni-directional sheet materials)

Appendix V

Interview Questions CompanyX Venturing
Name:
Part of master thesis project concerning relation between Corporate Venture Capital and Research and Development expenses.

Aim: insight in relationship between R&D and CVC and their balance.

Question 1: Do you perceive the relationship between CVC and R&D to be a positive or a negative one (or perhaps non-existing)? Please indicate why this relationship is as it is within CompanyX.

Question 2: Which factors do you perceive to influence the relationship between R&D expenditures and CVC investments? And in what way do these factors influence the relationship? (For example firm size, economic situation, type of organization etc)

Taken from Harvard Business Review: "Connect and Develop – Inside Procter & Gamble's New Model for Innovation"

"It is destined to fail if it is seen as solely an R&D strategy or isolated as an experiment in some other corner of the company."

The results from my analyses so far indicate that R&D and CVC are positively related and significant. Often though, when examining the data, I get the impression that bigger companies just raise their R&D expenditures every year while CVC investments are done on a much more irregular basis. Some years heavy CVC investments show, while a year later the CVC investments rapidly drop.

Question 3: From the text above it could be concluded that a lot of companies see R&D and CVC as two distinct methods of pursuing innovation. Should they separate these two modes of pursuing innovation (separate innovation strategies) like they often do, or should they view these two ways as part of one overall innovation strategy? Please indicate why and how you do this within CompanyX.

Taken from Harvard Business Review: "Connect and Develop – Inside Procter & Gamble's New Model for Innovation"

"By 2000, it was clear to us that our invent-it-ourselves model was not capable of sustaining high levels of top-line growth. The explosion of new technologies was putting ever more pressure on our innovation budgets. Our R&D productivity had leveled off, and our innovations success rate – the percentage of new products that met financial objectives – had stagnated at about 35%"

Question 4: P&G say that companies that still only look internally for innovations will be outcompeted by the competition, or as they put it "adapt or die". Do you believe this is correct? Should companies stop only looking internally for innovations and broaden their horizon to external innovations also? Do you think CVC could be a good way to do this? What is the view within CompanyX about this?

Taken from Harvard Business Review: "Connect and Develop – Inside Procter & Gamble's New Model for Innovation"

"We knew that most of P&G's best innovations had come from connecting ideas across internal businesses. And after studying the performance of a small number of products we'd acquired beyond our own labs, we knew that external connections could produce highly profitable innovations, too. Betting that

these connections were the key to future growth, Lafley made it our goal to acquire 50% of our innovations outside the company. The strategy wasn't to replace the capabilities of our 7,500 researchers and support staff, but to better leverage them. Half of our new products, Lafley said, would come from our own labs, and half would come through them."

Question 5: In the text above P&G states a clear objective that 50% of all innovations should come from outside the company. What is your view on the balance between internal innovation and external innovation (CVC could be a part of this)? Has CompanyX got a clear target on how many innovations should come from outside the R&D department?

Question 6: Assume a company A used R&D investments as the sole method of pursuing innovation. However now, company A starts using a combination of R&D and CVC. What method could the director of company A use after a few years to compare which situation was best for the company? Does the balance between R&D and CVC (for example 30%-70%) influence the effectiveness of pursuing innovation? Please explain.

Thank you for your participation in this research.

Appendix VI

Interview Questions COMPANY A Venturing
Name:
Part of master thesis project concerning relation between Corporate Venture Capital and Research and Development expenses.

Aim: insight in relationship between R&D and CVC and their balance.

Question 1: Do you perceive the relationship between CVC and R&D to be a positive or a negative one (or perhaps non-existing)? Please indicate why this relationship is as it is within COMPANY A.

Corporate Venturing at COMPANY A has links to both R&D and New Business Development and Innovation Management but not through functional lines but through business lines. So, as corporate venturing group we talk to senior management teams of the COMPANY A Business Groups and Emerging Business Groups where all three functions mentioned above (R&D, NBD, IM) are represented.
We believe that this is one of our key success factors and are convinced that corporate could not realize its objectives without it. We are an integral part of the businesses innovation and growth activities and they are an integral part of our venturing activity.
These relations are in general very positive.

Question 2: Which factors do you perceive to influence the relationship between R&D expenditures and CVC investments? And in what way do these factors influence the relationship? (For example firm size, economic situation, type of organization etc)

I am not quite sure I understand this question correctly but at COMPANY A, R&D and corporate venturing each have their own budgets – they are not structurally linked in any way other than at the highest possible overall COMPANY A level which decides every year how much money will be available for all kinds of activities. For innovation alone this includes e.g. and among others corporate R&D budgets, CVC budgets, Corporate Licensing budgets, Internal Incubator budgets, IP budgets; etc.… Each component is judged on its own merits (cost/performance) and there is (as far as I know) not a link that prescribes that if one goes up, the other goes down.
The second part of the question I really do not understand. General economic context and COMPANY A's corporate strategy determine of course the overall tendency to spend money on innovation but I am not aware that if my budget for investments gets increased that this automatically means less budget for R&D or Licensing.
I hope that answers the question but if not please give me a call to discuss.

Taken from Harvard Business Review: "Connect and Develop – Inside Procter & Gamble's New Model for Innovation"

"It is destined to fail if it is seen as solely an R&D strategy or isolated as an experiment in some other corner of the company."

The results from my analyses so far indicate that R&D and CVC are positively related and significant. Often though, when examining the data, I get the impression that bigger companies just raise their R&D expenditures every year while CVC investments are done on a much more irregular basis. Some years heavy CVC investments show, while a year later the CVC investments rapidly drop.

Question 3: From the text above it could be concluded that a lot of companies see R&D and CVC as two distinct methods of pursuing innovation. Should they separate these two modes of pursuing innovation

(separate innovation strategies) like they often do, or should they view these two ways as part of one overall innovation strategy? Please indicate why and how you do this within COMPANY A.

See above – at COMPANY A we feel we have many different tools (or methods as you call them) to pursue innovation – each serves its own purpose and is not in competition with the others but they all complement each other. Some objectives you can best achieve through venturing, others via internal R&D, and again others via acquisitions, or via in-licensing or internal incubator projects or NBD projects etc.
At COMPANY A Venturing we last year screened over 600 new start-up companies on their fit/overlap with COMPANY A strategy – in some we invested with venturing money, but with a lot more our businesses set up joined development projects or licensing agreements, etc. We count all of that as big successes for COMPANY A Venturing as a window-on-the-world tool – we in principle do not care whether our leads end up in an investment as long as they end up boosting COMPANY A's innovation in one way or the other.

Taken from Harvard Business Review: "Connect and Develop – Inside Procter & Gamble's New Model for Innovation"

"By 2000, it was clear to us that our invent-it-ourselves model was not capable of sustaining high levels of top-line growth. The explosion of new technologies was putting ever more pressure on our innovation budgets. Our R&D productivity had leveled off, and our innovations success rate – the percentage of new products that met financial objectives – had stagnated at about 35%"

Question 4: P&G say that companies that still only look internally for innovations will be outcompeted by the competition, or as they put it "adapt or die". Do you believe this is correct? Should companies stop only looking internally for innovations and broaden their horizon to external innovations also? Do you think CVC could be a good way to do this? What is the view within COMPANY A about this?
The COMPANY A view is that Open Innovation is no longer a competitive advantage but a competitive necessity. The world is too large and the number of developments too big for one company (any company, no matter how large) to innovate all on your own. So, yes, we believe that it is indeed adapt or die and are proud of our 'history of change' and adaptation and believe that that is one of the key reasons why we are still alive (and kicking) after more than 100 years in business and having started in coal mining in 1902.
And also yes I think companies should stop looking only internally for innovations – anyway an invention only becomes an innovation if there is a market that buys and accepts it and by definition you can not find that market and understand its needs without looking outside.
CVC is a very good way to contribute to looking outside but it is not THE way or the only way – you have to apply all possible tools dependent on the situation and context. CVC 'only' sees the world through start-up companies and VC market. Innovations/developments at SME's or universities, or at competitors or customers, etc. you will never find through CVC so you have to do more.

Taken from Harvard Business Review: "Connect and Develop – Inside Procter & Gamble's New Model for Innovation"

"We knew that most of P&G's best innovations had come from connecting ideas across internal businesses. And after studying the performance of a small number of products we'd acquired beyond our own labs, we knew that external connections could produce highly profitable innovations, too. Betting that these connections were the key to future growth, Lafley made it our goal to acquire 50% of our innovations outside the company. The strategy wasn't to replace the capabilities of our 7,500 researchers and support staff, but to better leverage them. Half of our new products, Lafley said, would come from our own labs, and half would come through them."

Question 5: In the text above P&G states a clear objective that 50% of all innovations should come from outside the company. What is your view on the balance between internal innovation and external

innovation (CVC could be a part of this)? Has COMPANY A a clear target on how many innovations should come from outside the R&D department?

I don't think we have such targets and I am also not convinced about the usefulness/effectivity of such targets – it runs the risk of suboptimal decisions between projects (i.e. choosing one project over the other) not because of an innovation portfolio management criterium like fit with strategy, impact on results, or whatever but simply because it will help reach the 50% target. Also it gives the impression that outside is better than inside and we prefer not to see these as competing but as complementing.
I do acknowledge that –especially in the beginning- such a target may help to focus/force people to look outside but I am not sure that that outweighs the risks I described above. We do not have such targets and we anyway have realized a culture that is open to outside innovation.

Question 6: Assume a company A used R&D investments as the sole method of pursuing innovation. However now, company A starts using a combination of R&D and CVC. What method could the director of company A use after a few years to compare which situation was best for the company? Does the balance between R&D and CVC (for example 30%-70%) influence the effectiveness of pursuing innovation? Please explain.

He can't compare because the two situations were in different time frames and different economic situations. PLUS: both R&D and CVC are relatively long term innovation tools – for a typical R&D started project/product to make it to the market and add to top and bottom line results may easily take 5-7 years. Before a venturing investment contributes to COMPANY A's top and bottom line result easily takes the same time.
An acquisition of a company with innovative products (assuming that that company is already selling products and profitable) will immediately contribute to top and bottom line. Does that then mean that acquisition is the better tool to innovate?

Just one final remark – I honestly feel that in your questions you assume a competition between R&D and CVC which is not or should not be there. The way we do CV at COMPANY A it can only work if we have R&D departments that support us in 1) scouting for new start-ups; 2) screening of new start-ups; 3) assessing the technical/scientific and IP position of new start-ups and 4) absorbing and using the relevant innovations at start-ups. The other way around our R&D people are supported by us because we find and alert them to new technologies/products that are relevant to their own ongoing R&D projects.

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