Investments in the Swedish Cleantech Sector

A Case Study of Swedish Public and Private Venture Capital Investments in Cleantech

**Authors:** Ying Yang  
Irina Sollén

**Supervisor:** Zsuzsanna Vincze

Student  
Umeå School of Business and Economics  
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Abstract

The ever-growing awareness of sustainable living brings us to Cleantech - a technology that aims to reduce pollution and enhance efficiency by developing environmentally friendly products and services. Investors nowadays claim they are moving towards investments incorporating CSR and ESG issues, which is closely connected to Cleantech investments. As a growing sector, the most concerning issue is the financing. Since Cleantech was introduced around 2006, the market has seen investors with different profiles. Among them venture capitalists (VC) have played a vital role in supporting Cleantech growth. It is noticeable that state-owned VCs, together with private VCs, have been actively participating in Swedish Cleantech investments. This study sets out to evaluate how public VCs differ from private VCs in terms of investment strategies, in Swedish Cleantech context. The results of the study aim to give an understanding of roles of different VCs in investment evaluations, which affect the decision making of their Cleantech investments.

Through Cleantech Scandinavia’s database we have collected information regarding previous investments made in Swedish Cleantech between 2007 and 2011. The results showed that public VCs and private VCs had similar stage preferences, focusing at seed and commercialization stages with little touch on expansion stages. The co-investing activities were mainly targeted at energy related segments in Cleantech. Based on this rough understating about Swedish Cleantech investments we conducted semi-structured interviews with 11 VCs, both public and private, to gain a deeper understanding on their investment strategies.

We found that the difference between public and private VCs lies merely in the sense that public VCs operates under governmental guidelines, which they have to comply with when making an investment decision. The majority of the public VCs must co-invest with private investors, which opens a door for private VCs seeking co-financing for Cleantech projects. Particularly public VCs with a regional focus work under both local governments’ and EU’s regulations, which make them restricted to some degree. On the contrary private VCs have the freedom to decide whatever they want under different circumstances. Apart from that, public and private VCs share a great deal of similarities in their investment strategies and evaluations in Cleantech investments.

Key words: Venture Capital, public, private, Cleantech, investment strategy, evaluation, Sweden
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Ying Yang                      Irina Sollén
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1 INTRODUCTION

The first chapter will be a presentation of the background of our research regarding Cleantech as an uprising investment industry and various investment capital structures. Then we will come to our research question and research purpose through the problematization of the issue. Knowledge gap and limitations relevant to this study will also be included.

1.1 Problem Background

1.1.1 The rise of Cleantech

We are writing this thesis with the support from NEFCO (Nordic Environment Finance Corporation), which was established in 1990 by five Nordic countries: Sweden, Norway, Iceland, Finland and Denmark. They have invented various instruments including funds for environmental and industrial sectors in order to generate a positive environmental impact by financing projects in the Baltic Region. NEFCO is considering making investments in the Cleantech sector, primarily in Russia, Ukraine and Belarus, where Cleantech companies, services, and know-how would be exported abroad. Since the market for Cleantech is unknown for NEFCO, our task is therefore to analyze the possibilities in it. NEFCO have supported us along the way, helping us to get in contact with some of the key actors, and financing our trip to Stockholm, where we could meet venture capitalists (VCs hereafter) in person and get a deeper understanding of the Cleantech sector.

Change in climate conditions all around the world create a need for an innovative technology that makes it possible to decrease production costs and more efficiently utilize already scarce resources. The solution to upcoming environmental challenges might be Cleantech, which refers to “products or services that improve operational performance, productivity or efficiency while reducing costs, inputs, energy consumption, waste or pollution.” (Swedish Institute, 2011, p. 3) Cleantech offers a wide variety of products, services and business models that intend to reduce negative environmental impact, using new and efficient methods. The Cleantech industry includes sectors such as renewable energy, biofuels, water and air quality, waste management and infrastructure. Over the years sustainable living has been a global topic and in order to meet the demand for technology development, it is important to consider whether there is enough financing.

1.1.2 Swedish Investments in Cleantech

In the year 2009 Cleantech investments reached SEK 1,031 million in Sweden, representing up to 9% of the total venture capital investments during that year. Although the total amount of investments declined compared to 2008, Cleantech was a competitive sector in the market in relation to other industries since it increased its portion on the venture capital market from 5% to 9%. (Swedish Energy Agency, 2010, p. 5) This growth is seen as great potential for Cleantech investments in Sweden because of the increased
proportion of investments despite the financial crisis. The Swedish Venture Capital Association (SVCA henceforth) claimed that Swedish venture capital started to recover from the crisis. (Swedish Energy Agency, 2010, p. 5) In this sense the Swedish Cleantech market was similar to the one in the U.S, where Pernick and Wilder (2009) argued that Cleantech continued to grow with promising revenues against the backward global economy. (Pernick & Wilder, 2009, p. 14) The continuing growth trend in investments, along with upstream performance comparing to other sectors during crisis, showed a great market potential for Cleantech investments.

In addition, a global survey conducted by Ernst & Young showed that investors are thinking highly of the Cleantech market, with 41% of the respondents’ investments allocated to Cleantech on average (Ernst & Young, 2009, p. 11). This indicated the worldwide trend of investing in Cleantech at the time: 35% of the respondents involved in corporate development investment expressed an intention to invest in Cleantech the following year, while 44% intended to invest in the following five years. (Ernst & Young, 2009, p. 11)

Among the world’s leaders in renewable energy, Sweden remains a strong player on the European market, where almost 45 % of energy is produced using renewable sources, completely independent of oil, coal, and natural gas. (Swedish American Chamber of Commerce, 2011; Molland 2012) Sweden’s ambition is to increase its share of renewable energy to 50% in year 2020, and the nation intend to reach their goal by pouring more investment into research and development and encouraging consumers to be more environmentally friendly by raising taxes for those who utilize carbon dioxide energy and eliminating the taxes for carbon dioxide free fuel (Swedish American Chamber of Commerce, 2011).

The demand for innovation is growing, and more countries are entering the race for renewable energy, which means the competition is getting fierce. During 2011-2014 the Swedish government is planning to allocate 400 SEK million to finance companies in the early stages that are involved in research and the improvement of environmental technology and have a desire to enter international market. (Kajembren, 2012)

Governmental support is only one of many techniques used to finance Cleantech projects in the developing stages. Other financing mechanisms include business angels, private equity and bank loans. Business angels primarily invest and provide entrepreneurial knowledge for companies in the early stages and their investment in Cleantech has increased from 8% in 2008 to 17 % in 2009 (Arvizu, 2010). Private equity consists of two sectors: VCs who usually provide capital in the early- and growth stages, and buyouts which are investments in the later, more mature phases. Between 2007 and 2012, 872 SEK million out of a total 31 SEK billion per year of venture capital investments were allocated into the Cleantech sector according to Growth Analysis (2012). Venture capital investment has declined between 2007 and 2009 from 886 SEK million to only 424 SEK million, especially in the seed company development, but has increased since 2010.
Growth analysis (2012) pointed out that the decline in investments from VCs could be explained by an increase in risk aversion after financial instability in 2008, and weak market prospects. In an interview with eight VCs in 2012, Growth Analysis outlined the main obstacles that complicate the investments. First of all, they mention that the returns in the Cleantech sector are not higher than in any other sector, but the risks are greater. Another barrier is that governmental regulations and policies have a great influence on Cleantech investments, for example as we mentioned previously the tax on carbon dioxide has an extremely strong influence on return of the investment. Cleantech is a capital-intensive investment, and some companies simply do not have sufficient funds to enter the investment. Besides that, investing in Cleantech is a long-term investment, which involves high development costs and eventually higher risk. (Growth Analysis, 2012)

According to Nordic Cleantech Review the investment in Cleantech in 2011 remained healthy and the amount of deals remains the same, but private equity investment declined dramatically, from EUR 384 million in 2010 to only EUR 117 million in 2011. Nordic Cleantech Review stress the importance of venture capital needed for the industry to succeed, but they also recognize that there are many start-ups that remain unseen. Most of the companies that need financing are in the seed stage, the development cycle are longer, and VCs might not want to take on that amount of risk or does not possess the patience needed, missing on valuable investment opportunities. They also mean that public investment is compensating for decreasing private investment and could be the best option to fund the companies that are not yet mature. (Brown, 2012)

1.1.3 Problem discussion

It is evident that private investments in the Cleantech sector are declining due to high risks related to investments (Growth Analysis, 2012). Adestam et al. (2008) discussed how VCs deal with and reduce various risks that apply to Cleantech investments in general; these are agency risk, business risk, and innovation risk. The authors came to the conclusion that it is only possible to reduce risk to some extent and primarily by carefully monitoring the activities of the entrepreneurs (Ademstam et al., 2008). It is evident that nowadays investments in Cleantech face a crisis of declining capital, especially after the financial crisis of 2008. The Swedish government’s ambition of encouraging innovations to promote sustainability and achieving goals of being a more environmental friendly nation would only be a daydream if not enough capital is on the market to support technology research and developments. The increasing budgets from the government is insufficient to meet the enormous demand for innovation growth, there must be other sources of financing to participate in the market, for instance VCs, to stimulate the market. It creates a win-win situation, if the Cleantech product or service is successful on the market; the investors are also embraced with considerable returns.

Nonetheless Cleantech remains promising but also a mysterious sector for investors.
What would be an appropriate research to deliver a general understanding for investors who are new in Cleantech? What type of information is appreciated for them to assess this investment opportunity? What tools should they use in such evaluations? By considering these questions we come to narrow down the scope of our research to discussion of various investment strategies in the Cleantech sector, and we intend to bring in new knowledge for a better development of the sector.

1.1.4 Knowledge Gap

Entrepreneurial finance includes quite a rich body of literature associated with venture capital, the investment process of VCs (Tyebjee & Bruno, 1984), the structure of VC organization and the factors influencing the industry (Sahlman, 1990; Jeng & Wells, 2000), agency relations between VCs and entrepreneurs (Sapienza & Gupta, 1994, Eisenhardt, 1989), market and performance tools for evaluation of the investments (Black & Gilson, 1998, Kaplan & Schoar 2003, Ljungvist & Richardson, 2003).

However, very few scientists/scholars distinguish between state-owned and privately held venture capital. Some argue that governmental involvement is necessary for VC industry’s success (Lereux & Surlemont, 2003; Lerner 2002), others discuss the complications that could arise from public involvement, such as misallocation of the capital in the VC industry (Cumming & MacIntosh, 2003) as well as changed investment patterns towards less risky investments (Buzzacchi et al., 2012).

1.2 Research Question

Having stated our research background, our research question is:

*How do investment strategies and evaluation methods differ between public and private Venture Capitalists in the Swedish Cleantech Sector?*

1.3 Research Purpose

A large percentage of start-up businesses are in need of external investments, especially those incorporating with high technologies. Thus drawing the connection between investments and technology projects is clear in a way that without financing, there is a very limited chance that these projects can become a reality. Pettersson & Nilsson (2012) argued in their thesis that venture capital may be the only realistic funding opportunity for Cleantech entrepreneurs. However venture capital can be funded by the state and by the private actors, and there is insufficient amount of scientific literature on that matter in the Swedish market. Our research purpose is to fill in this knowledge gap and to give an understanding of the different roles that public and private VCs have when it comes to the Cleantech sector.

1.3.1 Theoretical

We hope that by conducting this research and filling in the research gap, we would be
able to bring contributions to the academic research area. New knowledge that our thesis could contribute with would be regarding how public and private VCs differ in terms of their investment strategies. We also believe that investments strategies could have an influence on their evaluation methods and decision-making.

1.3.2 Practical

We also intend to introduce practical knowledge to the investors. In order to achieve this goal we will connect our theoretical and academic findings to the practical issue, thus providing an analysis that would find a both academic reality contribution as well as a real life solution. Currently within the Nordic region there are many institutions and organizations working to strengthen the ties between investors and Cleantech companies, such as Cleantech Scandinavia (CS hereafter), Cleantech of Sweden and so on. We hope that through our research, we could pass on a beneficial message to both existing and potential Cleantech investors on the understanding of different investment methods. Subsequently helping in promoting investment in Cleantech will bring us a better sustainable world to live in, for environmental concern grows as one of the biggest challenges for the modern society.

1.4 Delimitations

In this study we delimit ourselves to only analyzing the Swedish market, instead of the whole Scandinavia. Due to the time constraint it would be difficult to analyze and get in contact with VCs from five Scandinavian countries. Solely targeting Sweden will allow us to go into more depth when it comes to Cleantech investments, rather than touching the surface among five countries. The sample we chose for our analysis consists of mix of VCs, both large and small, beginners and experienced, therefore we believe this sample could be generalized to represent other Swedish venture capitalists that invest in Cleantech. Since our purpose is to see the difference in investment strategies between public and private VCs, we will not be investigating other financing actors, such as: business angels, buyouts, pension funds and other financing institutions.
1.5 Disposition

CHAPTER 1 INTRODUCTION - In this first chapter we present our research background, problematization in connection with our research purpose, and eventually arriving at our research question.

CHAPTER 2 THEORETICAL METHODOLOGY - Here we set up the methodological framework of our scientific research. Discussions regarding the design and our adopted methods will be held, taking into account our research question and research purpose.

CHAPTER 3 THEORETICAL FRAME OF REFERENCE - In this chapter we present our theoretical framework. Firstly Cleantech and venture capital investments will be discussed separately. Then we explain how VCs’ investment analysis and decision making works. The chapter ends with a summary with our own understanding and the relevancy of using these theories for our study.

CHAPTER 4 PRACTICAL METHODOLOGY - Continued with the theoretical methodology we introduce the practical action plan for data collection. Together we will give rise to a discussion regarding credibility and ethics in business research.

CHAPTER 5 EMPIRICAL EVIDENCE - Based on the methodology chapter we will implement our research. In this chapter we will explain how we decide on the chosen sample, how we collect all relevant data as well as the structure of our study making it closely connected to our research question and serve our research purpose.

CHAPTER 6 ANALYSIS AND DISCUSSION - Using our research findings we will try to interpret the results in relation to our research question and explore the possibility of come to a conclusion based on previous theoretical studies.

CHAPTER 7 CONCLUSION - In the last chapter we will answer our research question and explain the practical as well as academic contributions of this research study. Further research suggestions will also be included.
2 THEORETICAL METHODOLOGY

In this chapter we give a presentation of what scientific methods we chose to design our research study, concerning data collection and analysis methods. By providing a thorough discussion about our chosen approach, we argue for the reliability of this thesis.

2.1 Presumptions

We realized that for our research study, the main focus is to understand the investment strategies in the Cleantech sector in Sweden from different perspectives based on the investors’ types. In order to explore this field, previous understandings from our courses at Umea University were set up as our knowledge base. Thereafter we brainstormed all possible theories and relevant technics we have acquired so far to accomplish this task.

For a sector as Cleantech, which is largely dependent on governmental regulations and the speed of innovation, it could be really hard to draw conclusions and predictions that would suit into any situation and time period. Hence in that sense our study would be rather limited in the scope of time period and geographical location. Through the years of development Cleantech has faced many challenges along the way, and financing could be one of the major obstacles.

We are writing with the support from NEFCO, a financial cooperation that intends to draw connections through its networks among Nordic countries, thus the practical value generated from the thesis is of great importance. The empirical results of the study are hopefully beneficial to their new era of investment in Cleantech using private equity instruments. While at the same time we have always kept in mind the academic nature of this research study and the implementation of the research in a scientific manner.

2.2 Research Philosophy

Bryman & Bell (2007) argued that to understand the nature of business research, the research could refer to a list of questions regarding the aim, expected result, the organizational or social impact, the audience, and the academic development (Bryman & Bell, 2007, p. 6). Therefore when we construct our research question, we are aware of the issues that describe the characteristics of a business research, so that it serves the good nature of scientific research.

Our starting point at this part would be the two major streams within research methodology: epistemology and ontology. As Saunders et al. (2009) suggested, the best way to think through the research philosophy is to start with pragmatist philosophy which states that the most important consideration through the process is the research question (Saunders et al., 2009, p. 109).

When we start off we first come to the issue of epistemology. It concerns the question of
what defines knowledge as acceptable in a discipline (Bryman & Bell, 2007, p. 16). Ryan et al. (2002) stated that the central issue under epistemology is to determine how we could obtain knowledge as Plato defined as “justified truth belief” (Ryan et al., 2002, p. 11).

### 2.2.1 Epistemology

There are two branches under epistemology: positivism and interpretivism. The principle of positivism is to be in a position that motivates the adoption of using natural science methods to study social reality. It can both entail a deductive and inductive study, as well as distinct difference lying between theory and practice (Bryman & Bell, 2007, p. 16). By taking a positivistic view the researcher can only produce credible data by taking phenomena he/she can observe (Saunders et al., 2009, p. 113). This means that the positivism mechanism leans over to a “seeing is believing” philosophy that only observable phenomenon can lead to credible results that create generalized laws or principles.

On the other hand, interpretivism is the contrary epistemological stance to positivism. It holds the view that the way social scientists interpret the matter is different from natural scientists. Subjective meaning of a social action usually takes into consideration the difference between human behaviors against natural phenomenon. The major concern under interpretivism is that researchers tend to focus on the differentiations in human interpretations and intend to put interpretations, which have been stimulated under social scientific scheme. Furthermore social science researchers stress on the fundamental difference between social science and natural science that epistemology is vital, where the interpretivism researchers try to understand human behaviors and phenomenon according to their own prescriptions of the world. And their interpretations will go into circles where others will interpret based on their disciplines. (Bryman & Bell, 2009, pp. 17-21)

The emphasis on interpretivism is therefore on doing research among human beings instead of studying physical objects such as computers and trucks. The crucial part of interpretivism philosophy is that researchers adopt an emphatic stance, where they are challenged to put the research subject in the social orientation and try to understand from their point of view. It is argued that interpretivism is highly suitable in case of business and management researches since such studies are usually involved with complex business situations (Saunders et al., 2009, p116). This implies that due to the high degree of human involvement in business research, interpretivism is more appropriate for understanding human behaviors and phenomenon.

Naturally when it comes to our research question, interpretivism fits more in our study. What we do is not based on a natural phenomenon in the world, which is not manipulated or affected by human behavior. Instead we are studying a social phenomenon, which is affected by human decision-making. Furthermore the final result and conclusion will not apply to worldwide situations but rather limited to certain
degrees. As our study is within the field of social science, we are not using general laws that are applicable to every situation as one does in a natural science study. What we use in our study as theories and arguments are to a large extent dependent on the authors’ own beliefs and interpretations of the discipline.

2.2.2 Ontological Considerations

The center issue of ontology is to determine whether social entities can and should be considered objective entities, or they can and should be considered social constructions. Here two main positions are frequently discussed, namely objectivism and constructionism (Bryman & Bell, 2007, p. 22).

Objectivism implies that social phenomena and their meanings are independent of social actors. It means that what we use in daily routine as social phenomena and its classes have an existence that is independent from each actor within the orientation (Bryman & Bell, 2009, p. 22). In other words, the objectivism position asserts that social entities exist in reality external to social actors (Saunders et al., 2009, p. 110). Taking this as a standing point, the objectivism point of view suggests that the existence of social entities is a barely phenomenon that is not influenced by other players. And there is no such thing as inter-connections that would lead to impacts over the being of certain phenomena. Our study, however, does not fit into objectivism since the significant influence of investors and fund managers on the past investments made it impossible to ignore how closely the investments and human behavior are connected to each other.

On the contrary, constructionism denotes that social phenomena and their meanings are continually fulfilled by social actors. To expand this definition, one could come to the notion that researchers always represent a specific perspective of social reality. The terms stressed on the importance of social interaction to the existence of social entities, which are constructed in a constant state of revision (Bryman & Bell, 2007, p. 23). That is to say constructionism adopts the view of how social entities exist as the way they are today is due to the social actors’ influence on a continuous basis. Constructionism can also be sometimes referred to as subjectivism. Saunders et al. (2009) explained the term social constructionism by giving an example of studying customers in a certain environment. They suggested that social actors, which can be viewed as customers in this case, might give different interpretations in the situations where they find themselves. Therefore not only customers integrate with their own environment, but also try to make sense of their interpretations of the event and the meanings from such events (Saunders et al., 2009, p. 111). This is similar to our case that we could think of investors as customers. Public VCs may have different interpretations for investing in Cleantech, for their participation in Cleantech investments can be seen as the integration with the investment environment. Thus social constructionism is more suitable for our research.

Through the debates in social science studies, ontology has been a main issue towards methodology. The essence of ontology lies in the degree of viewing human nature in
relation to reality. Morgan & Smircich (1980) used a scale line to illustrate the network between subjectivist and objectivist approaches in social sciences. They proposed that an extreme objectivist view reality as a concrete structure whereas an extreme subjectivist regards it as a projection of human imagination (Morgan & Smircich, 1980, p. 492). It made easier for researchers to identify which research method they could use by taking perspectives in subjectivist or objectivist scale, in a way closely related to epistemology philosophy.

We are inclining towards the constructionism approach for this research study. Consistent with our choice of interpretivism under epistemological philosophy, we believe that our research is very much influenced by social actors and their interpretations and actions to create meanings for their situations. To break down the philosophy code, we intend to analyze the difference between public VCs and private VCs in terms of investment strategy and evaluation methods towards Cleantech. To simplify this, we can say that people is the driving factor of these investments. For instance portfolio managers have their own understanding in operating the funds, which would in turn affect the outcome of the portfolio.

The research question investigates the investment strategies that would affect investments. This is also the human factor under constructionism that investors may have distinct opinions towards investing in Cleantech sector, which may have an impact on the amount of investments thus the size of the portfolio. Hence to conduct our study we are aware of people’s various interpretations that are contributing factors to our results.

2.3 Research Approach

Following the analysis of research philosophies, particular research approach should be assigned to them. Two different theories exist in this regard. The deductive theory represents the common view of a scientific study concerning the relationship between theory and research. The research aims to deduce a hypothesis from a particular theoretical domain that already exists and test it through empirical evidence (Bryman & Bell, 2007, p. 11).

There are several important characteristics of a deductive research. Firstly it contains the desire to establish casual relationships between variables by using quantitative data. Then the hypothesis is formulated for testing, through structured methodology, which makes it possible to implement replication (Saunders et al., 2009, p. 125).

The major difference between inductive theory and deductive theory is the process of theory and observations. For an inductive process the theory comes as a result of observations, whereas the deductive process is reversed. To approach data analysis and theory generalization for inductive researchers, grounded theory is one of the ways but not always (Bryman & Bell, 2007, p. 14). A special focus of an inductive research could be the context where the event takes place, where a small sample is used instead of
quantitative data to make appropriate design (Saunders et al., 2009, p. 126).

There are no ready theories that we could draw hypothesis from according to our literature review. For now we are not able to start with a hypothesis to test. In contrast we aim to analyze whether various players on the market differ in terms of investment strategies and evaluation methods when making investments in the Cleantech sector. Thus the inductive theory would be more suitable for us as we start with empirical findings to reach at a theory.

### 2.4 Research design

The process of a research design is expected to set up the framework for data collection and analysis, which is facilitated by choosing the research method that, implies the technique for collecting and analyzing data (Bryman & Bell, 2007, p. 40). Along with choice of research design, the three prominent criteria will be examined, which are reliability, replication and validity. To review our research question and research purpose gave us a better understanding in formulating research design. Saunders et al. (2009) suggested that the research design should be based on objectives derived from research questions, which in turn lead to data collection methods, limitations analysis, and ethical concerns (Saunders et al. 2009, p. 137) Because of this our research questions and purpose will serve as the major reference in establishing our research design.

Based on this mix of types of research philosophies, our method is leaning towards qualitative one considering the three main features for qualitative research according to Bryman & Bell (2007):

- Inductive view where theory is generated from findings
- Interpretivism in epistemological position
- Constructionism in ontological position

(Bryman & Bell, 2007, p. 402)

We are not concerned by the quantity of data we are able to collect for this research, rather we are more interested in doing a detailed study to create a relevant framework for evaluations of such investments. Therefore we chose the method of constructing interviews since they are the mostly exercised method in qualitative research (Bryman & Bell, 2007, p. 472).

Ritchie & Lewis (2003) argued for the advantages for taking interviews are as follows:

- Detailed investigation on personal perspectives
- In-depth understanding of context
- Detailed subject coverage
- Particularly suited for research in requirement of complex processes and experience

(Ritchie & Lewis, 2003, pp. 36-37)

Based on the advantages of interviews, we think that since investment is a rather
complex issue and we try to gain a deep understanding of investors’ previous experience with Cleantech, the interview design stands out from various methods. It fits our research purpose and also adds strength for our data collection. Unlike surveys or questionnaires, which are commonly used in marketing, the interview gives researchers more opportunity to ask a question “why”. Surveys mostly explore how variables are distributed, where researchers could easily use the collected data to meet comprehensiveness, diversity and lack of bias given the response rate is satisfying (Richie & Lewis, 2003, p. 90). In our study we wish to gain thorough understanding of for example, the investment process, which requires more personal communications. This cannot be achieved solely by using surveys.

2.5 Research characteristics

The most common classification for research purpose into research method is threefold: exploratory, descriptive and explanatory. An exploratory method is adopted when the researcher wishes to discover what is happening, to ask questions and assess phenomena in a new perspective. Often when the researcher is unsure about the nature of the research or attempt to specify the interpretation of the problem, he/she would turn to exploratory research method (Saunders et al., 2009, p. 139). In our opinion, our research suits for exploratory research, as there is no previous studies or hypothesis we could compare to, not to mention that the answer to our research question could be hardly predicted. The venture capital market in Sweden has not been much explored by researchers using English/Swedish as their research language, further the term Cleantech only came into use during 2007. Thus we have a relatively new phenomenon to research on, which makes it exploratory study.

Literature search, conducting interviews with specialists as well as doing interviews with focus groups are the three principle ways of planning an exploratory research (Saunders et al., 2009, p. 140). Clearly interview was our choice here because we want to grasp a deeper understanding from the investors’ perspective. Before the major data collection, literature search is needed to establish a theoretical framework for our study. Details about our literature search will be discussed in section 2.7.1.

In addition, descriptive study could be seen as a forerunner to exploratory study since it is sometimes necessary to have a clear understanding of the phenomena before the collection of data (Saunders et al., 2009, p. 140). Thus our research is also of descriptive characteristic, as we try to use statistics to get hold of the landscape of Cleantech financing prior to interviews.

2.6 Research strategy

A cross-sectional design consists of data collection from more than one case at a single point in time with a quantitative or quantifiable data characteristic, in order to identify patterns of association (Bryman & Bell, 2007, p. 55). It implies that by using a cross-sectional design, the research is expected to yield results from variety of data,
which will indicate distinct patterns in the result. When choosing from the different types of research design, the cross-sectional design became our best fit. As our research question comes to investment strategies used for Cleantech investments by public VCs and private VCs, in terms of investors’ profiles and risk impacts, we think that the answer to this question exists within a number of various relationships. In order to do so we plan to investigate these relationships through the interviews with investors, as it is a common form of research strategy for cross-sectional design (Bryman & Bell, 2007, p. 59).

It can be difficult to determine whether it is better described as a case study or cross-sectional, for investigations are based upon both quantitative and qualitative research. (Bryman & Bell, 2007, p. 63) Ragin & Becker (1992) suggested two key dichotomies in how cases are conceived:
1) Whether it involves empirical units or theoretical categories. Where a realist thinks of cases as either given or empirically discoverable while a nominalist takes the opinion of cases as consequences of theories or of conventions.
2) Whether the cases are considered as general or specific. The cases of qualitative research tend to unite as specific categories because the course of research through for instance, in-depth interviews. (Ragin & Becker, 1992, pp. 8-9)

Our research can also be described as a case study based on these two dichotomies, that by taking the view of realist we think of our research as a discoverable phenomenon existing on the social arena, specifically about investments in the Swedish Cleantech sector. However the realist perspective is only applicable for our secondary data where investments information regarding amount, year, segments etc. is tracked. For investment strategies towards Cleantech we take a constructionism stand as we discussed under section 2.2.2. The reason for this is that people have different risk profiles, which affect their investment strategies and decision-making. Therefore investors have an influence on these investment deals, and have shaped the way these deals look like today. Hence the combination of realism and constructionism gave us more space to explore the subject, and not contradictory with each other. To answer the question in qualitative social science “What is this- the research subject- a case of” as suggested by Ragin & Becker (1992), we were able to put the specific category on the case study for our research design. That “Swedish public and private VCs are a case of investment strategy in the Cleantech sector”.

Yin (1989) discussed distinctions between single case study and multiple case study where primarily the researcher needs to decide which one to use in order to address the research question (Yin, 1989, p. 46). Our research question seeks to analyze whether public VCs and private VCs have a difference in investment evaluations therefore it is a single case of VC investing in Cleantech in Sweden. Furthermore, there are three rationales for conducting a single case study: one being that the single case could greatly contribute to knowledge and theory building (Yin, 1989, p. 47). As we are taking an inductive approach and defined our methods as exploratory, we choose to adopt a
single case study, since it helps us with theoretical contributions. Yin (1989) suggested that an embedded case study design is used when, for instance, the analysis may comprise results from subunits of the subject (Yin, 1989, p. 49). Since our case involves two units of analysis, i.e. public and private, we use the embedded case study design.

2.7 Secondary Data

Apart from our primary data from interviews, secondary data is also an important part of our research. As we argued in section 2.6 on research strategy, we use both qualitative and quantitative data collection techniques but together the study stays exploratory. Therefor it is important for us to address the combination of primary data and secondary data.

Secondary data can be divided into three categories: documentary, multiple source and survey. Written materials, as a sub-category of documentary could be, for instance, organizations’ databases which contain information that the organization has collected for their own business purposes. Documentary secondary data are often used together with primary data in research projects. Multiple sources could refer to books, journals, governmental publications and so on. (Saunders et al., 2009, pp.258-259)

For this research, we use both documentary secondary data and multiple sources. The documentary data come from a CS’s database which consists of previous investment deals made in Scandinavia, which we got access to due to support from NEFCO. Multiple sources imply the theories we have used to build up our theoretical background, which this study is based on. As we discussed in section 2.4 and section 2.5, we use an inductive approach that we hope to create a theory instead of testing one, and the research is of exploratory nature. Thus in the theoretical chapter we bring in the factors that are relevant for our research, with a summary in the end of the chapter that helps to connect everything together. We are using documentary secondary data to describe a situation. We intend to use the combination of both primary and secondary data.

2.7.1 Literature Search

Theoretical framework is crucial to our research as it not only sets up the base for our line of arguments, but also guides us through the amendments of research question and research design, analysis in data collection methods (Bryman & Bell, 2009, p. 94). The literature search would equip the research with possible theoretical knowledge regarding the field of study. Further as we found a number of previous study and theories related to our studying, it is vital to screen down what we believe are valid opinions that are suitable in our study.

When we first come to discussions regarding our research question, we have naturally referred to our previous course textbooks to look for inspirations. This goes in line with Bryman & Bell (2009) suggestions in the beginning of working on the thesis. Further they proposed that “a literature search relies on careful reading of books, journals, and reports in the first instance” (Bryman & Bell, 2009, p. 107). The focus of this process
lies in the matter of finding keywords to set up boundaries in the chosen research area, which serve as parameters to identify suitable references in electronic search engines (Bryman & Bell, 2009, p. 112).

Since we were trying to detect Cleantech investments in form of private equity, we firstly reviewed our knowledge in investments analysis and various types of asset class. Thereafter we used Google Scholar and Google to find information in both academic nature and establish basic grounds for the knowledge about Cleantech, which is a relatively new term, which only came to rise during the last decade (Cleantech Group LLL, 2013). Through this general search on the Internet, we were able to get hold of some valuable reports from for instance, the Swedish Energy Agency, which illustrated important figures regarding Cleantech investments. Reports from Growth Analysis, European Venture Capital Association, and Swedish Venture Capital Association also helped us to draw a general picture and gather inspirations for our research.

In order to get hold of previously published work in the field, we turned to Umea University Library’s database: EBSCO Business Premier Elite. We primarily used this database by using different combinations of keywords, such as Cleantech + investment, Cleantech + private equity, Cleantech + venture capital. In addition to understand better measurements regarding evaluation of performances, we also used keywords state owned + venture capital. By using these keywords we also came to a number of scientific journals and periodicals that consists of news and trends within the Cleantech sector, as well as recent findings that are valuable as a basis for our research study.

### 2.7.2 Usage of CS database

According to Bryman & Bell (2009), a secondary analysis is the analysis of data by researchers who have not been involved in the data collection process (Bryman & Bell, 2009, p. 326). This exactly matches our case since the collection procedure was executed by Cleantech Scandinavia, not us. As a company with special focus in Cleantech, we believe their dataset is of high quality, which makes it an advantage for us. Bryman & Bell (2009) described high quality as a key advantage of secondary analysis that dataset brings out possibly geographical spread for researcher. (Bryman & Bell, 2009, p. 328) The CS database itself captures the majority of investments within Cleantech sector in Nordic countries, though it is impossible to know every single deal since many of the investments are made by private investors (Personal Communication, April 2nd, 2013). Since our research question entails a focus in Sweden, which is geographically a part of Scandinavia, the database is of highly relevance to our research. The database makes a solid source for our research analysis because we intend to use secondary data as complementary to primary data. It means that the secondary data presents a phenomenon, which we use as a starting point for making research propositions, while primary data from interviews will be main results to answer our research question. Another advantage for us is that by using secondary analysis, we have an opportunity for longitudinal analysis, which makes it possible to chart trends and connections over time in some cases. (Bryman & Bell, 2009, p. 331)
2.8 Secondary data criticism

The usage of documentary secondary data surely added benefits to our study, since it provided us with solid evidence about Swedish venture capital investments in Cleantech. It is reasonable to judge the database provides a valid representation of Swedish venture capital investments. Bryman & Bell (2007) suggested four limitations of secondary data analysis: the lack of familiarity with data, the complexity of the data, no control over data quality and absence of key variables (Bryman & Bell, 2007, pp. 334-336) This is consistent with what Saunders et al. (2009) described as suitability criterion, where they referred to measurement validity as one of the most important criteria and coverage (Saunders et al., 2009, pp. 273-274). Due to these limitations, we had contacts with a manager of CS, who explained to us thoroughly the usage of the database from which we gained familiarity with how to use the data the way we wanted to.

It is rather evident that our study has a focus on venture capital investments and the Cleantech sector. The difficulty we find through our literature search is that both the definitions of venture capital and Cleantech are underlying myth. For example what American literatures refer to as venture capital can be different from how the term is perceived in Europe. Additionally how venture capital functions in different countries, even in European countries, could have both resemblances and variance. As we have a focus in Sweden we tried to use theories we found through literature search under caution that the case for Sweden may be altered. However it is impossible to say that countries have nothing in common at all. Therefore we made an effort to create a picture by using sources that make relevance for the case of Sweden.
3 THEORETICAL FRAME OF REFERENCE

In this chapter we present key theoretical backgrounds that support our research such as Cleantech development in the perspective of entrepreneurs and investors, and funding structure of technology based projects. By the end of the chapter we try to pull the thread between theories and our research question.

3.1 Cleantech with Corporate values

3.1.1 Defining Cleantech

Cleantech may be a frequently used word to describe the upcoming investment sector in the financial world, which has a rather vague definition. This is not surprising since the concept of Cleantech is relatively new. Clean technology, or Cleantech, refers to a product, service, or process that creates significantly less waste than traditional mechanisms. (Pernick & Wilder, 2009, p. 2) Valdmaa & Kalvet provided a better illustration where Cleantech refers to the environmentally friendly technologies aiming to reduce or eliminate pollution and waste while improving effective use of natural resources (Valdmaa & Kalvet, 2011, p. 8). It is somewhat clear that Cleantech covers a variety of instruments that are highly advanced and innovative for providing better solutions to numerous types of environmental issues. Or as Pettersson & Nilsson describe it, Cleantech is an umbrella term to describe process of creating and using tools to transit the world away from waste (Pettersson & Nilsson, 2012, p. 21).

It could be concluded that Cleantech consists of many sub-operational industries. However generally speaking, there are four main segments (Pernick & Wilder, 2009, p. 3):

- Energy
- Transportation
- Water
- Materials

A few examples of products and technologies that are involved within this area are wind power, biofuels, advanced lithium-ion batteries and solar photovoltaic system. (Pernick & Wilder, 2009, p. 3) The innovation is growing and developing every day, thus today’s top trend is unlimited which makes it a diverse business. Cleantech Group has detailed taxonomy of the industry verticals into 13 sub-categories:

1. Agriculture
2. Air & Environment
3. Energy Efficiency
4. Biofuels & Biomaterials
5. Energy Storage
6. Solar
In addition, Cleantech Group has made a statement that Cleantech distinguishes from the old fashioned term ‘Green tech’, which was popular during 1970s and 80s. The latter was only a representative for small market driven business whereas the former is based on productivity purchasing resulting in broader market economics with better financial upside and sustainability (Cleantech Group LLL, 2013). Pernick & Wilder (2009) also introduced Cleantech by tracing it back to the 1970s when Cleantech was regarded as “alternative” at its early phase of development thus costly to operate, which was also due to the lack of governmental support. Therefore, we could view Cleantech as the adult version of green tech, which explored and developed its skills in more areas. It serves for specific purposes (Cleantech Group LLL, 2013):

- Provide superior performance at lower costs
- Greatly reduce or eliminate negative ecological impact
- Improve the productive and responsible use of natural recourses

However, investors’ opinion towards the term ‘Cleantech’ could vary a great deal because of their genuine preference of investing, and it could be hard to define since it is a broad term thus obtaining such a thorough overview of the categories as Cleantech group did is rather difficult. Not everyone could be an environmental technology expert, but one could have a better understanding throughout the investment process. For instance, when asked about “What Cleantech is?” in an interview in 2010, Peter Grubstein, who was a pioneer in investing in Cleantech mainly described alternative energy and pollution abatement sector, which were the major sectors his business invested in (Grubstein & Euchner, 2010, p. 41). Whereas Cleantech Inn Sweden stressed the importance of sustainable development in their definition that Cleantech stands for “solutions that drive for sustainable development for the society” (Cleantech Inn Sweden, 2013). As an investor it is vital to understand how to categorize an investment as Cleantech, so that particular cautions could be made in the investment evaluation. It can be regarded as a perspective that integrates social responsibility into the concept of Cleantech, which lead us to the social philosophies regarding investment decisions.

3.1.1 Sustainable environment vs. sustainable investment

Valdmaa & Kalvet (2011) referred to Cleantech industry as “arena where business interests and environmental awareness can meet through a mutually strengthening partnership” (Valdmaa & Kalvet, 2011, p. 8). This means that Cleantech is a
A combination of business and environmental projects, bringing both parties’ mutual interests together. Nowadays the trend in the business world is to make profits that would create environmental benefits at the same time. Over the years Corporate Social Responsibility (CSR) has been the hot topic among different types of business, which has been a pushing factor for enterprises to consider environmental issues of their businesses. Recently the uprising development of ESG, Environmental Social Governance has led alternative investments into a new perspective. According to a report by Center for Social Philanthropy in the US market in 2011, Cleantech is among others the biggest factor that managers incorporate ESG issues with focus on portfolio management, a leading number of 147 alternative investment funds adopted criteria related to Cleantech (C-SocPhil, 2011, pp. 8-9). This indicated a significant role of environmental concerns play to alter shape of financing instruments.

3.2 Private equity and Venture Capital

Equity refers to any invested capital in the company that is not a debt and consists of public equity and private equity (see Figure 1). Investments in the companies that are listed on the stock exchange are considered as public equity, while private equity implies investing in the companies that are not quoted on the public exchange. Different development stages attract the capital from different types of investors. For example business angels are wealthy individuals who put their capital in seed stage of the development, VCs are mostly interested in start-up and expansion stages, and buyout is a major investment in mature companies with intends to restructure it. One of the essential characteristics these investments have in common is the acquisition of the ownership interest in the company. (SVCA, 2012)

![Figure 1 Structure of private equity (SVCA, 2013)](image)

Private Equity funds are usually set up in a form of limited partnership and can be divided in two categories: fund investment and direct investment The passive investors, usually called Limited Partners (LP), and who do not have any managerial control, invest their money into the fund. General partners (GP), also called fund manager are the ones who manage these funds and use them for investing into companies, the process referred to as direct investment. (Fraser-Sampson, 2010, p. 3)
Private equity funds operate in a way that when GP recognize an attractive opportunity to invest, he issues a capital call to each LP requesting a specific amount of money. Then LP put this amount in the fund and GP makes an investment. When investment has been realized, the money comes back to the LPs. That can be done in different ways; the shares can be sold on the open market (IPO), or a sale of the company to another investor or to another larger company (Metrick & Yasuda, 2011, p. 5). Typically the amount of original cost on the investment plus 80% of the profit goes to LPs and 20% of the gain are allocated to the GPs. (Fraser-Sampson, 2010, p. 4)

Venture capital is operated in a similar way, pooling money from various pension funds and other institutional investors and/or individuals and thereafter setting up funds or limited partnerships for financing of different companies/projects (Brander et.al., 2002, p. 428). In this case VCs act as GPs and other outside investors as LPs (Sahlman, 1990, pp. 473-474). There exist no legal definition of Venture Capital, however Black & Gilson (1998, p. 245) defined Venture Capital as “investment by specialized venture capital organizations (venture capital funds) in high-growth, high-risk, often high-technology firms that need capital to finance product development or growth and must, by the nature of their business, obtain this capital largely in the form of equity rather than debt”. Through equity VCs acquire ownership rights and become an active member of the board of directors in order to maintain control over the venture (Sahlman, 1990, p. 473).

In most cases more than one investor is involved in financing project or venture. Mayer et al. (2005) recognize five sources of finance that are often used in a combination. These sources are banks, insurance companies, pension funds, corporates, individuals and government (Mayer et al., 2005, p. 590). Isaksson (2006, pp. 22-23) categorize the sources for finance in a slightly different manner, banks and insurance companies fall under captive venture capital organization, public sector venture capital organizations are financed by government and private venture capital firms are set up in form of a limited partnership and is the most common form of venture capital organization.

Typically VCs’ funds are needed in commercialization stages, when the companies starts to make their way to the market and require a lot of capital to cover manufacturing and sales costs (Zider, 1998, p. 132). After a specific period of time, usually 10-12 years, VCs are looking to dissolve their investment and get back the return. (Zider, 1998, p. 137; Gompers & Lerner, 2004)

### 3.3 Investment strategies

#### 3.3.1 Venture life cycle

A study conducted by Growth Analysis (2012) showed that not only has Venture Capital investments declined significantly between 2007 and 2012, but also that VCs investment in the early stages of development has almost completely disappeared. VC choose to invest in industries that have a potential for fast growth and tend to avoid
industries that involve a lot of technology risk (Zider, 1998, p. 133), which could explain the declining VC investment in Cleantech sector.

On the other hand Mason & Harrison (2004, p. 328) found that there is no significant difference between performance of technology and non-technology investment, which the authors argue could question the traditional knowledge that technology investments implies higher risks. However the authors did not include the stage of development as one of influencing risk factors, and simple explanation to minimized risk in technology investment could be investment in later and therefore more developed stages when the company has already established itself on the market.

Sahlman (1990) who based his study on Plummer’s (1987) research adopted a very detailed description of the stages of venture capital investment:
1. **Seed** investments are described as a small amount of capital to evaluate if the idea is worth to invest more in.
2. **Startup** applies to a company that is less than one year old. The capital is used for product developing and investigation of market potential.
3. **Early development stage** involves modest manufacturing of the products.
4. During the **expansion stage** the products are introduced to the customers and it is easier to estimate market potential.
5. **Profitable but cash poor** - the company generates internal cash flows, but they are not sufficient to cover further expansion. During this stage more capital is needed from investors to expand marketing operations and improvements of products. The author argues that at this stage banks may be willing to provide some credit to the companies.
6. **Rapid growth towards liquidity** – companies find themselves at growth stage, they might still need outside resources, but in general can cover their costs on their own. During this stage companies prefer to reduce equity financing, and are more positive toward debt funding.
7. During **mezzanine (bridge) stage** companies are considering their alternatives on exit strategies. As the optimal timing for IPO’s can be very unpredictable, companies need to sustain their level of growth until then, which requires additional capital.
8. During **liquidity stage** (cash-out or exit) there is an opportunity for VC’s to gain liquidity for the amount of their holding in the company. This can be done in form of IPO or in form of cash, shares in a publicly traded company or short-term debt.

Jeng & Wells (2000) define the different stages of development that need financing in a slightly different way. Seed and startup capital are required for companies that find themselves at a very early stage of development. The main difference is that seed capital is needed for products research and development, and startup capital is used to produce, market and sell these products. When the company has established itself on the market and is looking to expand its operations further, it is in need of expansion capital for continuing R&D and financing manufacturing and distribution of the products. The authors do not consider buyout investment as a part of development stage, as their primary focus lies on venture capital investments. (Jeng & Wells, 2000, pp. 242-245)
Swedish Energy Agency (2010) also has a description of company’s life cycle that consists of four stages and is specifically designed for Cleantech sector. During R&D stage, which is the earliest stage, the companies turn to governmental investors to support their products or services. When the business plan is finished, it is time for seed (startup) stage. Business angels are the most active players in this phase, contributing with both capital and knowledge. Very few VCs are involved during start up stage, however when the start-up stage is almost over some VCs are willing to buy out Cleantech companies from business angels. In order to expand and develop the company further, a lot more capital is needed, more than business angels can provide. The expansion stage is when VCs are actively involved in the company’s development and can provide them with enough capital. After a period of 3-5 years it is usual that VCs exit the investment and the companies should be able to manage on their own. Not until these companies are mature and ready for restructuring that buyout actors come into play. (Swedish Energy Agency, 2010, pp. 8-9)

From this information we can draw a conclusion that at the early stages and even expansion stage companies are very dependent on VC, as banks are not willing to put their money into risky and uncertain investments. Swedish Energy Agency (2010, pp.8-10) also stresses the importance of private equity, and that combination of business angels, VC and buyout plays a vital role in growth of Swedish Cleantech companies.

Manigart et al. (2002) point out that the investments stage is an important risk factor for the investors. The author explains that early phases of development imply a higher risk and therefore VCs require higher return than for expansion phases. On average the required rate of return for early stages lies between 36% and 45% while required rate of return for expansion stages is only between 26% and 30%. (Manigart et al., 2002, p. 11) Studies also showed that investments in expansion stages generate higher returns than investments in early stages (Murray, 1999; Cumming, 2009).

3.3.2 Ownership and Syndication

One of the important characteristics of VCs is that they often co-invest with each other, a process called syndication (Brander et al., 2002, p. 424). A natural reason to syndicate would be to gather more capital and share the risk, however there are other factors as well. According to one rational of syndication an investor makes a better investment decision when another investor is also willing to undertake the investment (Lerner, 1994). Two investors might more effectively use screening techniques and take advantage of each other’s knowledge to evaluate an investment (Brander et al., 2002, pp. 424-425). Many state-owned VCs in Sweden are set up in a way where government is investing together with private investors (Isaksson, 2006, p. 23).

Leleux & Surlemont (2003, p. 99) argue that governmental involvement not only increase the growth but also brings in more money to Venture Capital industry. On the hand, when Buzzacchi et al. (2012) investigated “hybrid” funds (government
co-investment with private VCs), they found that public ownership influences the selection of investments moving it towards less risky and that duration of the investments is longer with higher public ownership, which leads to lower IRR rates (Buzzacchi, 2012, p. 712).

### 3.3.3 The performance of equity funds

As was mentioned previously one of the essential characteristics of Cleantech investments that makes them different from other investment in environmental technology is offering competitive returns to its investors. Therefore it is important to understand how to evaluate private equity and specifically venture capital fund’s performance in terms of risk and return.

Fraser-Sampson (2010) explains that investment in private equity funds can be illustrated as a series of cash outflows, when the money is drawn by GP and cash inflows, when investment are realized. The timing and amount of these cash flows is very uncertain, therefore simply calculating annual returns does not provide a valid measurement of private equity fund performance. The most common model that illustrates the tendency of cash flows in a fund is a “J-Curve”. Due to high management fees and the money pouring out from the fund, in the beginning the cash flows and return are negative, and when the investment start to produce return, the cash flows are positive. The cash flows are shaped in a J-Curve pattern, and are similar for all private equity funds. (Fraser-Sampson, 2010, p. 15-22)

The methods used to measure performance of the private equity funds vary, as different researches have unique perspectives on the criteria for investments. Kaplan & Schoar (2003) and Fraser-Sampson (2010) choose to calculate the IRR of the funds and PME (Public Market Equivalent) and do not include systematic risk into calculation. Phalippou & Gottschalg (2009) investigate risk adjusted return using PI (Profitability Index). Ljungqvist & Richardson (2003) evaluated whether private equity funds outperform S&P 500 by analyzing cash flows, risk and return of PE funds.

### 3.3.4 IRR

Internal rate of return (IRR) is a compound return over time of the cash flows of PE funds (Fraser-Sampson, 2010). According to SVCA (2012) it is the most common measure in capital budgeting that evaluates profitability of the investment. The IRR should be calculated for each fund and on cumulative year-to-year basis (Thomson Reuters, 2011) and it acts as a discount rate that makes net present value of cash flows equal zero. When evaluating several investments, the one with the highest IRR should be undertaken.

Manigart et al (2002) found that VCs return requirements differ across various types of VCs and depending which stage of financing they focus on. For instance VCs expect higher return while investing in earlier stages than expansion stages. That could be explained by high market and business risks associated with early stages. The authors
also argue that public VCs require lower returns than independent (private) investors. (Manigart et al, 2002, pp. 14-15).

State-owned VCs are usually limited in their operations since they have to follow guidelines that are set up by the government. While private VCs’ primary concern is to get financial return, state-owned VCs strive to develop and strengthen economic growth of small and medium sized companies. (Isaksson, 2006, p. 24) It would be interesting to see whether private and public investors who invest in Cleantech have different expectations for return and whether there is a connection with their focus of stage of financing.

3.4 Investment evaluation method

Prior to investing VCs typically put a lot of effort into analyzing the investment opportunity. Each VC probably establishes their own evaluation method, however there are certain margins that are the same for every investor. Among these margins are market size, customer adaptation, technology, strategy, competition, management team, and last but not least the risks. It is often because of the agency risk, mistrust and information asymmetry that investors dedicate a lot of time to create a good contract and overall a thorough screening process. (Kaplan & Strömberg, 2001, p. 5)

Tyebjee and Bruno (1984) have developed a model describing VC’s investment activity prior and during investment in five steps:

3.4.1 Deal Origination

This step describes how VCs become aware of the entrepreneurs. The author’s study showed that potential investments arise from three sources. The minority of deals originated from VCs using their networks, attending trade shows and conferences in order to keep a closer look on potential candidates. Many times the entrepreneurs themselves contacted the VCs. Most of the times, however, the knowledge of potential investment spread through referral from other investors, banks and investment brokers. It is quite usual that an investor who wishes to reduce the risk in their portfolio seek out other investors for co-investing. This process can even be called syndication. (Tyebjee & Bruno, 1984, pp. 1055-1056)

3.4.2 Screening

VCs have limited amount resources, therefore screening criteria is essential for them, as it help them to focus on solely those investments that they are familiar with and that has huge potential. According to the authors there are four important screening criteria. First the size of the investment, from their study it is evident that investors prefer to take on larger investments and co-invest with other. That way they don’t have to spread portfolio over many small companies and also it reduces competition. A second investment criterion involves technology and market evaluation. Since the technology is usually not yet completely developed and the market is uncertain, VCs make sure they are familiar with technology and market of the potential investment. The third criterion
is geographic location. Since VCs usually control and monitor the companies they
invest in, they are also trying to keep the travel time and cost down. Therefore many
times they choose to invest in the companies that are situated not far away. The fourth
and last investment criterion is the stage of financing. From their research we can see
that VCs tend to invest in start-up and/or expansion stages, sometimes even by several
rounds. (Tyebjee & Bruno, 1984, pp. 1056-1057)

3.4.3 Evaluation

New ventures are lacking operating history, and therefore the VCs can only evaluate
them by presented business plan. However those companies, which are more mature,
can be assessed by several factors. The authors mention two kinds of returns expected
and perceived and they are dependable on four factors. Market attractiveness is
determined by size, growth existence of market need. Product differentiation refers to
how entrepreneurs apply their skills to create unique products. Managerial capabilities
of VCs are the third factor and show how VCs are managing all business areas
simultaneously. The last factor, Environmental Threat Resistance demonstrates how
well the venture can manage and resist the external risk factors. These four factors are
used to assess the expected/perceived risk and make a decision to invest. (Tyebjee
& Bruno, 1984, pp. 1058-1061)

3.4.4 Deal structuring

After VCs decides to invest, both VCs and entrepreneurs need to make an agreement,
which includes clear price, ownership structure and rights to manage and control,
restrictions and other. These are the ground rules for VCs and entrepreneurs that will
influence how successful the venture could be. (Tyebjee & Bruno, 1984, p. 1053)

3.4.5 Post-Investment activities

When the contract is done and everything else is set up, VCs usually try to control
monitor the actions of the venture by either being an active member of board of
directors or by influencing different networks. It is recommended for VCs not to be
involved in day-to-day operations, as it could affect entrepreneur’s attitude toward the
venture. After adding the value to the venture, one of the primary incentives of the VCs
is to exit the investments and get return back. (Tyebjee & Bruno, 1984, p.1054)

3.5 Risk Characteristics

3.5.1 Technology risk

Even though venture capital is an essential ingredient for development of new
technologies, VC’s interest for technology-based companies is declining, because these
ventures are not easy to finance (Gompers & Lerner, 2001, p.7). One of the reasons
behind this statement might be that VCs perceive these investments to offer low returns
for relatively high risk (Mason & Harrison, 2004, p. 314). Technological risk implies
that new technology may take longer time to be developed than expected and even after
it is still immature and unproven on the market (Benaroch, 2002; Mason & Harrison,
Reid & Smith (2001, p.17) state that sometimes new technology is so new and complex that investors fail to recognize its potential and back off from the investment. In order to test the technology there is often a need to set up plant or factory, which is expensive and often not accounted for from the start by neither entrepreneur nor investor (Swedish Energy Agency, 2010, p. 13).

3.5.2 Business risk (Macroeconomic risk)

Business risk relates to uncertain market conditions. The risks in this category can comprise market, exit and regulatory risks and they have huge impact on investor’s decision whether to enter the investment or not. During the early stages of a new product, service or technology, the market is unknown and in many times nonexistent. In technology and renewable energy segments it is essential to enter the market in the right time and to understand and satisfy customers’ needs. (Wüstenhagen & Teppo, 2006, pp. 68-69). Market risk also can occur for products that are completely new, and could lead to a development of completely new market, which will be hard to determine and assess (Mason & Harrison, 2004, p. 318). Already before the investment, it is important to consider different ways of leaving the investment and also analyze possible timing of exiting (Giot & Schwienbacher, 2005, p. 2). Regulatory risk refers to governmental regulations that can influence investor’s behavior and investment itself. Due to uncertainty regarding tax incentives, subsidies and controlling of energy, telecom and biotechnology sectors investors are trying to avoid these sectors. The view is rather controversial. Some believe that governmental regulations make it harder for new companies to enter the market, others argue that governmental support gives them incentive to invest in energy sector (Wüstenhagen & Teppo, 2006, pp.73-74).

3.5.3 Management risk (Agency risk)

Agency theory describes the interaction between two parties (principal and agent) in a situation where they are cooperating, and principal communicates to the agent what work is to be done and the agent performs the task (Jensen & Meckling, 1976; Eisenhardt, 1989, Sapienza & Gupta, 1994). The problem within agency theory arises when their goals are in conflict and it is difficult or expensive for the principal to control the work that agent is doing (Eisenhardt, 1989, p. 58). This situation can be applied to VCs and entrepreneurs when they cooperate, but as the company is growing the goals of entrepreneurs may change, and this puts investors in a very difficult position. Apart from working towards the same objective the management of the company need to have some level expertise about the product and being able to handle change and contribute the growth of the company. (Wüstenhagen & Teppo, 2006, pp. 71-72)

3.6 Exit Opportunities

One of the factors that influence VCs decision to enter an investment is exit opportunity. A broad variety of research focuses on possible exit routes that are used by the VCs (Lerner, 1994; Black &Gilson, 1997; Schwienbacher, 2002; Cumming, 2002). The primary purpose behind investing with private equity in the first place is to exit, or sell it at a good price after a certain period of time (Cumming, 2002, p. 2). Since many
venture capital investments tend to be very capital intensive and can stretch out over many years, the cash flows in the beginning are always negative. The main way for VCs to earn positive return is to exit the investment. (Schwienbacher, 2002, p. 2)

VCs usually invest by several rounds, practically setting up millstones that must be achieved by the entrepreneur before VCs decide whether to invest more or to back off from the venture (Lerner, 1994, Black & Gilson, 1997). The exits might be full or partial, where full relates to selling of the entire investment, and partial refers to selling just parts of the shares that VCs hold (Cumming & MacIntosh, 2003, pp. 514-515). Five most common strategies of exiting that are discussed in the literature are (Schwienbacher, 2002; Lerner, 1994; Black & Gilson, 1997; Cumming & MacIntosh, 2003):

1. Initial public Offering (IPO), when the venture becomes listed on the stock exchange
2. Trade Sale (TS), when the venture is sold to an industrial buyer (larger entity)
3. Management Buyout, when the shares are sold back to the entrepreneurs
4. Secondary sale, when VCs sell their shares to a third party, typically another VC
5. Liquidation, when the venture is forced to go bankrupt

Lerner (1994) argued that the timing is crucial for an IPO; his results showed that VC takes ventures public when the market is at its peak however continuing investing when the valuations are low. Market conditions are very important to make a successful IPO (Black & Gilson, 1997, Lerner 1994). Schwienbacher (2002) found evidence that it is not only applicable for IPOs, but also even for TSs, even though the market is open during longer time for TS by an industrial buyer. Even though IPO is considered to be a very prestigious way out, it is not available for anybody. In many cases only highly profitable ventures can afford to go public. (Schwienbacher, 2002, p. 24-25)

Schwienbacher (2002) analyzed the influence of various venture capital firms’ characteristics on most common exit strategies in US and European markets. One out of the total six countries that were analyzed for European market was Sweden, which makes it relevant to our study. Schwienbacher states that since the market is less liquid in Europe, it takes longer time for VCs to exit an investment (Schwienbacher, 2002, p.16). According to his research a trade sale is the most preferred way of exiting an investment, even though IPOs may bring the most benefits for both investors and entrepreneurs. If the IPO is successful the entrepreneurs gain more control over their company and VCs can receive reputation benefits.
3.7 Summary of Theoretical Chapter

![Theoretical Frame of Reference Diagram]

3.8 Previous Empirical Research

1. Vällfors (2009) investigated in her degree project the Swedish market for Cleantech investments and its various players, such as business angels, VCs and governmental agencies. Her focus lies in analyzing VCs’ risk perceptions and preferences when investing in Cleantech. The aim of the research is to find the gap between governmental financing and private equity-investments in Cleantech sector, which as suggested by (Tvede-Jensen, Ringmar, 2007) lies somewhere at the expansion stage, when governmental grants are no longer given to the companies and there is not enough
venture capital available. (Vällfors, 2009, p.7) She is analyzing various investments stages (seed, startup, expansion and buyout) as well as risks experienced by VCs. The risk profile analysis includes market risk, regulatory risk, technology risk, management risk and exit risk. (Vällfors, 2009, pp. 18-25) She distinguishes between VC in a following way: private venture capital, less private holding companies, university based holdings and funds. Less private VC are defined as capitalist that invest less and have incentives of long-term ownership. (Vällfors, 2009, p.45) For the study she conducted 15 telephone interviews with various VCs (Vällfors, 2009, p.47). When it comes to risks the majority of VCs always make a separate risk analysis for each company, however they do perceive Cleantech as more risky than other sectors. In her finding she argues that higher risk in Cleantech sector makes VCs to invest in later stages and also that information asymmetry between entrepreneurs and VCs makes it more difficult for them to find each other. (Vällfors, 2009, pp.61-62)

2. In 2012 Pettersson & Nilsson made a qualitative study of how venture capital firms evaluate Cleantech companies in Sweden in comparison to more traditional investments. They conducted 8 interviews with VC firms and made a comparison between which stages of financing they focus on and how that influences their valuation of Cleantech companies (Pettersson, Nilsson, 2012, p. 29). In their analysis it is evident that VC firms in the growth and expansion phase tend to rely on historical data that is available about Cleantech companies. On the other hand when the focus lies on seed and early stage investments, the VC firms look around for similar companies and their valuation in order to produce their own. (Pettersson, Nilsson, 2012, p. 56) Their findings show that there is no difference when evaluating a Cleantech investment or any other investment, what matters is the stage of financing. The authors argue that due to large amount of capital and time needed and difficulties to put a fair value on the company for an investment in early stages, this may lead to a difference in valuation method, however it is typical for all investments in early stages. (Petterson, Nilsson, 2012, p. 63)

3. Ademstam et al. (2008) wrote a bachelor thesis regarding how VCs reduce agency, business and innovation risks associated with Cleantech sector. After conducting interviews with six VCs, they found that VCs are reducing their risks through closely monitoring their investments and syndication method. Ademstam et al. (2008, p.42) argue that is not tools themselves that help reduce tools, but rather tools combined with know-how of entrepreneurs and VCs.

It is evident that in the previous empirical research regarding Cleantech sector and VCs, the various stages of investment has been analyzed, as well as various actors on the market and the risks associated with Cleantech in Sweden. However we are not generalizing VCs into one category, our emphasis lies on the distinction between private and public VCs in Sweden.
4 PRACTICAL METHODOLOGY

In addition to theoretical methodology, we reached the practical side of the research, in Chapter 4 we will present our data collection methods and interview mechanisms, and at the same time a line of criticism regarding truth criteria and ethical issues.

4.1 Data collection

Yin (1989) suggested six sources of evidence collection for case studies, namely documentation, archival regards, interviews, direct observation, participant observation and physical artifacts. Documentation could take in a variety of forms which are relevant for the research topic. (Yin, 1989, p. 85) Unsurprisingly interviews are widely used for case studies since they provide deep insights on specific situations (Yin, 1989, p. 90). We have chosen to use both documentation and interview as our data collection methods, due to the relevancy of information and importance of knowledge they bring. The source of our data would have two categories: primary and secondary. To recall our research question, we are interested in Cleantech investments made by public and private VCs. This type of data would come from a database, which could be seen as documentation. The other data would be gathered from interviews with investors.

4.1.1 Primary data

Our primary data comes from interview results as we explained under section 2.6 in our research strategy. One important issue regarding data collection is the access. The researcher’s ability to obtain primary and secondary data depends on the possibility to gain access to an appropriate source or sources when there is a choice (Saunders et al., 2009, p. 169). The importance of access also is due to its impact upon whether the researcher is able to select a representative sample or secondary data in pursuit to answer the research question and bring quality to the research so that the results are unbiased and data is reliable and valid (Saunders et al., 2009, p. 170). The access to CS database enabled us to gain relevant information for collection of both primary and secondary data, thus the problem of access is of minor difficulty concern for us.

4.1.2 Sampling

As we explained under section 2.7 the CS database tracks down investments deals made since 2007. Deal information includes the names of the investors divided into categories. We use the database as a reference for sampling by downloading data and incorporating them in Excel file. By using filter for venture capital we got 51 investors. Unfortunately the database does not distinguish between public VCs and private VCs, therefore we used our own knowledge about Swedish state owned VCs from chapter 2 and information on the investors’ websites to make a distinction. 15 out of 51 investors can be considered state-owned, while 36 are private VCs.

4.1.3 Sampling Method and Sample Size

Non-probability sampling is used as an umbrella term to describe all forms of sampling
that are not related to the canons of probability sampling. (Bryman & Bell, 2007, p. 197) Since we want to capture an in-depth overview of Cleantech investments, it is easier to decide that all investors that appeared in our list from the database would fit in as our sampling population. As a matter of fact these investors are the ones actually involved in previous Cleantech investments, their experience and opinions are important for us.

Saunders et al. (2009) suggested that non-probability sampling provides a number of practical techniques based on the researcher’s own judgment. When it comes to business research the research question, research purpose together with research strategy may yield an indication of a non-probability sampling. (Saunders et al., 2009, p. 233) In our case, the pursuit to Cleantech investments made by public and private VCs and the aim of providing potential investors in the Cleantech sector excluded us from probability sampling because we are looking for a specific group of people to share their knowledge and experience. Therefore we are concentrating on a specific group of people as our interviewees. In order to grasp a more general view of different types of funding in Swedish Cleantech sector we try to divide our interviewees into two categories: public funding and private player. This is also a part of the category technic that was used by CS database, which is regarded as convenient sampling for our segmentation.

Regarding the sample size, we counted down to 15 of state owned VCs and 36 of private VCs. Eventually we got 14 investors who participated in our study, which consists of 8 on the public side and 6 on the private side. Out of the 8 public investors, 3 of them only give out grants so we excluded them from our research sample, which leaves us with 5 public VCs. Since this thesis is written with support from NEFCO, we think it is beneficial for us to include as many players as possible to get a view on government support to some degree. That is why we had investors who give public funding in sampling method but not for answering of our research question. Instead they will be used in our executive summary report for NEFCO.

Bryman & Bell (2009) pointed out that when it comes to the question of sample size there is no definitive answer; it depends on a number of considerations, in which time and cost are the most common ones. (Bryman & Bell, 2009, p. 194) When we contacted the investors, we have also taken into account where they are located. As it turns out many of them were in Stockholm, and we believe that a trip there for personal interviews was advantageous for our data collection. Based on this thinking we managed to book in total 6 personal interviews in Stockholm.

### 4.1.4 Finding respondents

As full-time students at the university, we think of ourselves as an external researcher since we were trying to get respondents from organizations that we have no prior contacts with, therefore it is important for us to negotiate for access carefully at physical, continuing and cognitive levels (Saunders et al., 2009, p. 172). Taking the role of external researcher implies that there are several key issues to keep in mind as Saunders et al., (2009) suggested:
• To remain sensitive to goodwill or the organization and try to achieve it at every level
• To show the competence and integrity of the research study where the purpose is correctly addressed
  (Saunders et al., 2009, p. 172)

Having this in mind we used different means to get in contact with the potential interviewees. Firstly we created a contact list by using Excel, which contains information we gathered from the CS database as well as the investors’ websites. In the contact list we have put in the name and type of the investor, contact person’s email and phone number, the general contact email and phone number of the switchboard, together with the amount of investment and in which Cleantech segments it was made. Then we constructed an introductory letter and interview guide. The introductory letter requesting access is supposed to describe the research purpose and what happens if the respondent participates in a brief and concise way that gives a higher possibility of gaining access (Saunders et al., 2009, p. 179).

In our introductory letter we started off by presenting ourselves as two students from Umeå University writing a thesis on investments in Cleantech sector, trying to analyze previous investments from both public VC and private VC’s prospective. Then we explained how the interview would proceed and ensure the sensitivity issues of not letting out sensitive information to increase our chances of gaining access. As an attachment of the introductory letter we included an interview guide, which contained questions that we were interested in so that potential participants in our study could have a clue of what types of questions would appear in the interview.

Our first contact with investors was through email to both the investors’ general contact email address and investment managers, project officers’ individual email box so that we could have direct contact with our potential interviewees. Following the email we also made an effort of trying to reach them by phone so that it would be both time efficient and increase the certainty of getting a reply. We used the organizations’ switchboard number when we were not sure who was the right person to contact, as well as the investment managers’ own lines to make calls if contact information could be found. To make contacts by telephone proved to be the most results-generating method to gain access, from which we got 11 accesses out of the 14 interviews we got.

Speaking of the position of the person holds in the organization, we have selected the ones who were responsible for these investments, mostly investment managers, since they have the actual knowledge and experience. In order to do so we looked for contact information on both the investors’ webpage and in CS’s database. To use a single respondent to represent an organization is a common practice in business research for respondents, as Bryman & Bell (2009) suggested. The person is often senior manager and can be interviewed about issues related to their work. This is cost and time efficient, as well as resource wise (Bryman & Bell, 2009, p.197). Further when it comes to
investment strategy and risk profile the investment manager is usually the one who understand better than anyone else in the corporation. In that sense we refer the interviewee as the organizations’ representative to speak of the organization as either public actor or private player in funding Cleantech investments.

4.1.5 Secondary Data

As we discussed in section 2.7, we use CS database as documentary secondary data to support our study. In order to get a better understanding of the functions of the database we had an expert interview with the project manager at CS.

In order to find out which investments have been made in the past, we chose “previous deals” under investment category. We have ticked the box “Sweden” under Country since our research is focusing on investments made in Sweden. By using these filters, the database generated 355 results as “deals’’. The results are presented based on the amount of transactions that Cleantech companies have received, which means there could be multiple transactions into one Cleantech company over the years from different investors. At the same time, since the results are sorted by cash flows into Cleantech companies, the database only showed the total amount of cash flow when it came to co-investment activities.

We downloaded these results into an Excel file and organized the data by putting down the names and types of investors, the development stages of the Cleantech companies, Cleantech segments, the amount of investment, and the time when the transaction was made. Through listing of multiple investors for one transaction, we had 54 co-investments in which 13 of the transactions were made with international investors. We have taken these deals out of the sample since we intend to only study investments from Swedish investors and it is impossible to allocate the total co-investment amount to each individual investor. Similarly we have also taken out a total of 19 single foreign investments. This gave us a sum of 323 investments as our sample, out of which 41 are co-investments and 282 are individual investments.

One thing that we paid special attention to is how the database uses classifications and terminology. The database itself identifies these different sources by using public funding and venture capital as investor types, where public funding describes the general allocation of government money to SMEs and venture capital represents both public and private VCs. As we mentioned in our research question we aim to study if public VCs and private VCs differ in terms of investment strategies and evaluation methods, we picked out “Venture capital” as our main focus. However it was interesting to use public funding as a reference to VC funding, to see if similar patterns exist and analyze the changes over time. Thus we have included public funding deals as well in our data collection.

In addition the database uses “Seed”, “Commercialization”, and “Expansion” to describe different investment stages. The criteria used to distinguish between the stages
are whether there is customer commitment, and how much customer commitments exist. “Seed” refers to prototype, real scale or customer testing phase where the product or service is not proved for customer commitment. “Commercialization” means customer commitment exists but there are only few customers, while at “Expansion” stage there a numerous existing customers. (Personal communication, April 2nd, 2013) This distinction method was also used for interviews so that both primary and secondary data collection use same terminology.

4.2 Interview procedure

4.2.1 Interview type and method

Considering the various types of interviews, we find that semi-structured interview fits us mostly due to the flexibility it brings. Particularly for an exploratory study, semi-structured interviews are often used because they help researchers to understand for example the relationships of variables shown in descriptive study (Saunders et al., 2009, p. 322). Since our study is of both exploratory and descriptive nature, semi-structured interview is apparently our choice. Bryman & Bell (2009) suggested that semi-structured interview is conducted by using an interview guide with a number of follow up questions depending on the respondents’ answers (Bryman & Bell, 2009, pp. 474-475). Hence by using semi-structured interview we have more freedom to ask questions besides the ones we have in our interview guide, which aids us in better receiving useful information that is relevant for our research question.

Regarding the construction of our interviews there is information that investors don’t want to expose to the general public, and at the same time we as researchers always need to alternate our questions depending on the types of investors. Semi-structured interviews also simply variations, that researcher may omit questions in certain interviews given the organizational context (Saunders et al., 2009, p. 320). Public and private players genuinely have different perspectives and behavior, and furthermore each person has his/her unique talking style. We are working towards a way to make interviewees feel free to share their views by concentrating on answering our questions, so that we find the balance for our interviews. Since we are only entitled to a budget of three days in Stockholm, we made 6 interviews in person. The rest of the interviews were conducted either through Skype or telephone based on the interviewees’ preference, 3 were made through telephone and 5 were made through Skype.

4.2.2 Interview Guide

The themes of the interview guide can be derived from literature and theories related to the investigation, or to be combined with other sources where themes reflect the focus of the research. The questions are supposed to cover topics to be discussed at the interview and leave spaces for follow-up questions. Other issues to be careful about is the order of the questions should be logical and the language should be comprehensive for interviewees to understand. (Saunders et al., 2009, p. 329)
The construction of our interview guide was made based on the recommendations by Saunders et al., (2009). We tried to focus on the issues that are relevant to answer our research question, thus we started off by factors concerning investment strategy, followed by risk characteristics and screening and evaluation methods regarding decision-making. The order is logical for us, to begin with investment stages, motives and segments which define the characteristic of the investor which in turn has an impact on the decision-making process. Nonetheless we tried to cover as much variables as possible as venture capital investments are involved with multiple factors. Thus we think that in order to generate satisfying results it is better to include different factors so that our understandings are based on a broader perspective. The interview guide was written in English since it is the language that both researchers and interviewees could understand. The full version of the interview guide can be found in Appendix 2.

4.2.3 Conducting Interview

All interviews are recorded with the interviewees’ approval. Average time for the interview is around 40-60 minutes. Before the interview we tried to gather information from the corporation’s website to get a general understanding of them, which was helpful to ask specific questions that were not in the interview guide or just simply build up a closer connection. 6 of the interviews were made in person, 3 made through phone calls, and 5 were made through Skype. We also used English in the interviews in consistence with the language of the interview guide.

Bryman & Bell (2007) described to be balanced during the interview means that the interviewers should not talk too much or too little because the interviewee would feel either passive or not talking along the suitable lines (Bryman & Bell, 2007, p.484). Due to the fact that interviewees tend to have different talking styles and we adopted a semi-structured interview strategy, we tried to keep the balance, so that we do not talk either too much or too little, and so that the interview is focused on our questions in the interview guide. During the interview both authors have made notes, which we refer to after the interview to check if we have the same understanding.

4.2.4 After the Interview

Transcribing is the number one job after the interviews. Bryman & Bell (2007) argued that in qualitative research the interview is usually transcribed whenever possible (Bryman & Bell, 2007, p.489). All 14 of our interviews were transcribed where we wrote down word for word what the interviewees have said. The transcriptions equipped us with a good base for presenting our empirical findings.

4.3 Conducting Secondary analysis

As we mentioned under section 4.1.5, we are using CS’s database for a secondary analysis. Initially we tried to find evidence that public investors and private investors tend to have different preferences on investments stages and if the situation has changed over the years. Secondly we intended to see if VC investments have decreased in recent years especially after the financial crisis in 2009 and whether it is true for both public
and private actors. We tried to put investors in categories in a way that we could see if distinct differences between them stand out, and how it changed over time. Therefore we used graphs in Excel to catch changes over time, if there has been any, and investment activities towards different segments in Cleantech. The results of secondary data will be presented in Chapter 5.

It is important for us to have results from secondary analysis as a contextual background for the collection of primary data, because it gave us a general understanding of how private and public VCs acted during their investments in the Cleantech sector. We use the secondary data as a phenomenon to base our primary data collection on, that what we found in secondary analysis will be further explored in interviews. In that sense the secondary analysis is closely connected with primary data where results from secondary analysis show “what happened”, while results from interviews try to answer “why it happened that way”.

4.4 Truth criteria

In research design there are two aspects that researchers should pay special attention to in order to reduce wrong answers: reliability and validity (Saunders et al., 2009, p.156). However credibility issues arose from and were developed in natural science research, which makes it difficult and inappropriate to assess similar criteria in qualitative research by using mathematical or physical measurements. When it comes to the broadest conception of reliability meaning “sustainable” and validity meaning “well grounded” they are relevant even for qualitative research since they gave definition to strength of the data. (Ritchie & Lewis, 2003, p. 270) Hence the topic of reliability and validity is linked with qualitative study but the nature of qualitative research in social science determines that it is differently addressed as in natural science.

4.4.1 Reliability

Reliability refers to the degree of possibility of consistent findings of the data collection method and analysis procedures (Saunders et al., 2009, p.156). It concerns the replicability of research findings and considers whether they will be repeated by another study using the same or similar methods for data collection (Ritchie & Lewis, 2003, p. 270). In other words, a research is reliable if same or similar methods used in different studies generate consistent findings.

LeCompte and Goetz (1982) described several problems that come alone with establishing reliability criterion for qualitative research. For example, external factors such as social setting and circumstances can be fast evolving thus making researchers having different research status position, in which the relationship between researcher and participant would affect the results. (LeCompte & Goetz, 1982, pp. 37-38) In our case, several of the respondents’ had connections with Umeå University, which may have helped us to gain support from them. One of the respondents was an alumnus from Umeå University studying the same program as we do, which added extra bonus for us. More importantly as we write the thesis with the support from NEFCO, the usage of
their name to present ourselves to our contacts may also gave assistance in the way of getting respondents.

Further the ever-changing social context in terms of economic conditions adds extra challenge for replicating research findings. In a global view the Cleantech sector together with its investment market have seen dramatic changes in the past few years, therefore investors’ perceptions and attitudes may have altered through the passage of time. There have been a few studies in Sweden in the field of Cleantech investments constructed by university students before us, but we find it difficult to compare our research findings because of the time factor. For instance it is impossible to compare our results to a study made during the economic crisis around 2008/09, due to the difference in economic situations.

Regarding the assessment of reliability of a qualitative study, Ritchie & Lewis (2003) suggested the following series of questions: (Ritchie & Lewis, 2003, p. 272)

- Was the sample design/selection without bias? “Symbolically”’ representative of the target population? Was there any known non-response within the sample?

As we used CS’s database which tracks most of the investments made in this area, we feel our sample is a reliable representative of Swedish investors in Cleantech. Moreover the sample is balanced between public investors and private investors which provided us an opportunity to analyze the entire investment industry, with an emphasis on the private ones in consistent with our task description from NEFCO. During the process of contacting respondents, we came across several declined cases but it doesn’t bring bias to our sample since our sample size is valid comparing to other research studies.

- Was the fieldwork carried out consistently? Did all respondents have sufficient opportunity to cover sufficient grounds and portray their experience?

The majority of the interviews were constructed by personal meeting, with a few through telephone or Skype. All interviewees were given sufficient time to present basic points about what they do and their past experience in Cleantech, during which we try to refer to the interview guide or add follow up questions to explore more information. Meanwhile we made notes in order to make comparisons afterwards.

- Was the analysis carried out systematically and comprehensively? Were classifications, typologies confirmed by multiple assessments?

As we discussed under section 4.1.5 the expert interview with the project manager at CS equipped us with solid knowledge of terminology and classifications of the database. We understand the different classifications of investor groups and the usage of different terms such as investment stages and type of funding. This set up the basic ground for a reliable research conduct.
After the interviews we proceeded into transcribing process, where the manuscripts were later compared with our notes from the interviews. Both authors had discussions regarding how they understand the interviewees’ opinions to make sure that we agree on our observations and comprehension, which LeCompte & Goetz (1982) referred to as “internal reliability” (LeCompte & Goetz, 1982, p. 41).

- Is the interpretation well supported by evidence?

During the interview we realized some of the interviewees have used jargons and their own words for explanation, especially when it comes to the definition and classification of Cleantech. In such situations we made sure to add a question for further clarification on the term so that we don’t misunderstand anything. With the support of our transcriptions we were able to do double-check on specifics.

- Did the design/conduct allow equal opportunities for all perspectives to be identified?

Since we always sent an interview guide before the actual meeting with the investors, they are on some level acknowledged what types of questions we are interested in. At the beginning point they do freelance speech on the topic of Cleantech investments. All interviews are approximately the same length in time, 40-60 minutes, with only few longer than the rest.

### 4.4.2 Validity

LeCompte & Goetz (1982) argued that validity is the major strength of qualitative work, in the sense of both internal and external validity. By internal they refer to whether the researchers’ observations match the theoretical ideas they develop, while by external they mean the degree to which generalizations could be made under social settings (LeCompte & Goetz, 1982, p. 43) It means that validity is one of the factors to assess the quality of a qualitative research.

The inter-correlation between reliability and validity makes the assessment of validity harder but comparable. The primary question to ask addressing internal validity would be: “Are we accurately reflecting the phenomena under study as perceived by the study population?” (Ritchie & Lewis, 2003, p. 274) By this statement the researchers need to question the connection between the social phenomena and the population. Our research aims to study Swedish investments in Cleantech, which makes our study population to be Swedish investors that participated in the previous deals. The key word for the phenomena is the potential for Swedish Cleantech Market, which would be a result of investors’ opinions and behavior towards Cleantech investments.

External validity is often referred to as “generalizability” which examines whether the research results are applicable in other settings. (Saunders et al., 2009, p. 158) As we
stated previously under research purpose, our study focuses on investments made by Swedish investors to Swedish based Cleantech companies, not foreign direct investments, which is unapproachable for us and difficult to measure. Therefore the social setting for the study is the general Swedish economy within a limited time horizon as Cleantech is a rather new concept and most investments started around 2006. In other words our research findings are only applicable under a limited time horizon, since activities in the business world are very much affected by the general economic orientation. However analytical generalization is possible when researchers make careful reflections on various issues, such as the questioning of, the evidence regarding quality and potential to further inference. It is necessary to have corroborations from other sources when possible, as well as clear documentation of research methods and analytical processes for other researchers to make judgments on how inferential assessments are made. (Ritchie & Lewis, 2003, p. 284) In our case it is possible to make generalization on the Cleantech investment phenomenon, since it has a well-received global characteristic. Nevertheless to generalize our findings for venture capital investments would be difficult since the market differs from country to country, and how venture capital is perceived as an asset class could also be a barrier to make generalizations.

4.4.3 Ethical concerns
As we conduct a research regarding financial asset as private equity, we have been cautious of ethical issues throughout our entire study.

Our first point of departure regarding ethical considerations would be not to harm participants’ benefits, as described by Saunders et al., (2009) that research design should not cause the research population any harm in terms embarrassment or material disadvantage. (Saunders et al., 2009, p. 160) Thus when we try to get in contact with possible interview respondents and even with our commissioner, we have emphasized that we are aware of ethical issues regarding business research. And that we are willing to sign a confidentiality agreement in order to protect private information of the company as well as sensitive issues concerning commercial competitions, as suggested by Bryman & Bell (2007, p. 134) As this thesis work is done with the support of NEFCO, we have signed a contract saying that neither of the authors are spreading any confidential information to any third party.

Further Bryman & Bell (2007) pressed the point that confidentiality and anonymity issues bring in special difficulties in qualitative research when the researcher should take special concerns regarding identification of person and organization. (Bryman & Bell, 2007, p. 134) this will be used as our guideline to present our research results, as our presentation of research findings will be in consistency with the ethical code we signed up to. All our respondents in the interviews are informed that both their companies’ names and their names will stay anonymous in our study. Since we have access to information about investments from different investors in the database, we made sure that we have not spread any confidential information from one investor to
another.
5 EMPIRICAL EVIDENCE

In this chapter we present the data we collected from interviews as our primary data, as well as dataset from CS’s database.

5.1 Secondary data

The following results are based on our study by the usage of database CS. We have decided to present secondary data first because it served as a primary understanding of the public and private VCs investments in the Cleantech sector.

5.1.1 Public Funding and Venture Capital

As Figure 3 shows public funding and VC in the market have adopted similar trends during 2007 and 2011. Firstly when the Cleantech concept started around 2007, there were large amount inflows from VCs, which continued to increase until 2008. At the same time public funding grew continuously and peaked in 2009. So did VC investments, which had an increase in 2010 after the slump. Both VC and public funding decreased to a large degree after the peak.

Figure 4 is an illustration of different stages by different types of funding. It could be
clearly seen that public funding concentrated on seed and commercialization stage with a tiny touch on expansion, while VCs have the largest amount of capital in commercialization and almost equally same amount for seed and expansion stages.

5.1.2 VC investments

Seed stage financing from VCs has been increasing between 2007 and 2010, with an approximately EUR 10 million decrease in 2011 comparing to 2010, when the amount for seed stage peaked at EUR 27.98 million. Investments at expansion stage increased dramatically 2008 to over 7 times comparing to 2007, and stayed at similar amount in 2009. However in 2010 the amount hit the hardpan of only EUR 1.27 million. Commercialization stage has been the most steady one between 2007 and 2010, but the amount shrunk to the lowest point of EUR 3.73 M in 2011.

The above captures the investments made by public and private VCs at different stages.
The majority of private VCs stayed at commercialization and expansion stage, which comprises 38.6% and 45.5% of total investments sum respectively. On the other hand over half of the public VC investments fell into commercialization stage, and a small amount was contributed to expansion stage. The percentage of seed stage investments from public VCs is more than the doubled percentage from private VCs.

Figure 7 VC investments, 2007-2011

Figure 7 illustrates the trends of public VC, private VC and Co-investments from 2007 to 2011. It can be seen that the amount of investments from private VCs have decreased from 24.61 M EUR to only 3.27 M EUR. The general trend has been declining, with a small bouncing-back on the market in 2010. Interestingly it could be easily seen that public VC investments and co-investments shared similar patterns, where the top points incurred in 2008 and 2010, which were caught in between growth and reduction. It is also notably that all these types of investments had comparable reduction from 2008 to 2009, as well as from 2010 to 2011.

Figure 8 Co-investments by private and public VCs in different segments

It is not unusual that the same type of investors co-invest. If an investment is made by a
mix of actors, the classification of whether a deal is public or private is based on the new owner of the company (Personal communication, April 2\textsuperscript{nd}, 2013). According to this classification method, we created the graph above (see Figure 8) to show the total amount of investment by private and public investors divided into segments they belong to. The energy related segment consists of energy efficiency, energy infrastructure, energy storage together with energy generalization. It is the absolute popular segment taking up 91\% of all investments, followed by materials and transportation, which take up 8\% and 1\% respectively.

![Co-investments in different stages](image)

Figure 9 Co-investments by private and public VCs in different stages

In figure 9 we show the chart with co-investments in different stages by private and public investors. The most common stage for co-investments is the commercialization stage, which represents 64\% of total investments. A quarter of the investments are made at expansion stage while only 11\% belongs to seed stage.

5.2 Primary data

Our sample consists of 14 investors that have previously and/or currently been involved with Cleantech investments. Eight of them invest through public funding, and are recognized as public investors. Six of the respondents use private funding, who are classified as private investors. The typology is based on difference in ownership structure that according to CS’s definition, public investors are governmental agencies or state owned who invest through giving out grants or loans. While private funding are basically VCs. (Personal communication, April 2\textsuperscript{nd}, 2013) Figure 10 illustrates the distribution between public and private investors.
In order to make the presentation of our empirical findings as simple as possible, we will use abbreviation ID with numbers from 1 to 14. ID stands for Investment Director in the following text, since our interviewees are either investment managers or project officers who are responsible for the investment. ID 1 to ID 6 will be used for investment managers from private companies, ID 7 to ID 11 represent project officers from public organizations, and ID 12 to ID 14 are public organizations, which give out grants or soft loans (not VCs).

5.2.1 How to define an investment as Cleantech

One of the biggest questions we have always held in this research is: What exactly is Cleantech? Though there are various definitions and taxonomy from different sources as we presented under Chapter 2, we still puzzle. Therefore the primary question to ask in our interviews is what Cleantech is.

Almost all of the respondents agree that when it comes to Cleantech the definition is rather broad, and the line that distinguishes Cleantech from other sectors is rather blurry. Many of them agreed Cleantech is about reducing environmental impact. ID 9 stated that in a way everything is Cleantech, anything that is new, improved, and efficient and is good for the environment. ID 1 thinks that Cleantech is incorporated in everything that it prioritizes everything in the whole life cycle. He then described from manufacturing to recycling a product to illustrate what he meant by the life cycle. Environmental impacts are connected to usage of resources, consumption of energy and recycling process in each and every way. He concluded that Cleantech is a way of optimizing the whole life cycle of products, not only the technology behind it. So Cleantech is not a business sector, in this sense. ID 5 referred Cleantech as methods within the areas where technology are used to reduce emissions and improve efficiency in energy, water treatment and other sectors.

Two of the IDs said they used Cleantech Group’s definition. ID 10 expressed the
importance of good effect on the energy as well as environmental situation to be called Cleantech, that it can be extremely broad to be almost anything. ID 3 had a focus on energy efficiency from energy storage to energy transformation for a more efficient distribution, that Cleantech is good for human kind.

Interestingly ID 11 used Cleantech for companies that develop new technologies for efficiency improvements, which have positive effects on the environment. ID 2 thinks that Cleantech is an area where products and services of the companies have good environmental influence and the health of human race in some ways.

Two of the IDs defined investments as Cleantech based on the sectors they have invested in. ID 4 suggested that for them Cleantech is the energy efficiency sector in terms of the technology because it was where they placed their initial investment. ID 8 used Cleantech for their energy efficient and emission reducing investments in solar panels, for they don’t have a clear definition and the term is quite wide.

Similarly the typology of different sub segments of Cleantech depends much on the investors’ own perspective. ID 9 said that they don’t actually distinguish between Cleantech and Greentech, where they invented another classification term for the sector that they specially focus on which is called efficient production. This view of Cleantech is shared by another ID, who described Cleantech could be so-called greentech or alternative technology. ID 13 used Cleantech as a sub-group of high-tech, but not necessarily. He explained that high-tech usually refers to the areas where the investor needs to have a background in engineering in order to understand the technology, while Cleantech has more focus on reducing negative environment impacts. Segments regarding life science and ICT (Information and Communication Technology) can be categorized as high-tech. But Cleantech does not need to be one of this areas, it can be outside of it. Based on this rather complicated typology methods adopted by different investors, we managed to make a graph to show the different segments that interviewees engaged in for their Cleantech investments.

Figure 11 Cleantech segments in previous investments
It can be clearly seen in Figure 11 that energy efficiency and other energy related segments such as energy generalization, energy reduction and energy infrastructure, have been the leading ones among all sectors. Over half of the investors we interviewed have invested in this area. On the contrary solar and other areas such as agriculture, air and water had the smallest shares. The rest of the shares on the Cleantech market were taken by transportation, materials and manufacturing & industrial related areas.

5.3 Motives for investment: return or environment?

All VCs have a definite answer regarding expectations from the investments: the returns. From the private side ID 5 gives the absolute answer that potential return is the motive that “it has to be financial return.” ID 1 says, “If you are an investor you have to have a financial motive. That is the key.” It means even if an investor has environment motive, it will never work without a good business case. ID 4 states that in telecom and life science areas the competition has become tougher and mature therefore it is difficult to see growth, that’s why they tried out the Cleantech sector as a new thing. ID 6 says that their main priority is to make profits. Apart from the returns, ID 2 mentions that main reasons for an investment is that to be able to make good use of the technology for the parent company in the long run since their business is technology related.

For public owned VCs on national level, the opinions are much alike private ones. ID 9 states that “everything we invest in need to give us a return.” as investments are made on commercial grounds. Being a state-owned company means that they have to follow governmental guidelines about how the corporate should run. ID 10 claims that “it’s purely a matter of trying to get good financial return on an investment.”

Turning to state owned VCs with regional focus, they are a bit different. ID 8 says that apart from potential returns, they have the mission to support regional growth and development based salutes from the county council and EU. The mission also implies to bring out private investment in the area as a public accelerator. ID 13 talks about as a regional fund “Primary factor is the financial return that we see an opportunity in making successful exits in the future and high return on the investments.” And at the same time being a government fund means that they are not competing with private investors, but rather trying to fill in the insufficiency of capital on the market.

5.4 Investment Strategies

5.4.1 Investment Stages

When it comes to investment stages all interviewees have their own classification of different phases sometimes in small details, which differs from what we have in Chapter 2. However we try to summarize their previous and current investment stages in some way.
From Figure 12 we can see that most of the investors do get involved in the early stages, even though there are much more risks acknowledged. The number of investors that go from seed, commercialization to expansion is rather even distributed. R&D makes up a small part in the pie chart, which was defined as the phase prior to the early stage. The result is also due to the fact that “early stage” was used by investors to describe different types of stages.

Particularly for private VCs we can see that the majority of the investors are in commercialization and expansion stages, where the business reaches rather mature levels. However, some of investors stayed at seed and even R&D stages.

ID 6 stressed the importance of being in the commercialization stage for VCs since usually investments are capital intensive and there are too few VCs to support the companies to expand the market and go international possibly. When it comes to investment from VCs in the Swedish market, there are few players at commercialization stage. “During the last ten years globally the number of venture capitalists has shrunk
that there are definitely fewer. If you look at Sweden the number of players has been drastically reduced.” Thus it will be a difficult time for Cleantech companies to get investors if no more players, both domestic and international, choose to participate in the Swedish market.

ID 3 stated that they invest at expansion stage when the product is hopefully ready for the market. Then the product faces fierce competition on the market in order to seek market presence, distribution channel as well as good relationship with the bank. It is difficult to be cost efficient to take market share for the product and takes longer time, which in turn affects the investment returns.

ID 2 claimed that they have been involved in quite early stage which is after the seed stage when the Cleantech company is up for the first external round. However there has been a change of strategy recently that “We are more moving to expansion phase like everyone else.” The reason for such a change is to reduce risks from early stages. While at expansion phase the investor needs to see customer acceptance of the product as well as a proven business model.

ID 4 used early stage to describe everything from seed, start-up to rather mature companies such as expansion. What matters is that they aim to see rapid growth in the company in order to gain market share.

ID 1 said that they invest in both seed and expansion stages. “We actually think the most interesting is to go into existing kind of business and see what kind of business strategies can be used to improve CSR impact.” He then explained by using an example to change business strategy in a renewable energy company since they saw a market for cost efficient solutions.

![Investment stages for public VCs](image)

**Figure 14 Investment stages for public VCs**

Figure 14 shows that seed stage, which is rather early phase in the business, is the most popular stage for public investors. Both R&D and commercialization stages captured
similar attention, while expansion stage has the least focus among all others.

Most public investors are acknowledged with the lack of financing in early stage companies. Two of them talked about banks don’t usually give out loans to companies due to the risks involved. ID 11 explained the reason why they have a focus on early seed stage. “We are seeing capital biased early stage company. Banks no longer give loans to these companies; there is lack of capital in early seed phase. Venture capitalists are looking at larger targets, so then companies are in need of couple of millions of Swedish krona.” ID 13 stated that as a government fund, they should focus on early stages where there are not sufficient private funds because they are co investing with private investors and they should not compete with them.

On the other hand, public investors who have broader investment stages, for instance from start-up, early to expansion don’t address the lack of capital like others. ID 10 said that they do very early stages such as R&D from time to time but not very often. In comparison they do not go in expansion stages very much either. It is very important that the product has proven concept and initial customers, made sales in the market thus able to reach a broader market. He pointed out that “The market is much more difficult.” ID 9 prefers later stages where they can see interests from customers so that commercial risk is smaller. At the same time technology risk is basically small to non-existing.

5.4.2 Investment ratios

All of the private and public VCs except for one (ID1) used IRR to evaluate the potential for investments. ID1 used ROI (Return on Investment) ratio, where return on the investment is divided by the cost of the investment and expressed in percentage. ID1 expressed that they expect above 50-70% of ROI.

VCs point out that the higher the risks and the holding period of the investment the more requirements they have on the IRR target. In general private VCs require 20-25% IRR on the whole portfolio and higher return on the individual venture, somewhere between 30-50% IRR. It is typical that some of the investments in the portfolio will fail miserably and other would have to compensate for them, as ID6 mentions, “If we invest in 10 companies, we probably have to acquire a much larger return from each company because we know that some are to fail”. ID4 states “That depends on the risk of the company, one the portfolio we will go for 20% per year, but that includes total losses...at that point, when looking for individual investment you would be looking for 40-50% IRR per year”.

Public VCs in general have similar return target to private VCs, however a little lower. On average the IRR requirements shift between 15-20% on the portfolio, and a bit higher on individual investment, from 20-40% IRR per year. One of the public actors, ID7, mentions however that they have two targets “one is IRR of 2% per year, so that’s not a lot. On the other hand we also have regional developments”. In general the
requirements of IRR for Cleantech were not different from other sectors that both private and public VCs focus on.

It was interesting to see how investors think about their Cleantech investments performance. Results showed that it is hard to make profits in Cleantech due to risks associated in all stages. As ID 3 points out “It has been a challenge for Cleantech in the last 6 to 7 years, and a challenge for VCs in general for the last 14 years. Venture capital as an asset class is being questioned. Do you get paid for the risks you take? Doesn’t look like it. Cleantech is exactly the same and even worse, because the word is sticking out whether it will yield return from 2005-2007. Mostly because funds in venture capital are declining”. When asked about whether 20% IRR per year is realistic for Cleantech, the reply from ID 4 is “History has shown that it has not been realistic; it might be if the model is right, depending on what you are investing in and what stage. I think it is hard for independent venture investor in the Cleantech area. It is more for industrial companies and other types of players”.

The same was confirmed by a public VC ID 9, “On average in Cleantech sector, you have a negative return, so in the past 5 years a lot of venture capital funds closed down, which means that you have a lot less investors today than what we had, say 6 years ago”. He then continues: “Before I started we made a couple of investments in really early stage companies and R&D companies, and we closed those investments down, so we just had to write that off. I actually think we have a negative return.” ID 1 also mentions that the relationship between risk and return in Cleantech sector is not ideal, “We have a market complementary role and we invest in so early stages, the risks are so high, so normally the return, potential return is not in parallel with the risk you take.”

5.4.3 Screening process

The screening process can be divided into 3 categories.

- The investors do it themselves.
- To hire consultancy firm to do it.
- To rely on the co-investor.

For investors who do the screening themselves have used internal investment process to analyze. ID 2 refers to such process as “rigorous deal flow” where they set up different gates to investigate the companies. ID 5 says that they use a formal process with different checks, and the process is the same for Cleantech and other investments. ID 4 mentions to use “full screening” to find potential investors as they understand Cleantech is different from other investment sectors. Therefore they tried to do full screening of all Swedish Cleantech companies with their criterion attached, which include some revenue requirements, no political risk, large market potential and a unique technology. ID 6 says that they have same internal process for Cleantech and other investments.

ID 10 speaks of buying external due diligence resources to take a look at for example
patents due diligence, human due diligence and financial due diligence. The term due diligence describes the process of investigating an investment opportunity. Technology analysis is often purchased from external sources. However they do market analysis on their own, therefore the screening process is a mixture of first self-analyzing then external due diligence. ID 3 describes the due diligence process as a very long process that they take many steps from first contact to signing the contract.

ID 8 says they rely on co-investors who come to them in seek of co-investments. They have no expertise in Cleantech therefore they use the partners’ expertise in technology.

**5.4.4 Co-investing**

When it comes to acquiring equity stake the range for private VCs lies between 10-50% and 15-30% for public VCs. Ownership stake of public VCs has showed to be less than private VCs, however all of them are trying keeping a minority position in the company for various reasons. Even though private VCs can take a majority position of the company, they are staying away from it. For instance as ID 2 point out “We normally aim for 35-45%. Normally Cleantech is correlated to higher risk, in that sense it is high technology risk and high commercial risk, the company is not cash positive, and therefore we go under 20%”. Another public VC ID 3 mention, “We have been and can be majority owners, we prefer to stay low. The more you owe in the company the more responsibility you have to take”. ID 5, who once acquired an ownership of 80%, mentions: “It is usually when something is not going according to plan and you end up putting in more money than anticipated”.

The majority of all respondents use syndication as method to “reduce the risks” (ID 2), and provide more capital into fund. Other reason for co-investing is “to bring broader competence among investors” (ID 4). On the public side it is evident that 2 out of 5 VCs’ purpose with syndication is to attract more capital into the industry. As ID 7 states “We always go into the companies with private investors, sharing the risks and giving the business an opportunity to get big money, privately owned money”, and ID 11 mentions “Sometimes in the second round we co-invest to give a positive signal effect to the follow-on investors. It is important for attracting of the capital”.

The co-investment pattern varies for different stages of financing, for example ID 8 recognize that “the earlier the project the more risk it is, the longer time it can take to come to positive cash flows. Then it is good to have other investor’s network and if more money is required”. When asked about later stages of financing he replies “I think then it is less important, it is less surprises, it is basically a new opportunity presented and you know by the history of the company, the assumption are quite thorough. The question is: Do you have the money?”

Some of the VCs problem is to find another investor to syndicate with, because “there is a statement that Cleantech is dead some way” and the investors “are not prepared to invest” (ID 2). His explanation for that is that “it involves two factors: financial market
and exit opportunities. The financial market is cold at the moment, but the price of oil also matters”.

5.5 Risk awareness

We are all aware venture capital investments are very much involved with risks. Therefore it is interesting to see their risk profile for Cleantech investments comparing to other investments they made.

Our risk related questions can be divided into three set: what risk factors do they consider and what the risk mitigation measures. Most investors agree on their risk settings fall into the following cat in their general investments:

### Agency risk
- potential of the entrepreneur
- management of the company

### Business risk
- timing and market for the product
- long time horizon
- capital intensity
- political risks

### Innovation risk
- technology risk

Figure 15 Typology of risks

When it comes to Cleantech, most investors claim that the risk factors are almost the same with their other investments with a few special focuses.

5.5.1 Agency risk

The agency risk was quite an emphasis from the investors’ perspective. Basically the investors have to see a potential in the entrepreneur as someone who could do successful business. ID 3 find management risk is the most difficult and toughest which brings most damaging effects, and it is the least thing an investor wants because a bad management makes bad decisions and do not tell the truth. On the other hand a good management can overcome technological difficulties and eventually sell the product to the market. This is agreed by ID 9, who believes management is more important in early stages of an investment. A good idea won’t work without the right people. By right people he means “the ones have right skills, right personalities, and right incentives.” ID 8 referred management risk to execution risk that even with a ready innovation the entrepreneur may not be capable to push the product into market for more revenue. ID 4 suggested that they look for a good management and good board that do not operate in a
mess. The board of directors has to have commercial and governmental thinking to run the company well. ID 8 agreed that there has always to be good management. ID 5 spoke of great management consisting of qualified individuals were considered as factor of a good investment, meaning the chemistry has to work out between the entrepreneur and the investor. ID 6 agreed by saying that management risk is among the high-risk profiles. ID 13 stressed the good team is on top of everything. “It is better to have the best people than the best product because otherwise it does not work anyway.”

5.5.2 Business risk

Most IDs agree that normal business risks and financial risks have similar presence in the Cleantech sector. In terms of average time horizon, the most agreed periods are around 5 to 10 years. Particularly for Cleantech the investor could even see a prolonged time horizon, for instance it is not unusual to hold one company for 10 to 20 years, as suggested by ID 6. 3 IDs suggested that investments can take longer time than expected, ID 5 believe that for Sweden the time horizon could be 8 to 10 years. However it is possible to shorten the time horizon if money is put in the right business according to two IDs, ID 10 made an exit after 2.5 years and ID 6 says the good investment generate returns before 4 years.

Among all business risks the political risk is the hottest issue related to Cleantech investments particularly within the energy segment. ID 5 thinks that the rapid change in governmental decisions in subsidized segments in Cleantech, which is a challenge for investors. 2 of the IDs consider political risks come first when they consider all types of risks involved with Cleantech investments. The reason why political influence thought to be enormous is that government can decide on to retreat subsidies on one particular segment, which makes it less competitive on the market thus more difficult to generate returns. ID 4 claimed that the company avoided investments in solar cell and biofuel segments due to the unpredictable situations in political changes. Three IDs agreed on to stay away from solar cells segment based on past experience in Germany and Portugal among many other countries in the world that the dependence of subsidies takes along unpredictable events.

Generally as ID 10 concluded, the political risks differs in specific segments within Cleantech, solar electricity for example has received large amount of government subsidies. The collapse of one specific segment will not have a huge impact on the investors if similar governmental subsidies could be found in countries other than Sweden, where investments could continue. However if only a limited number of countries apply subsidies, for instance in the biogas segment, investors face a tough situation because alternative investments areas are restricted comparing to segments such as solar energy. ID 3 suggested that healthcare area, energy related areas along with other hot debated segments are much influenced by political decisions and regulations. On the other hand risk can also mean opportunity. Therefore an investor needs to make a good assessment carefully around political risks because it is an organic risk.
Another aspect that is related to time horizon is product life cycle, that if the product has a chance to survive on the market. ID 13 thinks that the political aspect of market risk is more important for Cleantech companies because it is a market driven business.

One the private side market risk is also widely discussed from different perspectives. ID 6 gave an example of market risk in relation to market risk that “To invent a technology costs one, to product develop takes 10, and to market it 100 in cost.” It implies that it costs more capital to bring the product to market than inventing the technology and manufacturing. ID 3 thinks that the product faces fierce competition in solar and wind segments. Particularly he mentioned the China effect that “the Chinese has come here with all kinds of products including solar, selling at lower price. That's tough for factories to keep up with. Very tough.” It creates tough competition for European factories since Chinese products have entered the market with a lower price, and market potential of the product is paying for that. ID 2 refers it as commercial risk since the customer won’t buy Cleantech products if they are not proven to be more effective and positive than existing ones. This phenomenon has changed during the years, where at the beginning companies have the possibility to sell their products to have the image of working in environmental area, however today the strong demand of Cleantech products requires better performance and lower costs. He added that “Only describing that the product is reducing CO2 and others are not good enough.” ID 1 and ID 5 agree with that. According to ID 1 Cleantech sector brings significant changes by creating and bringing new technology into the market and a new product could get abandoned on the market if it does not bring better impact. ID 5 expresses the difficulty with a new product that is changing the behavior of the market.

5.5.3 Innovation risk

The word “Cleantech” speaks for itself that technology is an important part of it. At the same time technology is very much connected with different investment stages.

The majority of private investors claim that they choose not to invest at early stages because the technology risk is enormous. ID 6 thinks that early stage simply implies technology risks therefore most venture capital investments have decreased at early stages. It is believed that technology risks are high because they are unpredictable and unproven, where he made a comparison between technology in software and Internet investment to Cleantech. It is much easier to get into the market quickly and see results for a software while for Cleantech especially energy related areas, it is very capital intensive that at certain it is needed to build a factory even without customer commitment. Therefore their company is more at commercialization stage where they could see the potential in market and customer commitment. ID 6 concludes “The technology risk is there almost all the time unless you started to commercialize it in a bigger scale.”

ID 2 expresses that “We have always been striving with technical risks in the sense that
it is normally difficult to go where we were aiming to go.” ID 5 believes that technology risk is one of the highest since they are involved in both early and commercialization stages. The long R&D cycle was difficult and one of the companies they have exited by selling it to another investor, but still have not been able to create a decent product. ID 3 talks about technology risk at expansion stages in some cases when configuration of products is needed. One investment they have in a biofuel company had very high technology risk for example. However it is can differ depending on which segment the company does business in.

For investors on the public side, technology risk was also acknowledged. ID 8 refers to it as technology shift that because of other product was developed in the market one particular product got wiped out because customers no longer need it. ID 11 thinks technology risks are more common to all technology companies than Cleantech, that investing in very early stages with the unproven technology and uncertainty about whether it will work. ID 9’s opinion is that technology risks are related to different stages, that once the technology is proven by tests where the results are fine and customers say okay, it is less risk. However in terms of strategy “even though you eliminate technology risk, there is so many risks in timing....We would rather not take a bet, where it is 50-50 that it will work.” When asking about which risk is the highest on Cleantech, ID 13’s response is technology risk, describing it as a huge risk. The reasoning behind it is that “Because if you fail on technology in the Cleantech space it often takes a long time to twist that technology and come up with a new solution.” Comparing to software development, technology in Cleantech takes longer time typically.

5.6 Exits: do they exist?
Most of our respondents started investing in Cleantech during and after 2006 when the official concept of Cleantech came to be. However, some of them have been investing in environmentally friendly technology since 1990s (ID1, ID2, ID6 and ID9). All of the VCs recognize that Cleantech sector is very capital intensive compared to other sectors, as ID3 mentions “A lot of investors underestimated the need for capital for Cleantech investments, comparing to IT, they need a lot more capital to go from seed, prototype stage to commercial stage”. They mean that the time to the market in Cleantech is really long and require a lot of capital.

Both public and private VCs state that it is very difficult to make an exit in Cleantech. The average holding period is between 5 and 7 years, however Cleantech investments were held longer, sometimes up to 10 years or more. Many investors state that “the market is closed right now” and therefore they are continuing being owners. Very few have managed to make exits or partial exits and the most common way of exiting as can be concluded from empirical evidence is trade sale and liquidation, where the latter is not a very successful way of exiting. Very few IPOs have been done in Cleantech sector.

Three out of six public VCs (ID 1, ID 3 and ID 6) managed to make an exit. ID 6 made
some IPOs and trade sales, ID 3 sold one back to entrepreneur and another was liquidated and ID 1 made a trade sale, where they sold their investment to industrial buyer. The rest are still owners and ID 2 states “we’ve done exits before, but not within five years”.

On the public side we can see that it does not look so bright either. ID 7 who started investing 7 years ago mentions: “we still have some companies and don’t see any exits”. So far they made some exits through liquidation. ID 9 managed to make 3 exits since 2007, two of them by selling their shares to another investor who wanted to continue and one by selling the whole company to an industrial buyer. ID 10 who has been investing in Cleantech for 13 years made several exits by liquidation. ID 11 made partial exits, where they sold some of their shares in order to invest in and support other companies. Other remains to be owners.

Some of the investors mention that it very hard to find a buyer to exit their investments or to exit in a way that suits the investors. ID7 says “It’s quite difficult to exit with 15-20% because you need the whole company to be sold. To only sell our share is difficult”. On the other hand ID 11 claims that “It is not difficult to find actors who are interested in our companies, but they want to put money in the company not by shares, just giving money to us for our shares. It’s a difference between investing buying new shares and buying old ones”.
6 ANALYSIS AND DISCUSSION

In this chapter we analyze data, which will be our empirical findings from the previous chapter, in the hope that through critical discussions in relation to Chapter 3 the theoretical backgrounds to draw primary patterns.

6.1 Secondary data analysis

6.1.1 Financing structure of Swedish Cleantech investments

Our secondary data defined various sources of financing on the Swedish Cleantech market. In spite of the knowingly VC funding which come from public and private VCs, other public organizations had a share in the market as well by supporting R&D and providing grants and loans to Cleantech companies.

Comparing to public funding, VC is a bigger player on the market since its proportion on the market is larger with a strong presence at all investment stages. As shown in Figure 4, public funding had not been active at expansion stage, but quite fruitful at seed and commercialization stages. Public funding and VC funding seem to share similar patterns from 2007 to 2011 that the amount of investments grew from 2007 to 2009, and followed a downslope between 2009 and 2011, although VC money decreased from 2008 to 2009. It may indicate that VC investments were largely affected by the financial crisis even though there was an increase in 2010. The US Cleantech investments fell sharply from 2008 to 2009 in line with the big drop of oil prices, but it was not the only reason. Instead Cleantech is more connected to economic trends, capital market and political influence. (Tierny, 2011, p. 81) Since Swedish VC investments in Cleantech had similar patterns as US, the decrease in investments may have been caused by economic dislocations.

According to Swedish Energy Agency (2010), it is usually governmental agencies and business angels that are involved with start-up and early stage investments in Cleantech, and VCs usually take over after business angels for product development on the market (Swedish Energy Agency, 2010, pp.8-9) Figure 6 showed that VC investments in Cleantech is strongest at commercialization stage and equally powerful at seed and expansion. VC investments at commercialization stage were almost twice as much as public funding, not to mention the huge difference in expansion stage. At seed stage public funding was almost equally matched by VC investments, with amounted 41.3 M EUR and 63.036 M EUR respectively. It shows that VCs in general may have a preference on later stages comparing to public funding, where customer commitment is visible.

6.1.2 Public VC vs. Private VC

Turning to Figure 6 we can see that there is a difference in stage preferences between public and private VCs. Similar to public funding, public VCs had a small proportion of
investments on expansion stage. Rather they invested mainly at commercialization stage and seed stage. On the contrary, private VCs have mostly invested at commercialization and expansion stage. One may suspect that commercialization stage is the favorite stage that VC money involved with

According to Figure 7, there are a series of changes in VC investment activities between 2007 and 2011. Private VCs have decreased their investment to a large extent, with a dramatic drop of 24.61 M EUR to 3.67 M EUR. At the same time we could identify an obvious parallel pattern between co-investments and public VC investments. Previous study has shown that public involvement tend to invite more VC investments over all in a Granger causality test (Leleux & Surlemont, 2003, p. 84). We suppose that it is the same for Sweden, that the presence of public VC stimulates more syndication opportunities.

Figure 8 and Figure 9 describe in which Cleantech segment and during which investment stage these large amounts of co-investments went to. The answer is energy related segments and commercialization stage.

6.1.3 Summary of secondary data analysis

Documentary secondary data could be used both quantitatively and qualitatively to help the researchers triangulate findings based on other dataset, for example primary data collected through interviews (Saunders et al., 2009, p. 258). In our study the usage of secondary data was made before the primary data collection phase. The results from secondary data analysis aided us to gain a general picture for VC investments in Cleantech under 2007 and 2011. Through data processing we could recognize a few characteristics of VC investments:

1. VC investments have generally decreased
2. VC investments are strongest at commercialization stage
3. Public VC investments tend to have similar investment behaviors as public funding that both are actively involved in seed and commercialization stage, with a small attention to expansion stage.
4. Most co-investments from VCs are made in energy related segment. The most preferred stage for investing is commercialization stage.

6.2 Investment strategy comparison

It is known that VCs have their own unique investment strategies based on risk tolerance. The matter could be further divided into three categories: investment stage, investment segments and ownership.
6.2.1 Investment stage

Based on our interview sample, private VCs prefer to invest at commercialization and expansion stage where the product is more ready and easier to see market potential. Our secondary analysis suggests a similar pattern that the majority of investments in Cleantech from private VCs are at commercialization stage from 2007 to 2011. Theory has suggested that early phase investment imply higher risk comparing to later stages, therefore investors demand a higher return at early stage investments that in pursuit of higher return there is always higher risk (Manigart et al., 2002, pp.14-15). However the reality has been the opposite that according to study results by Murray (1999) and Cumming (2010), early stage investments have lower return than later stages such as expansion. Therefore it is reasonable that private investors to choose later stages such as commercialization and expansion for their investments, since early stage is associated with higher risk and lower returns. For those who were involved with early stage investments, the market situation has made them to alter their investment strategy towards later stage investments in Cleantech, according to ID 2. According to ID 3 the reality in Cleantech investments was “higher risk and low return” in some cases, that is why private VCs are adopting the strategy of moving to later stage investments.

Even though private VCs claim that they prefer to invest at later stages, there is also lack of capital from VCs on the market, as suggests by ID 6. The reason for this is that normally investments in Cleantech are more capital intensive comparing with other sectors such as software and Internet, thus investors are always seeking co-financing since the amount is too large for one single VC to bear.

On the other hand public funded VCs with regional focus can participate in early stage investments as to fill in the gap of insufficient capital. Under regional as well as EU guidelines they are to stimulate regional economic growth and capital market with a wide range of focus, where Cleantech could be one of them. It is suggested that the presence of public VCs in a venture capital fund should strengthen the capacity of VC market in order to attract private capital resources, which is called the seeding hypothesis stressing on public intervention in promoting VC industries (Leleux & Surlemont, 2003, p. 99). As our secondary data suggests, the amount of co-investments between public VCs and private VCs have experienced both ups and downs, which followed a much alike pattern of public VC investments as shown in Figure 8. It may indicate that the public presence on the market had a positive effect on VC market through co-investing with private investors.
6.2.2 Ownership and syndication

Syndication is widely used in Cleantech, as our results showed that most investors, no matter public or private, use syndication as a strategy. Isaksson (2006) suggested that in many cases Swedish public VCs are required to co-invest with private investors (Isaksson, 2006, p. 23). All public VCs in our sample claim that they always co-invest with other investors. The reason for syndication is to spread the risks at different stages. The adoption of syndication increases the possibility of making a better investment decision (Lerner, 1994), at the same time it has decreased the private VCs risks on some level, especially when the public VC have a particular focus on Cleantech. As the establishment of a public VC with a special industry focuses aims at stimulate growth and development of the industry in the long run, the public VC is at frontier of sensing governmental policies which means it is easier to shift the investments on the alert of regulation and policy changes. ID 13 mentioned a case when they understand political risks are largely involved it is essential that the Cleantech company has a regulated body to keep an eye on changes, for them to make the investment. With the regulated agency the company could manage to coordinate their activities towards the regulation side. This is what they call a proactive strategy.

The upper limit of acquiring ownership for private VCs is around 40-49%. ID 5 claims that in one special case they become owner taking 80%. On the contrary, public VCs have the approach of taking minority ownership, ranging from 15% to 40%. Isaksson (2006) argued that state-owned VCs are limited that they are obliged to follow governmental guidelines (Isaksson, 2006, p. 23). Private VCs on the other hand do not work that way, thus they can freely choose how much ownership to take in an equity investment. This is so far a big difference between public and private VCs.

6.2.3 IRR requirements

There is no genuine difference between public VCs and private VCs in terms of IRR. The ones who use it as decision making tool usually requires an average of 20% IRR which is no difference from investments made in other areas. However public VC with a regional focus are unique again that only 2% IRR is required annually. This is a special situation that since the public VC carries out the mission to stimulate regional growth as well as the VC market, the criteria was set up to be low. Isaksson (2006, p. 20) argued that stated-owned VCs aim at long-term economic growth, which is a distinction from private VC. Our results support this argument, because sometimes public VCs require lower IRR to promote the local business development. Differences in regional regulations and guidelines create different profiles of investors.

6.3 Investment evaluation method

As Figure 17 shows we examined thoroughly on each interviewee's investment analysis process.
### 6.3.1 Deal Orientation

Three of the private VCs actively search for investors themselves either through own searching or consultancy firms while only one public VC does the same. It is more common for public VCs to have investors come to them and ask for funding since they are more known to the public of what they do. Three of the public VCs use network, forum and meetings to meet potential companies they could invest in.

There is commonly 50/50 split between companies come in for funding and the usage of network. ID 1 says that network has not been very useful for them. Currently there are great number of networks in Sweden that help to connect Cleantech companies and investors. Some of them are governmental supports such as SwedishCleantech.se, others are membership based private companies. The large number of choices also brings competition to the market, that which network has helped investors to gain higher profits? Or are they really helpful? Such issues may be looked upon in future research.

### 6.3.2 Screening

Tyebjee & Bruno (1984) suggested four major criteria to pick out investment opportunities. The first is taking control of the size of the investment. None of our interviewees have a limit on Cleantech investments. This brings us back to the basic theory: VCs are after financial returns.

The second criteria market and technology evaluation is apparently important under the Cleantech context. Through our interviews, when the IDs gave an example of their Cleantech investments, they were all able to describe the technology concerning how it works to gain market acceptance. Thus we believe that the expertise in technology is essential to make a good investment. ID 4 who had expertise in technology, even thinks that it does not necessarily mean it is the same expertise in Cleantech. ID 11 thinks that in order to be an investor in high-tech, the person needs to have engineering backgrounds from the university to understand. As Cleantech involves numerous segments and the definition and clarification of the term is not systematic, the investors’ good knowledge on technology is beneficial in the screening process. On the public side, ID 10 uses external due diligence to analyze technology potentials, and ID 8 relies on the co-investor who has expertise in technology as part of the screening process. One problem with public entities direct involvement in setting up VC funds is that public fund manager as government employees may not have experience to select entrepreneurial companies (Leleux & Surlmont, 2003, p.84). This statement is partially true since not all IDs from public VCs have technological expertise in Cleantech. However by adopting due diligence measures, the impact of the problem could be minimized.
Geographical location is an interesting criteria to look at. Tyebjee & Bruno (1984) suggested to investors tend to choose opportunities that are close to them so that they are able to control and monitor the business (Tyebjee & Bruno, 1984, p. 1056) What we discover about regional public VCs is that their investments have to be made in their regions, as their existence is to stimulate the local VC market and regional growth. Such guidelines were set up by both the government and EU. This is again consistent with what Isaksson (2006, p. 23) proposed about the constraints of state-owned VCs. Similarly the limitation applies to investment stages also. Regional public VCs are not supposed to compete with private investors, but rather to fill in the investment gap and accelerate the VC market through co-investing. Therefore they focus on seed stage where private VC investments are said to be insufficient.

### 6.3.3 Evaluation

The evaluation process could be seen as an incorporated phase, with investment strategy as reference, the investor finally arrives at decision making.

Pettersson & Nilsson (2012) suggested that VCs use the same evaluations tools for their Cleantech investments and other traditional investments (Pettersson & Nilsson, 2012, p.63) In the Growth Analysis (2012) report, this opinion is strengthened that investors claim that Cleantech are assessed the same way as other investments. The proposed criteria for any type of investment are:

- Strong underlying organic growth within the market segment
- Strong potential market position with potential competitive edge
- A competent, driven management team at the companies one is planning to invest in.

(Growth Analysis, 2012, p.3)

In addition Tyebjee & Bruno (1984) mentioned to use business plan to evaluate new ventures (Tyebjee & Bruno,1984, p. 1035). The market is important in terms various factors. Foremost it concerns with which stage the investor is at. For those at commercialization stage where customer commitment can be recognized to some degree, the market implies risk of whether the product will be successful. For those at expansion stage, the market means competition, sometimes fierce. ID 3 emphasized on the “China effect” that Chinese manufactures have been pouring into the European market with different types of products selling at lower prices. It creates a difficult situation for European manufactures to keep up with, to be both cost efficient and competing for more market share.

To participate in the global market for the Cleantech product or service is a common expectation from both public and private VCs. As a regional public VC focusing only on Swedish municipalities, ID 8 claimed that they always wanted the portfolio companies to go global and the technology to be globalized. ID 6 says that the product needs to have an international market, which is one of the criteria to evaluate investments.
6.4 Risk characteristics

The risk characteristics are strongly connected with the investment analysis, in a way that the terms “Cleantech” or “Venture” both suggest risk. Being aware of all risk factors as well as investors’ own risk philosophy plays an important part in the decision making process. On the other hand, investment strategy could be based on the understanding of different risk factors. How the risks are perceived is reflected upon the investors’ strategy or working approach. Being aware of the risks also implies certain measures to be taken in order to keep the risks at minimum level as possible. In discussion of risks invites various other factors in, therefore we try to stick to the framework we established in Chapter 2 in order to keep our analysis consistent with theoretical backgrounds.

6.4.1 Technology risk

The technology risks are acknowledged to be spread out for all investments stages, until the investor makes an exit. Early stage investments are regarded more risky since the technology is unproven. As VCs it is more important to see market potential in the product or service itself, that a number of committed customers are seen as prove that the product may have a chance to succeed on the market. As Reid & Smith (2001, p.17) suggested the technology could be so new that without professional knowledge the investor may fail to acknowledge the potential and reject the investment opportunity. Our empirical results suggested that having expertise in the technology is very much required for investors to mitigate the risk.

Unlike other sectors, the technology risk in Cleantech also implies high capital demand. It is sometimes needed that the investors need to build up a plant factory to do test-runs for the product, which almost never happen in other industries, for instance the software sector. Therefore investors are trying to shift away from Cleantech segments, which require the building of the factory, such as energy segment.

6.4.2 Business risk

Business risk is a rather broad term, which covers various issues such as the market, timing, exit opportunities as well as regulatory changes. All these risks are vitally important in Cleantech since special conditions exist.

VC investments usually take long time, however with Cleantech most VCs know that it takes even longer time. The average time horizon of Cleantech investments is 5 to 7 years, which is most agreed upon according to our empirical results. This is consistent with Schwienbacher’s finding that due to illiquidity of the European market, the exit time horizon is longer on the VC market (Schwienbacher, 2002, p. 16). At the same time most IDs acknowledge that how long it actually took them to make an exit is usually longer than they expected. There are no differences in opinion between public VCs and private VCs, ID 6 and ID 10 both think that the earlier to make an exit the better.
Growth analysis (2012) pointed out that there have been very few profitable divestment opportunities in Cleantech (Growth Analysis, 2012, p.2). This is no good news for VCs since the primary purpose for a VC investment is to exit (Cumming, 2002, p. 2). Tierny(2011) argued for the crucially of successful exits that if time horizon for IPOs are delayed it is harder to attract VCs in the future since there is no proof of market acceptance (Tierny, 2011, p. 81) Nonetheless, as our results show IPOs are not the most popular mechanism to exit in the Swedish Cleantech market. Indeed there have been few exits, that some VCs still keep their investments for over 7 years. The exits that have been made usually took the form of trade sale, which means VCs sell the investments either to another investor, or back to the entrepreneur, or an industrial company who could make use of the technology.

Both public VCs and private VCs have affirmative reply on unexpected regulation changes, even for Sweden, which is a country that supports greatly innovations. The dependence of governmental policies is higher in the Cleantech sector than any other sectors, for example the renewable energy segment is whole dependent on carbon dioxide tax levels (Growth Analysis, 2012, p. 3). Our research found the same results that energy is regarded as the most “dangerous” segment in Cleantech. For public VCs who work under governmental guidelines, the political factors are less concerned but it also depends on what Cleantech segments they make investments in.

Isaksson (2006, p. 70) argued that public VC tend to make more management buyouts than trade sales. Even though the theory does make sense, since giving the shares back to the investor is allowing them to take more control over their company and that is the primary reason of public investing, to support them in the beginning and then allow companies to grow. However in our evidence none of the public VCs has made a management buyout, secondary sale on the other hand is far more popular exit, made by two out five public VCs (ID9 and ID11).

6.4.3 Management risk

It is mostly agreed by investors that a good team is vital in their evaluation. They have to see the potential in the entrepreneurs that they could manage good business. The corporation between VCs and entrepreneurs could be in threat if they have different goals of management, which put the investor in a difficult situation (Wüstenhagen & Teppo, 2006, pp. 71-72). Thus when evaluating investment opportunities VCs tend to
look for entrepreneurs that share the same values with them. Pettersson & Nilsson (2012) suggested that the relationship between VCs and entrepreneurs is of major importance from the entrepreneurs’ perspective that they need to show good characteristics to VCs in seeking of funding (Pettersson & Nilsson, 2012, p.63). Our research results showed that from VCs’ point of view the good management team could even overcome technology difficulties and market risks, because a good product or a good idea needs to cling to the qualified personnel to be successful on the market. The idea is acknowledged from both public and private VCs.

### 6.5 Summary of empirical analysis

There are minor differences between public VCs and private VCs in terms of investment strategies. As we discussed under section 6.2, the differences lie in four aspects:

1. **Stage preferences**
   Public VCs have little concentration on expansion stage, while private VCs are active at both commercialization and expansion stages. Generally private VCs wish to see proven technology on the market so that the technology risks will be smaller. Some public VCs think alike that they need to see interests from customers. One clear distinction we found is the regional public VCs works under mission to support early-stage investments to fill in the gap in capital.

2. **Ownership requirement**
   The majority of private VCs state that they want to be minority owners, where their limit of ownership ranges from 15% to 49%, with exception of even higher percentage in some case. That is to say private investors have the freedom to choose how much ownership they could take by investing. On the other hand public VCs are restricted due to governmental guidelines that the percentage is not supposed to exceed certain amount.

3. **Syndication**
   Public VCs are working under governmental guidelines; therefore they are required to co-invest with private investors, which could also be referred to as syndication.

4. **IRR requirements**
   Some regional public set up low IRR because they don’t want to demand too much from the companies. In spite of that, other public and private VCs have similar standards of an IRR ranging from 15% to 40%. Isaksson’s (2006) theory could be an example to explain the above differences. Public VCs, as they are of state-owned nature, are operating under guidelines from governments, and sometimes EU. This makes the public VCs highly restricted in certain ways.

The investment analysis refers to the decision making process from deal orientation, screening and evaluation. The screening and evaluation processes are important because they directly affect the outcome of the decision-making. We found no major difference in the analysis process, that the investors use similar criterion to evaluate their opportunities. Since factors to be analyzed in evaluation are external which is not a factor that investors could take control of, the scheme remains the same.
Studies have shown that integration between a firm’s strategic investment projects and the firm’s strategy, which is usually set in advance for all types of investments, forms a critical pre-decision control. The pre-decision control mechanisms can take in various forms, for instance to use the hurdle rate for investment managers. (Alkaraan & Northcott, 2007, p. 147) It shows that the organization’s strategy usually set up as a reference base for strategic decision making, and the adoption of mechanisms such as budget limit and hurdle rate affects the decision making process. Part of our study findings supports this view. The investment strategies we have mentioned regarding stage preference, ownership, syndication and IRR are used to screening down investment opportunities to certain range. Then the following evaluation of investment opportunities is affected. For example, public VCs who has the investment strategy to focus on investments in seed stage, eliminates opportunities to later stages during screening process. During evaluation phase it is impossible to analyze the market potential for instance, since at seed stage there are still technology risks involved and the product may not be ready.
7 CONCLUSION

In the last Chapter we go back to our research questions to give an answer based on our major findings in summary. We also present theoretical and practical contributions from our research to draw connections between our answers. Suggestions for further research are also included.

7.1 Research Question and Research Purpose

Under section 1.1.4 we discussed the knowledge gap that the area of VC investments by state owned VCs and private VCs have not been touched upon, not in Cleantech sector or other industries. As Sweden has various public VCs it is important to understand if the nature of being owned by the government necessarily implies a difference comparing to private ones. Thus we arrived at our research question:

How do investment strategies and evaluation methods differ between public and private Venture Capitalists in Swedish Cleantech Sector?

VC financing has been a vitally important source of Cleantech financing. Both public VCs and private VCs have supported Swedish Cleantech developments. However there are limited traces of the difference between them, except that public VCs have to work under governmental guidelines, which make them constraint in some situations. The majority of the public VCs are required to co-invest with private investors, and that is the main discrepancy from private VCs. Regional public VCs particularly, work to stimulate private VC on the market and fill in the capital gap at seed stage. Of those regional public VCs, the IRR requirements do not follow a certain pattern, but spread out in a range of the lowest 2% to 40%. Such difference may result from regional regulatory grounds, based on in which county council they are located in Sweden.

It is also noticeable that in essence of public presence on the VC market is that public VCs carry the mission of creating long-term economic impact, or strengthening growth in certain Cleantech segments, adding value to GDP growth. In nature the public VCs and private VCs adopt rationale philosophy of a general VC where financial returns are what they are after. This view could be well explained by combining the goal of achieving financial return from Cleantech investments together with creating values on the market, such as promoting a certain Cleantech segment and creating more employment opportunities. These financial returns are realized through various forms. However they share the same characteristic that the realizations of financial returns are measured from both macroeconomics and individual VCs’ profitability perspectives.

The evaluation methods used by public VCs and private VCs are similar as well, since the process involves screening and evaluation phases for an investment analysis, which comprise as an examination of external factors. These factors include business plan, market potential, growth potential and management team’s potential to monitor risk
factors and other unexpected events in the future. Private VCs seem to be more concerned with political risks that the change of governmental policy could have significant, sometimes damaging impact on their investments. On the other hand public VCs are less worried about regulatory changes, but it does not necessarily mean they are totally neglecting this risk factor. Such concerns are dependent on if the public VC is created to accelerate growth for a certain Cleantech segment. The more focused their business is, the less they are influenced by policy changes. The reasoning for this is clear: the government’s operations are rigorous, and the set-up of state-owned agencies must be consistent with its policies.

Moreover, a part of the public VCs demonstrated a lack of expertise in technology, comparing to private VCs. However the impact of this problem is not amplified since public VCs that do not own technological expertise chose to use due diligence as screening process.

7.2 Theoretical Contribution

There are perceptible differences between public VCs and private VCs in terms of investment strategies for Cleantech. Public VCs are generally working under governmental guidelines therefore they are more limited in certain investment strategies. Even within the public VC group there are differences, such as regional public VCs operate under regulatory demands from both Swedish government and EU. Public VCs share similarities, but each one of them can be regarded as a unique case based on their special organizational mission which in turn influences their investment strategies. Cleantech investments are regarded to be much related with governmental regulations, and the creation of different public VCs had an influence on Cleantech investments by increasing the amount of co-investing with private VCs. The example of public VCs and private VCs co-investing in the Swedish Cleantech sector may be seen as a case of promoting private money into the market by governmental involvement.

To make an investment in Cleantech requires careful examination of all factors, which means both taking the stand of the investor’s investments strategy as well as the external factors that involve investigation of the technology, the product, the market and entrepreneurs’ management abilities. One important part of this screening process is to use due diligence to select the best candidate.

7.3 Practical Contribution

To add on more competence of the market, it is important for VCs from both public and private side to understand how the working routines of the investors. The government needs evidence to make sure that establishment of public VCs serves the purpose as they are supposed to be. Does the involvement of public VCs necessarily boost the Swedish VC market? The syndication of public and private VCs clearly added in more capital in Cleantech investments. As a new investor in Cleantech, the knowledge of how differently public and private VCs work in this sector as well as how they collaborate is beneficial since it may bring more investment opportunities. As a new player in
Cleantech investments, it is important to establish investment strategy prior to seeking investment opportunities for efficient decision making. Since some of the public VCs are required to co-invest with private players it might be advantageous to seek co-investments opportunities with them since private VCs are competing with each other about who gets the best deal.

### 7.4 Recommendation for further research

Our first proposal for future research is to conduct longitude study for the Swedish VC market. As technology and innovation trigger the global trend of sustainable development and Sweden being an active in promoting innovation and research, it is important to ensure that there are enough capital from the VC market to support these. At the same time the investments are value-creating in both innovation development and financial returns for investors. Results from a longitude study could teach valuable lessons for Swedish VC market on how to stimulate growth. Especially a comparative study between the Swedish VC market and U.S. market would be beneficial, as the U.S. market is more mature and more ahead in development.

We studied investments in a high-tech investment sector that sometimes the investors need to have expertise in the technology itself in order to make an investment decision. Is it the same with other investment sectors? For instance in medical science or real estate, is it necessary for investors to gain professional knowledge in the areas they invest in?

Furthermore it would be interesting to make comparisons between Cleantech sector and software, internet sector, since they all share a booming characteristic in the beginning. Is Cleantech going to go down similar to the dot-com bubble in the 1990s in the future? Exclusively the business cycle of Cleantech investments needs further investigations.
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## Appendix 1 Taxonomy of Cleantech segments

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<th>Agriculture</th>
<th>Air &amp; Environment</th>
<th>Energy Efficiency</th>
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<td>Land management</td>
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<td>Monitoring</td>
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<td>Natural pesticides</td>
<td>Cleanup/safety</td>
<td>Building envelope &amp; insulation</td>
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<tr>
<td>Crop yield</td>
<td>Monitoring/compliance</td>
<td>Building automation</td>
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<td>Sustainable fertilizers</td>
<td>Trading &amp; offsets</td>
<td>HVAC Appliances</td>
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<td>Precision agriculture</td>
<td>Clean coal</td>
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<th>Energy Storage</th>
<th>Solar</th>
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<td>Systems</td>
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<td>Fuel Cells</td>
<td>Cells &amp; Modules</td>
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<td>Other Storage Technologies</td>
<td>Thin Films</td>
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<td>Lithium on Charging &amp; management</td>
<td>Concentrated PV</td>
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<td>Geothermal</td>
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<td>On-site Systems</td>
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<tr>
<td>Hydrogen Production</td>
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<tr>
<td>Combined Heat/Power</td>
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Appendix 2 Interview guide

1. What is Cleantech in your opinion?
2. What financial instruments do you use for your Cleantech investments? (Funds/loans/ownership). Maybe a combination?
3. What factors drive you to make an investment in Cleantech?
4. If there were multiple motives, how would you scale them in terms of importance?
5. Did you focus on a particular sector in Cleantech?
6. What stages have you been investing in? Why? [Seed/Commercialization/Expansion/RD]
7. What proportion do your Cleantech investments take in your total investment portfolio? [in percentage/in numbers]
[Do you have a limit for your investment?]
8. What was the average time horizon for your investments?
9. What did you expect from the investment (expected returns)? What have your risk-adjusted returns been on average? (Average IRR/ROI)
[Do your actual returns differ from your expected ones? [profit/loss]
10. We’ve found research that suggested socially responsible investments (SRI) tend to generate excess return together with corporate environmental performance. What’s your opinion towards such statement?
[What do you think about CSR/ESG issues in your investment portfolio?]
11. What do you think about the risks involved in investing in Cleantech? Are they different from the risks associated with your other investments?
What do you feel towards the following risks?
1) Agency risk [Relationship entrepreneur vs. venture capitalist]
2) Business risk [timing/market/political]
3) Innovation risk [R&D, the Swedish paradox]
How would you scale these risk factors from 1 to 5, 5 being the highest?
12. Have you taken any risk mitigation measures to monitor these risks? If so, what are they?
13. Would you say that your risk aversion towards Cleantech is different from your investments in other sectors? [1-10, 1 being willing to take risks]
14. Have you made any exits for your investments? If you did what are they? How would you comment on them? [IPO/trade sale]
15. Have you used any genuine network to get connections with Cleantech companies? [Cleantech Scandinavia etc.]
Or do you use other connections for potential investments?
16. Have you made co-investments with other investors? What is your opinion towards it?
17. Have you established any method or screening process to select Cleantech companies or any investments? Could you describe them briefly?
18. Do you have any comments to add?