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Venture capital

In need of new valuation tools?

Master's thesis within corporate finance

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Master's Thesis in corporate finance

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Abstract

Venture capital investments have become a major contributor the growth of start-up firms. Investing in start-up firms carries a substantial risk of failure, only a minority of start-ups is high-return investments. This put great responsibility to the valuation methods used by the venture capital firm. It is argued that when uncertainties about future pay-offs are high traditional valuation tools are of little help, they are said to be too static and not to comply with change. A valuation method that is alleged to act in accordance with a changing environment where uncertainty is high is real option which is said to consider these variables, thus giving a more accurate valuation. The structure of venture capital funding can be seen as well suited for real option valuation.

The authors find it interesting to find out how venture capitalists screen possible investments, if the traditional valuation methods hold in proportion to the challenges they face and if the real option approach could be suitable.

The purpose is to describe and analyze how Swedish venture capital firms can valuate investments.

The research was carried out using a qualitative method. We conducted interviews with four venture capital firms that operate in Sweden. The participating firms were: Industrifonden, Itact, FöretagsByggarna and LinkMed.

The authors found in their research that the most important factors when screening the possible investments are the market and the entrepreneur. The venture capital firms use of valuation methods differ significantly. LinkMed and Industrifonden apply traditional valuation tools in contrast to Itact and FöretagsByggarna that rely on personal experience and expertise. Limitations found in the traditional models were lack of accurate and reliable estimations. The structural outlay of the investment is in line with that of the real option approach and the authors believes that real options exist embedded in the respondent's investments. This implies that a real option approach is suitable for them.

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1 Introduction

1.1 Background

Venture capital investing has become a major contributor to the growth of innovative start-up firms. According to Bergemann and Hege (1997) venture capital has grown to be the financing mode of choice for projects where uncertainty of future pay-offs are high. The Swedish venture capital market has developed over the last decades and statistics from SVCA[1] (2004) show that there are currently around 118 venture capital firms in Sweden. The number of investments peaked in 2001 with a total sum of SEK 8 billion. Although the amount of investments has decreased since then, the value of total administered capital has increased. Following the burst of the dot-com bubble the investors have become more risk-averse. Millman (2005) comments on this by saying that even though substantial volumes of money are pouring into venture capital funds, investors, rather than making several small uncertain investments, look for fewer larger ones.

According Botteron and Casanova (2003) venture capital investing carries a substantial risk of failure, only a minority of start-ups is high-return investments. Bergemann and Hege (1997) call the decision to invest and how much to invest the most challenging problem for the investor. Leslie and Michaels (1997) argues that when uncertainties about future pay-offs are high traditional valuation tools such as net present value (NPV) is of little help. The predictions given are too static and do not comply with changing conditions.

A valuation method that is alleged, by several theorists (e.g. see Trigeorgis, 1996; Copeland & Keenan, 1998; Yeo & Qiu, 2002; Olsson, 2003a), to act in accordance with a changing environment where uncertainty is high is real option. Real option valuation is said to consider such variables as uncertainty by giving it an intrinsic value. Leslie and Michaels (1997) claim that real options provide management with a decision making tool that will enhance strategic opportunism. It assumes a flexible approach that allows managers to alter the course of a project in response to change (Copeland & Keenan, 1998).

Davis, Schachermayer and Tompkins (2003) point out that the structure of venture capital funding is well suited for real option valuation. Botteron and Casanova (2003) also emphasize in their study that the application of the real options approach offers new perspectives in the valuation of start-ups as it allows assessing the value of risk management within a start-up investment.

1.2 Problem formulation

As mentioned earlier venture capitalists are confronted with a considerable risk of failure. Caselli and Gatti (2004) call for a thorough screening process. Factors of importance involve markets, technology, management, strategy etc. This leads to the first question:

- *What factors can be important when venture capital firms examine possible investments?*

Venture capitalists face a dilemma between risk-aversion and high potential gains. Dealing with uncertain predictions and changing conditions put high demands on valuation tools.

[1] Swedish private equity & venture capital association

Davis et al. (2003) write in their report that valuing early-stage growth companies is a challenge to current valuation methodologies. This raises the questions:

- *Which valuation methods can be used by venture capital firms?*
- *What limitations can be found in the traditional methods by venture capital firms?*

It was almost thirty years ago that MIT professor Stewart Myers coined the term "real option" which was supposed to be the new and superior capital budgeting tool. Still that is not the case (Teach, 2003). Although it has been praised by its advocates as the valuation method of choice when uncertainty is high and flexibility is desired few practitioners have adopted the method (Yeo & Qiu, 2002; Davis et al., 2003). Drawing from the these arguments it would be of interest to answer the following question:

- *Can the real option approach be suitable for venture capital firms?*

1.3 Purpose

The purpose is to describe and analyze how Swedish venture capital firms can valuate investments.

2 Method

2.1 Choice of method

There are traditionally two methods for data collection and interpretation; quantitative and qualitative. The quantitative approach uses a representative selection from a population from which it derives large amount of data (Holme & Solvang, 1997). The data received is then analyzed using statistical calculations in order to find patterns which can be applied to the population as a whole. The method yields general conclusions without any significant depth (Lekvall & Wahlbin, 2001).

Qualitative studies interpret and analyze data which can not be analyzed using statistical methods. In the data collecting process only a small number of respondents are being used (Lekvall & Wahlbin, 2001). Opinions and interpretations shape the conclusions drawn by the researchers (Holme & Solvang, 1997). The purpose is not to create universal truths but rather gaining a deeper understanding regarding the motives of the respondent. (Silvermann, 1993).

The authors have in this study decided to use the qualitative methodology. A qualitative study will grant the possibility of an in-depth analysis and encourage a deeper understanding based on the purpose of this thesis. Thus, providing for a better conclusion.

2.2 Literature

The Literary resources found interesting and necessary in order to create the theoretical background have been obtained through various sources. The initial inquires for previous theses and books, connected with the chosen subject, and were made through the university library in Jönköping. Databases, provided by Jönköping university library and Gothenburg university, and Google internet search engine were used to find scientific articles and foreign studies.

Common keywords when conducting the searches were: "Venture capital", "Private equity", "Real options" and "Staged investments".

2.3 Selection

In qualitative studies the selection process is of a subjective kind. The chosen selection is not statistically secured thus, not able to represent the whole population (Corbin & Strauss, 1998).

The selected respondents were found through the homepage of SVCA. Their member's database was used to obtain a first selection of possible respondents. The search criterions used in SVCA's member database were the following:

Investment stage: Start-up

Investing country: Sweden

In the initial search 22 venture capital firms were found. The possible respondents were all contacted and in the end four agreed to participate in our study. Time constraints were the reason given by the possible respondents that did not want participate. The participating

respondents are given a short presentation below. The date that each interview was conducted is also listed.

Industrifonden

Industrifonden provides development capital, for Swedish growth companies. They invest in early stage and early expansion phases with a focus on knowledge intense markets such as Life-science, Information and Communication Technology and Industrial venture. Their head office is located in Stockholm.

Industrifonden manages an equity of about SEK 3.2 billion and their head office is located in Stockholm.

The interview was conducted with Björn Ogenstam on the 8 December 2005. Björn Ogenstam holds a position as Vice president and has been working with Industrifonden since 2002.

FöretagsByggarna

FöretagsByggarna invest in Swedish early stage companies. They are mainly interested in companies within software, communication, media and medical equipment. Their head office is located in Stockholm

FöretagsByggarna manages about SEK 950 million.

The interview was conducted with Per-Henrik Norhagen on the 8 December 2005. Per-Henrik Norhagen has been a partner since 1997. He has previously worked with business development and has also been management consultant for many years.

Itact

Itact focus mainly on early stage investments in hardware related technology, such as global datacom, telecom and semi-conductors. Their head office is located in Stockholm

Itact manages a fund called V2 Fund that holds SEK 314 million.

The interview was conducted with Fredric Gunnarson on the 12 December 2005. Fredric Gunnarson co-founded the company in 1999 and has been the CEO since 2002. Prior to Itact he worked at Ericsson as venture manager at the venture capital unit Ericsson Business Innovation.

LinkMed

LinkMed invests in early-stage life science companies involved with biomedicine, biotechnology or pharmaceuticals. Their head office is located in Stockholm.

LinkMed is an independent development capital company with about 120 shareholders. The company is 60% owned by other companies, both listed and privately held, with the remaining 40% in private hands.

The interview was conducted with Ingemar Lagerlöf on the 12 December 2005.

Ingemar Lagerlöf is a senior investment manager that holds the primary operational role at LinkMed.

2.4 Interviews

Since the intention is to carry out a qualitative study the authors have chosen to conduct interviews in order to receive the information needed. The main advantages with interviews according to Welman and Kruger (2001) are the opportunity of instant feedback, the unlimited possibility to ask different types of questions and to adapt the interviews to each specific situation. Lekvall and Wahlbin (2001) develop the reasoning by saying that it is important to clarify which type of interview that is to be conducted. It is agreed (Lekvall & Wahlbin, 2001; Welman & Kruger, 2001) that there are generally three types of interviews.

> In **standardized interviews** both the questions and the order, in which they are asked, have been predetermined.
>
> **Non-standardized interviews** offer a more situational approach and flexibility. The interviewer chooses freely both questions and their order.
>
> A middle of the road approach called **semi-standardized interviews** grants the interviewer with a level of freedom when it comes to follow-up questions and question order.

Standardization seeks to make the interviews as similar as possible for all the respondents thus enabling a more quantitative processing of the answers. Using standardized questionnaires improves the possibility of comparing different interviews and drawing conclusions (Lundahl & Skärvad, 1999). According to Arksey and Knight (1999), non-standardized interviews are better suited for in-depth qualitative studies.

The authors chose to use semi-standardized interviews in this study. A semi-standardized approach provided for consistency in the collected data but also allowed for more in-depth insights, which would have been overlooked with a standardized questionnaire.

The authors have not been able to conduct personal interviews on location with the respondents due to the time constraint of the respondents and the authors. Before the interviews the authors e-mailed a draft of the questions and a short explanation dedicated to the purpose and theoretical background of the study to the respondents, in order for them to be prepared. While conducting the interviews the authors tried not to use any leading questions to avoid any biased answers. Both authors were present during all interviews. The interviews were recorded using a tape recorder. This allowed for accurate transcription of respondents answers and prevented any distraction from taking notes. The respondents were asked before each interview if they opposed the use of a recording device. The interviews were conducted during week 49 and 50 year 2005. The average time for each interview was 30 minutes.

2.5 Validity & reliability

In all surveys/studies there is a demand for a certain level of reliability and validity. In order to achieve credibility none of these aspects can be neglected.

According to Eriksson and Wiedersheim-Paul (1999) validity is the extent to which a measure accurately reflects the concept that it is intended to measure. There are several factors that affect the study, such as interviews, question-design and the respondent's sincerity. The respondent might also feel his/hers integrity to be threatened, and the interviewer could influence the respondent with his/hers opinions and values. (Svenning, 1997).

Reliability is the extent to which a measurement instrument yields consistent results over repeated observations under the same conditions each time (Holme & Solvang, 1997). According to Silvermann (1993), the demand for reliability in qualitative studies is to be disregarded. This is due to the researcher's subjective influence that is to be regarded as an integrated component of the methodology, thus one can not expect to receive identical results over repeated observations (Silvermann, 1993).

It is important that both the respondents and researchers understand what the other is asking or answering. In order to ensure a high validity in our study the authors sent a questionnaire and a short explanation of our theoretical background to the respondents in advance. During the interviews the authors asked follow-up questions to clarify any possible misunderstandings. The authors are aware of that the validity of the study is influenced in a negative way due to that only four respondents were willing to participate. But the respondent's personal experience and positions within their companies gives a large credibility to their answers, thus strengthening the validity

The authors are aware of the intrinsic problem of reliability when conducting qualitative studies. The authors can not guarantee that similar studies with different respondents would generate the same results.

3 Theoretical framework

3.1 Venture capital

Isaksson (1999) presents in his article an easy clarification about the different concepts of venture financing. He gives an account of the different ways in which money can be transferred to a company. This section will provide the reader with a first insight in venture capital and its comparables based on Isaksson's conclusions.

The first example of foreign financing is probably the most obvious one; raising a loan from a bank or credit institution. According to Covitz and Liang (2002) this might prove difficult to some firms due to lack of previous track-record or that they operate in a risky market. The other form of financing is risk capital, which is the same as an investment in the company's private equity. Normally the supplier of risk capital becomes a part owner of the company. Other forms of risk capital can be convertible debt instruments, profit share loans. It is commonly agreed by Isaksson (1999), and Covitz and Liang (2002) that the main difference between these ways of financing is that the supplier of risk capital has a higher risk but at the same time expects a higher return.

Isaksson (1999) point out that it is called risk capital due to that private equity takes the first hit when the company is in insolvency. In same time dividend payments will only take place if it is possible according to future expectations. When it comes to other investors they will get their interest payments regardless if the company is generating profit or not.

Three terms often mentioned when talking about how to finance a company are risk capital, private equity investments and venture capital. As we mentioned earlier risk capital is a way of transferring money to a company and in return be a part-owner of the company. This can be done in any company, both quoted and non-quoted. Buying shares on a stock exchange for example is a form of financing a company with risk capital (Isaksson, 1999).

A private equity investment on the other hand involves investments only made in non-quoted companies. These investments are of a passive kind that only includes financial involvement (Isaksson, 1999).

Isaksson (1999) define venture capital as an investment in a non-quoted company where the investors also assume an active ownership engagement. Hosmer (n.d.) supports this by saying that entrepreneurs turn to venture capitalists not only to finance the development of their firms but also to gain access to professional management skills and strategic support of experienced investors. Isaksson (1999) further mentions that the active engagement can for example be by representation on the company board and assistance with competence. In general venture capital investments are a part of the private equity. In some cases though it can be in the form of loan capital like convertible debt instruments, subscription rights to new shares and stock options. The companies which a venture capital firm is investing in are often called portfolio companies due to that the investor spread the risk in a portfolio of investments.

Venture capital firms are specialized in investing in companies with potential development opportunities. Venture capital investments are also done by private persons, often called business angels due to the reputation that these angels are contributors and not rational in-

vestors (Isaksson, 1999). Recent research conducted by BVCA[2] (2004) show that business angels generally invest smaller amounts compared to specialized venture capital firms. It is often hard to distinguish between business angels and venture capital firms. This is due to that many of the business angels make their investments through companies they control and recently, networks of business angels have also been established (Isaksson, 1999; BVCA, 2004).

Isaksson (1999) mentions that venture capital investments always have a time limit. The investors have an objective to sell their shares in order to realize a capital gain. The venture capital firm will exit the collaboration either when the wished development is reached or when the collaboration no longer generates any value. In general there are no dividends received by the investor during the collaboration due to the fact that any surplus has to be reinvested to achieve further growth. BVCA (2004) mentions five different exit options held by the venture capitalist.

> **Trade sale**: The sale of your company's shares to another company. The majority of exits are achieved through a trade sale.
>
> **Repurchase**: Occur when the company and/or its management repurchase venture capitalist investors' shares.
>
> **Refinancing**: The purchase of the venture capitalist investors' shareholdings by another investment institution. This type of exit may be most suitable for a company that is not yet willing or ready for flotation, but whose private equity investors may need an exit.
>
> **Flotation**: To obtain a quotation or initial public offering (IPO) on a stock exchange. In the case of a flotation, the venture capitalist may not sell all the shares it holds, it might continue to hold the newly quoted shares for a year or more.
>
> **Involuntary exit**: Where the company goes into receivership or liquidation.

3.2 Investment process

Given the distinctly low success rate that venture capital investments provide the investor with, it is important to be able to screen out possible failures from the cash cows (Bergemann & Hege, 1997).

Caselli and Gatti (2004) explain the rigorous screening process that is needed in order to determine which investments and partnerships the investor should go through with. Mainprize, Hindle, Smith and Mitchell (2002) views the evaluation of business plans as a major component of the decision making process. According to Caselli and Gatti (2004) each proposal passes through different evaluation steps that analyze a series of critical factors. A first brief analysis which is strongly influenced by the investor's strategic orientation covers areas such as geographic location, industry structure and type of product. This first stage generally gets rid of fifty percent of the proposals. Proposals that reach the second-stage are examined with greater care. Elements such as the chosen market, expected economic-financial results and amount of financing required are in-depth analyzed. An additional thirty five percent is eliminated after the second-stage. The remaining proposals are scruti-

[2] British private equity & venture capital association

nized even further with the main focal point on the business plan and the investment process. The business plan is evaluated on the basis of the entrepreneur and the management team, competitive advantage and timing of investment. The entrepreneur must communicate the concept of having an absolutely feasible business idea that is only missing sufficient capital. The investment decision and the signing of the final contract, by the investor, occur only successively once a series of verifications have been made. A phase referred to as "due diligence" begins where the investor performs activities which analyze the current state of the company and its future potential, in order to reach a final valuation. BVCA (2004) indicates that the due diligence process is used to find out any fundamental problems that may exist. They further explain that external consultants might be needed when assessing market prospect and technical feasibility of the proposition, unless suitably qualified people exist in-house. The primary parts on which the due diligence activity focuses on are classified as follows.

> **Market due diligence**: An elaborate analysis covering potentiality and risks of the current market, it establishes whether the entrepreneur can commercially produce the product. It provides the investor with an understanding on how the business plan compares to the actual market situation due to that entrepreneur's often are overly optimistic when making their forecasts (Caselli & Gatti, 2004; Golis, 1998).
>
> **Financial due diligence**: Examines the economic-financial aspects from the view point of future financing. The analysis takes into account factors of success that are unique for the company in question and past historical trends. It assess the following estimations; future cash-flow, budget, organization structure, liabilities and risks (Caselli & Gatti, 2004; Golis, 1998).
>
> **Legal due diligence**: Investigates any legal constraints connected with the creation of the final contract. It particular examines any possible lawsuits and commitments undertaken with third parties (Caselli & Gatti, 2004).
>
> **Tax due diligence**: Analysis the fiscal outcomes of the value creating process between the investor and the entrepreneur (Caselli & Gatti, 2004).
>
> **Management due diligence**: The management team is seen as a key aspect of success. The investor needs to determine if the entrepreneur have the combination of drive, intelligence and persistence to succeed. Track records of previous experience and personal references are two ways for the investor to make a judgment (Golis, 1998).

If there are no obstructions found during this last phase of analyzes the investor will go through with the investment.

As can be seen in the figure below, it is not an easy road to travel. As many as eighty-five percent of the proposals received are being rejected after a couple of brief analyzes. Only about one percentage reaches the final investment process and receives funding.

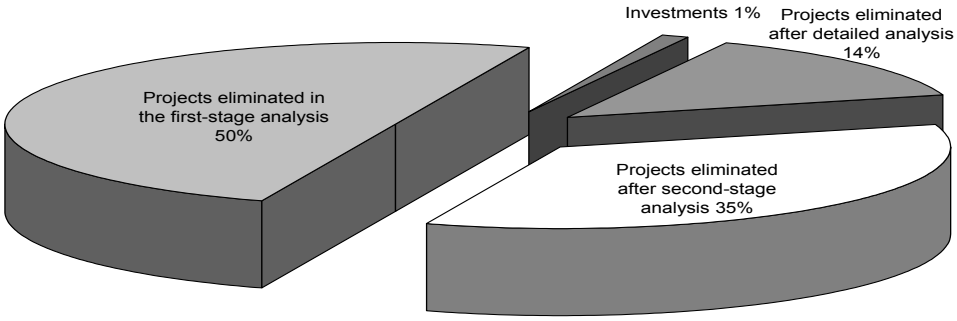

Figure 3-1 The selection of the investments by the venture capitalist (Caselli & Gatti, 2004)

Venture capitalists do not only invest in firms in their build-up stage. There are a number of different phases during a company's life-cycle that may require additional funding. Different investors, because of previous experience or personal preference, invest in different phases.

Seed financing: A partnership is created between the entrepreneur/innovator and the investor before a firm has been established (Företagarguiden, 2005). The investor gets involved in the experimentation phase, when the product/service is not yet technically validated. The investor contributes with a modest investment in the initial development phase (Caselli & Gatti, 2004).

Start-up financing: Funds are provided to a recently established firm that lacks the means to facilitate its product/service (Företagarguiden, 2005). The commercial validity is not yet known. Financial contributions are larger than in seed financing (Caselli & Gatti, 2004).

Expansion financing: Necessary investments are being made to a firm in an early expansion phase. Production and sales are increasing but the firm lack the required working capital to expand (Företagarguiden, 2005).

Replacement capital: An investor purchases shares of an existing shareholder who wish to dispose of all or part of his/hers shareholdings. The existing shareholder might be the owner or another venture capitalist (Företagarguiden, 2005).

Management buyout: Enables the current operating management and investors to acquire or to purchase a significant shareholding in the business they manage (BVCA, 2004).

3.3 Valuation process

Golis (1998) clarifies that estimating the value of the investment is a fundamental part of the investment decision. The closing of the deal depends on the agreement about the amount of funding that is required. Valuation concerning start-up firms can prove to be a tough nut to crack especially if there is no previous track record and highly risky market

with poor economic and financial performance. The first problem that analysts face is how to choose a proper method of valuation. A number of different valuation methods are available and the key is to decide which method is most suitable. Caselli & Gatti (2004) mentions a couple of determinants that can be used to assist in this process.

> **Type of industry**: Different industries have different value drivers. Industries where the firm has a large part of its employed capital as fixed assets and working capital (tangible assets) the analysts should choose a balance sheet based method. Typical industries would be manufacturing, real estate and chemistry. Companies whose competitive strength is invested in intangible assets, such as research and development (R&D), which do not show in the balance sheet should use cash-flow and income based methods.
>
> **Availability and reliability of valuation based data**: The type of data available highly influences the choice and accuracy of the valuation methods. Information regarding the past, the present and the future value of all relevant variables affecting the performance of the firm is desired. If the information gained is not reliable enough, forward looking methods such as cash flow or income based methods can be strongly subjective.

3.4 Traditional valuation methods

The valuation methods mentioned in this section are commonly used in investment valuation.

3.4.1 Comparables

Recent transactions concerning similar or equal assets may provide a good indication for value (Caselli & Gatti, 2004). According to EVCA[3] (2005) this method is appropriate for valuing seed's or start-up's in R&D intense sectors because of the frequency with which funding rounds are often undertaken.

3.4.2 Multiples

This methodology is likely to be appropriate for an investment in an established firm with continuing earnings. It may also be applicable to companies with negative earnings, if the losses are considered to be temporary. Multiples are based on public information from traded companies (Caselli & Gatti, 2004).

3.4.3 Net present value

The most common approaches to project evaluations are based on discounted cash flows (DCF) analysis which provides measures like net present value (NPV). In the NPV method the expected future cash flows for each period are discounted using the company's discount rate to account for the time value of money. If the NPV is positive, the project should be accepted (Yeo & Qiu, 2002).

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[3] European private equity & venture capital association

3.4.4 Payback period

The payback period method focuses on how long it will take to recover the initial cost of an investment. It is a simple method that assumes a straight payback. Because it ignores the time value of money it is favorable to complement the analysis with other methods (Ross, Westerfield & Jaffe, 2002).

3.4.5 Internal rate of return

This method calculates the rate that will give us a NPV of zero for the investment. If the internal rate is higher than the cost of capital then the investment is profitable and investment should be done (Anthes, 2003).

3.4.6 Scenario planning

According to Raynold, Tremblett and Schmidt (2005), scenario planning is a process of exploring and developing strategies that can work in a variety of situations or possible futures. Raynold et al. (2005) adds to this by calling scenarios a set of stories, each one with its own plausible world in which we might have to work and live in. Peterson, Cumming and Carpenter (2003), describes the process of building scenarios as a systematic method for thinking creatively about possible complex and uncertain futures. Scenario planning evolves around carefully constructed "plots" that emphasize important elements of the world. These plots often fall into three categories representing a best, middle and worse type of scenario (Raynold et al., 2005).

3.4.7 Decision tree

Decision tree analysis involves building a "lattice" representing all possible scenarios, with their assumed probability, and the decisions to make in response to them. The valuation process involves discounting expected cash flows with a risk-adjusted discount rate. The main problem with this approach is that it deals with unknown probabilities of future outcomes (Olsson, 2003b).

3.4.8 Disadvantages with the traditional methods

It is commonly agreed (e.g. see Trigeorgis, 1996; Yeo & Qiu, 2002) that traditional discounting methods assume that management will pursue a passive commitment to a predetermined operating strategy. The flexibility to adjust and revise decisions in the future due to changes in market developments are not captured by these methods.

According to Olsson (2003b) the DCF technique was developed to be used when future cash flows are known with certainty and the investment is inflexible, like bonds and stocks. The holder of a bond knows the future cash flows and there is no action that can be made to change them, which implies it is a passive investment. When the cash flows are known with certainty and the investment is inflexible, then the DCF gives accurate values. Trigeorgis (1996) point out that market investments involve change, uncertainty and competitive interactions, which traditional approaches do not capture. The future cash flows expected by management will probably differ when realizing them. In time new information will arise, uncertainty decrease and future cash flows will be more accurate. This may lead management to have the flexibility to revise its initial strategy to be able to capture future opportunities or lessen losses. Many academics and corporate practitioners have been dissatisfied with the traditional methods due to its inability to implement flexibility. Studies

have shown that in order to accommodate flexibility and other strategic considerations managers sometimes overrule traditional investment criteria.

A principal disadvantage with scenario planning is the inability to know which, if any, of several possible futures will actually occur. Thus, the scenarios themselves must be as detailed and diverse as possible, capable of addressing every conceivable set of possibilities Raynold et al. (2005).

The decision tree model captures flexibility but does not adjust for risk (Copeland & Keenan, 1998). Olsson (2003a) argues that under the assumption that we are dealing with situations with unknown probabilities of the future outcomes, the decision tree method cannot satisfactorily be employed. Further the method does not modify the discount rate to reflect the actual riskiness of the cash flow.

The accuracy of a valuation obtained through the use of comparables is eroded over time. Changes in market conditions will also act diminishing on the appropriateness (EVCA, 2005).

The difficulty working with multiples lies in the need to identify companies that are similar, in terms of risk attributes and earnings growth prospects, to the company being valued. This is particularly hard when the company being valued is not publicly listed (Caselli & Gatti, 2004).

3.5 Real option approach

A method to capture the value of flexibility has been desired both by academics and managers. A method that has been argued to consider flexibility when evaluating an investment is the "real option" approach. The phrase real option was founded by Stewart C. Myers in 1977. He argued that the concept of pricing a financial option also could be used when evaluating real investments. Myers' real option theory has its origin in Black and Scholes financial options pricing model that was created in 1973 (Olsson, 2003a).

Financial options are tradable derivative securities which derive its value from the underlying asset; a stock, a stock index, an exchange rate or a forward or future contract. Financial options give the holder the right, with no obligation, to buy or sell the underlying asset for a specified price on or before maturity. The value of having the right but not the obligation to exercise the option is called the option value. A holder of a financial option has an opportunity to improve its upside potential while limiting downside losses (Yeo & Qiu, 2002). Trigeorgis (1996) argues that in the same way the real option approach gives management the flexibility to adapt its actions to future market conditions. The value of having the opportunity to revise an investment is captured in real option analysis.

Leslie and Michaels (1997) compares a traditional NPV methodology with real options and identifies the corresponding value levers and how each lever affects the valuation.

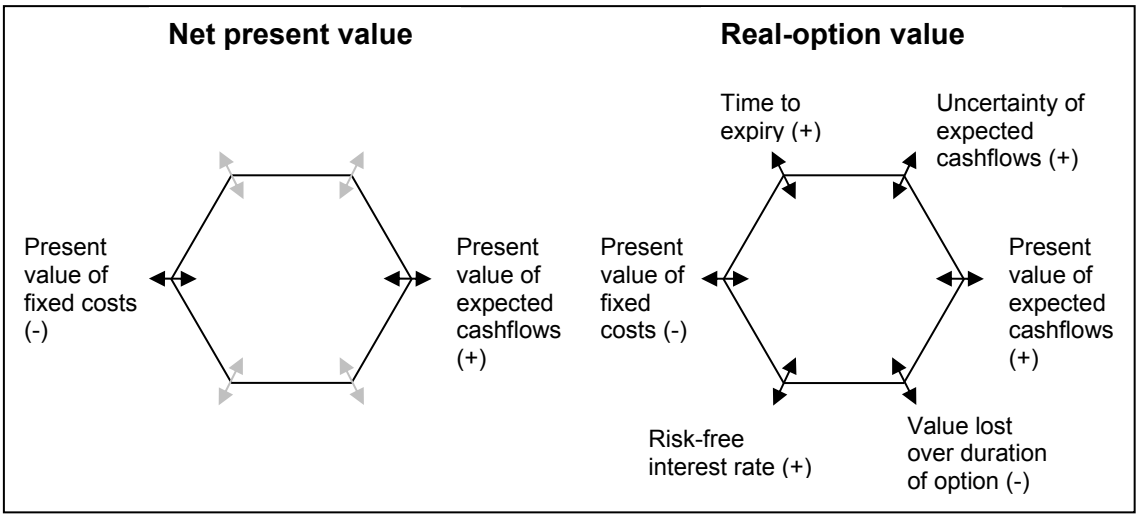

Figure 3-2 Comparison of valuation methodologies (Leslie & Michaels, 1997)

Leslie and Michaels (1997) states that the shortcomings of the NPV depends on its inability to capture flexibility. They further explain that NPV can mislead whenever there is flexibility, especially flexibility to respond to uncertainty over the rate of cash flow growth, because it includes only two key levers of value creation. Mauboussin (1999) agrees with Leslie and Michaels (1997) reasoning about flexibility and adds two additional features to the debate. Mauboussin (1999) mentions the consequences of *contingency* and *volatility*. *Contingency* occur when future investment opportunities are dependent on the success of today's investment. According to Mauboussin (1999) traditional budgeting models inadequately value option-creating investments that depend on overcoming obstacles or certain efficacy hurdles. This is valuable because investments can be made in stages, rather than all upfront. The latter aspect of Mauboussin's (1999) theory; *volatility* implies, in accordance with Leslie and Michaels (1997) value drivers, that greater uncertainty raise option value.

Several theorists (e.g. see Miller & Park, 2002; Mauboussin, 1999; Olsson, 2003a) agree that the real option analysis is only a complement to the traditional methods. This is due to the fact that the traditional methods are most useful when flexibility is not considered in the evaluation of the investment. Real option analysis should be used when it is possible and useful, when uncertainty and flexibility affects the investment.

The real options approach is, according to several theorists (e.g. see Leslie & Michaels, 1997; Amram & Kulatilaka, 1999; Yeo & Qiu, 2002), not only a tool for valuation but it involves a way of strategic thinking. It provides management with a systematic framework that will enhance the value of flexibility. The traditional mindset of taking one-time decisions on the basis of static investment plans tends to narrow the managerial vision. It is often dynamically possible to change course or even abandon a multi-year investment project once it has been undertaken. This will become even more evident when applying a real option mindset.

3.5.1 Different types of options

Depending on industry and the nature of investment, there are different types of real options available for management. Different theorists have classified these options into different categories.

Trigeorgis (1996) has classified the different options into seven categories.

Option to defer: The value of delaying an investment originates from reducing the uncertainty of the investment until more information is available. Even if the investment has a negative NPV the option to defer the investment has a positive value. The option is useful when uncertainty will be reduced in time and additional information will be available. This could be the case when a company holds an option to buy valuable land or resources. The company can then wait to make the investment until market conditions justify the investment. The real option to defer is especially important in natural-resources industries, real-estate development, farming and paper products due to the high uncertainty and the long investment horizons.

Staged investment: Staging the investment implies that you view the investment as series of options. In each stage you have the ability to abandon or continue with the investment depending on the new information that arises. Staging investments are suitable in R&D industries, long-development capital intensive projects and start-up ventures.

Option to alter operating scale: This approach implies that the company can change the scale of production according to current market conditions. When market conditions are more favorable than expected the company can increase the scale of production. On the other hand if market conditions are worse the firm can reduce it. The company can also in extreme cases stop the production and restart it when it is favorable to do so. Natural-resource industries, construction in cyclical industries and consumer goods are some of the industries where this approach is important.

Option to abandon: The company has the opportunity to abandon current operations permanently if market conditions decline severely. When taking this action they can sell the assets on the secondhand market and realize the re-sale value. This opportunity arises in industries like, capital-intensive industries, financial services and new introductions in uncertain markets.

Option to switch: Management can change the output product when prices or demand change, which is called product flexibility. Alternatively, the management can produce the same output products but change the input products used, called process flexibility. Product flexibility is important in industries selling goods in small batches or when demand is volatile, like consumer electronics and machine parts. Process flexibility is essential in for example chemical and electric power industries.

Growth option: Early investments give way for new information and knowledge that will help the company to seek new growth opportunities. R&D, lease on undeveloped land or oil reserves and strategic acquisition are some examples of early investments that will enable the company to develop new products, access new markets and strengthen the core competence of the company. This option is important in high-tech, R&D, computer and pharmaceutical industries.

Multiple interacting options: In real-life projects it is common that various options are involved. The combined value of these options may be different from their value separately, because of their interaction.

Amram and Kulatilaka (1999) give their opinion about the most common types of real options.

Timing option: A company that has an investment proposal that involves high uncertainty has the opportunity to postpone the investment until more information is available or when timing is more suitable. The value of the risk avoided by doing so may be higher than the profit loss by postponing the investment.

Growth option: A company has to decide if they are going to make a large investment. By making the investment new opportunities may be created in forms like new markets or products. The initial investment creates growth options with value beyond the returns generated from the initial investment.

Staging option: The company can stage a large investment that has high uncertainty. By doing so the company reduces the risk exposure. In each stage the company will evaluate the new information and then decide if to precede the next stage in the investment. For every stage the company will face options to continue, delaying or abandon the investment.

Exit option: This involves an option to abandon the investment if conditions are not favorable. Because the exit option reduces the size of risk it increases the value of the project.

Flexibility option: A company has the opportunity to adopt a flexible way of thinking to prepare it for unpredictable changes in the environment. This could be the option of being able to change production to meet new demands.

Operating option: This option could arise when a company does not have its own production plant is thinking about building one. By doing so, it will gain operating options like, shut down the operation when demand is low and increase operation when they are facing high demand. These option values will be added to the value of the plant.

Learning option: When a company is not certain about the demand for different product that are due to be released, the have learning option available. They will need information about the demand to be able to decide on which product they should put most of the advertising budget. In this case they could offer the product in limited markets to gain information about customer demand. Based on what they learned they can refine their marketing plans.

Individual real options as interpreted by Copeland and Keenan (1998).

Scale-up option: Early entrants can increase later through cost-effective sequential investments as market grows.

Switch-up option: An immediate commitment to first generation technology gives the company a privileged position to switch to next generation.

Scope-up option: Investing in proprietary assets in one industry enables a company to enter another industry cost-effectively.

Study/start option: Allows the company to delay the investment until more information or skill is acquired.

Scale-down option: Shrink or shut down a project part way through if new information changes the expected payoffs.

Switch-down option: As new information is obtained management can switch to more cost-effective and flexible assets.

Scope-down option: Limit the scale or abandon operations when there is no further potential in a business opportunity

3.5.2 Disadvantages with the real option approach

Real option valuation comes with a number of inherent problems. The most common objection against real option is that it is too complex to be worthwhile (Coy, 1999; Bowman & Moskowitz, 2001; Teach, 2003). Bowman and Moskowitz (2001) develop their concerns by stating that the difficulties lies with matching the characteristics of the investment proposal with the assumptions of the option valuation model being used. Further they declare that the effective use of a model depends on the possibility to calculate its inputs. If the inputs are improperly estimated the results from using the model will be incorrect, i.e. "garbage in, garbage out". Teach (2003) and Miller and Park (2002) are both in line with Bowman and Moskowitz (2001), saying that real option only work for tradable assets, i.e. when the asset price over time can be observed in the financial market. They point out that the key parameter in a real option is volatility, and that to estimate volatility, you need appropriate and sufficient data, such as historical data and actuarial information.

3.5.3 Real option in venture capital

Venture capital firms invest in small start-up firms that operate in high-risk fast growing markets. The start-up firm is initially in need of outside funding until it has reached the stage of maturity where positive cash flows are created. During its maturity process the start-up firm will face different stages. Stages which are all subject for further investments Davila, Foster & Gupta, 2003). The entrepreneurs themselves would prefer receiving a one time fixed amount covering all their future costs. This is not an optimal solution for the investor because of the underlying high risk of project failure, which leads to a high realized loss. The venture capital firm will favor dividing the investments as the start-up firm, during its maturity process, reaches pre-determined objectives (so called milestones) and further funding after the first is optional. This will reduce the investor's possible loss in case of project failure. The latter way of investment is the one normally used (Botteron & Casanova, 2003). According to Davila, Foster & Gupta (2003), staged funding provides venture capital with a real option. This option can be exercised or abandoned over time as the uncertainty about the start-up firm is reduced.

Bowman and Moskowitz (2001) mention that one potential advantage of using the real options approach is that it might change the type of investment proposals that are evaluated. If options are seen as a valid approach to analyzing proposals, then more option like proposals may be considered.

To illustrate an example of how real option analysis can be applied in venture capital investments, the authors will use the model developed by Botteron and Casanova, (2003) in their research paper, *Start-ups defined as portfolios of embedded options*. The authors have chosen to exclude the calculations, because the purpose is only to show a possible outlay of how real option can be favorable when investing in start-ups. The research paper show how the investment decision could be structured and timed, which can be valuable when negotiating.

Botteron and Casanova, (2003) have developed an option-pricing model that allows the venture capital firm to evaluate the flexibility when staging their investment. The objective is to solve the conflict between investors and entrepreneurs when negotiating capital raising. As mentioned before the entrepreneurs would prefer receiving a one time fixed amount, which is not favorable by the investors because of the high risk of failure. The solution is staging the investment financing, which can be done in several phases.

The assumptions of investment:

A start-up firm is in need of venture capital. The investment by the venture capital firm will be divided into two parts.

The first investment that will be done at time=0, is called the "seed capital investment" and will help the start-up firm to launch its activity. In exchange the venture capital firm will receive a fraction (α) of the company, with $0<\alpha< 1$.

The venture capitalist has the exclusivity for the second investment and the second investment will only occur if the objectives set are reached. The investment will be carried out in time=1, and is called "the venture capital investment" and will help the start-up company to continue its activity. The venture capital firm will get another fraction (β) of the company, with $0<\beta< (1- \alpha)$.

The objective set for time=1 has jointly been fixed by the investor and the entrepreneur. The objective (K) is measured in terms of start-up value V. If the start-up value (V) is equal or higher than the objective (K) at time=1, then the investor will do the second investment.

The model assumes the start-up value (V) is found by using discounted cash flow methodology. The future cash flows are discounted at a risk-adjusted discount rate and r is the constant risk-free interest rate where assuming no inflation.

By the assumptions the investor gets a fraction of the company when doing the initial investment. After that the investor have the exclusivity to invest at time=1, thus giving him an option, with the right but not the obligation to invest the second time. The investor will chose to invest only if the company has reached the objective, which was set to be $V_1 \geq K$.

The payoff for the investor will be zero if $V_1<K$, hence the investor will not do the second investment. If on the other hand $V_1 \geq K$, the investor will invest and get a fraction (β) of the company in exchange.

The payoff for the investor:

Payoff $t=t_1$ $= (\beta V_1 - I_1)$, hence the fraction received multiplied with the value of the company and then subtract the second investment.

$$= (\beta V_1 - \beta K + \beta K - I_1)$$

$$= (\beta (V_1 - K)) + (\beta K - I_1)$$

The start-up value can be seen as two European option values.

$C_1 = \beta (V_1 - K)$ and $C_2 = (\beta K - I_1)$

Using the underlying value of the company (V_1), strike price (K), volatility (σ) and time to maturity (t_1-t) in the Black and Sholes formula the value of C_1 can be found.

$C_1=VN(d_1)-Ke^{-r(t1-t)}N(d_2)$

With

$d_1=(\ln(V/K)+(r+\sigma^2/2)(t_1-t))/\ \sigma\sqrt{(t_1-t)}$

$d_2=d_1-\sigma\sqrt{(t_1-t)}$

For the second option a formula from Willmot (1999) is used (cited in Botteron & Casanova, 2003). C_2 is dependent on the underlying value of the company (V_1), Strike price (K), payoff ($\beta K_1- I_1$), volatility (σ) and maturity ($t_1- t_0$).

$C_2=Ke^{-r(t1-t)}N(d_2)$

Thus, the value (E) for the investor at time=0 is:

$$E= \alpha V + C_1(\beta) + C_2(\beta, I_1) – I_0$$

The investor has four parameters (α, β, I_1 and I_2) that can be changed. The model, gives the investor the possibility to fix three of these parameters and then bargain on the base of the remaining parameter. Three scenarios will be shown that gives the same value, but with different characteristics.

Table 1 Three different scenarios of investment (Botteron & Casanova, 2003)

	Scenario 1	Scenario 2	Scenario 3
Total investment I	250	250	250
I at time=0	125	75	150
I at time=1	125	175	100
A	10%	5%	13%
B	20%	25%	17%
Value of the start-up (V)	1200	1200	1200
Objective (K)	1200	1200	1200
σ	25%	25%	25%
R	5%	5%	5%
T-t	0.5	0.5	0.5
Strategy Value	73.28	73.32	75.71

As the table shows, all three scenarios have about the same value. According to the model, the investor can chose different values on the four parameters depending on his risk-preference.

4 Empirical findings and analysis

The empirical findings presented in this chapter have been obtained through interviews conducted with the respondents. The according dates for which the interviews were conducted can be found under "selection" in the method chapter.

4.1 Characteristics of the invesment process

All four respondents claim that their engagement begins with investing capital through new share issues. Industrifonden points out that they also have used other types of financing such as convertibles and option loans. This is consistent with Isaksson (1999) which mentions that private equity investing is the most common way of obtaining part-ownership. According to the respondents the structure and conditions for these investments are primarily outlined in the investment contract.

The common characteristic, for the four respondents, in their active engagement is that they all demand representation on the board of directors. Further, the respondents acknowledge the need for other types of engagement and assistance in order to support the company. Industrifonden mention that there are lots of advice to give new small companies and the commitment varies with the stage the company is in. Itact, LinkMed and FöretagsByggarna encourage an active engagement from the beginning where key positions in the target company are held early on until suitable management is recruited. Itact further mentions that the entrepreneurs/researchers are not willing and in some cases not suitable for holding management positions.

The active engagement described by the respondents corresponds with the views shared by Isaksson (1999) and Hosmer (n.d.) which state that entrepreneurs are not only in need of capital but also competence.

Both Itact and FöretagsByggarna keep a short-term perspective on their investment, they usually intend to exit their collaboration within three to six years. LinkMed and Industrifonden mentions that they invest on a more long-term basis with no time limits. The most common, according to the respondents, to end the collaboration is through a trade sale. In some cases exits through IPO's or liquidations have occurred. The way of exit chosen is always the one believed to generate the highest value for the venture capital firm. This way of collaboration is in alignment with Isaksson (1999) that states that the venture capital firm will exit the collaboration when it no longer generates any value. The way of exit mentioned by the respondents match the ones identified with BVCA (2004).

In accordance with Bergemann and Hedge (1997), it is agreed by the respondents that the risk of failure is high. Itact estimates that about 60-70 percent of all their investments fail to generate a positive return at exit. Industrifonden and Itact points out that because of the high rate of failure the successful projects must compensate for those that fail. Thus, demanding a very high rate of return on investments.

The respondents states that a large part of the proposals received via an active search through their established networks. The networks can be of various sorts, such as universities, industry contacts, previous associates etc. The respondents are also approached by entrepreneurs/researchers seeking funding for their ideas. LinkMed, FöretagsByggarna and Industrifonden have previously invested in proposals obtained through both sources, Itact has only so far used their business network. Itact mentions that proposals found through the use of its network carry a larger credibility than proposals obtained externally. This is

due to that Itact believes that people within their network holds more knowledge and experience than external entrepreneurs.

The screening process is said, by the respondents, to be given much attention. LinkMed carries out extensive market research of present and future conditions, involving both competition and technology. Additionally, future exit strategies are considered. They also highlight the need for cooperation between all parties involved. FöretagsByggarna also emphasizes the importance of cooperation. They believe that it is important that the entrepreneurs and investors are synced, that they have the same interpretation about the future path. It is, according to Företagsbyggarna, a mix of business plan, management and entrepreneurs that are the determining investment factors.

Industrifonden have the same opinion as FöretagsByggarna about important investment factors. There has to be a solid base covering management, market, uniqueness and competition to build on. Industrifonden also rank previous experience for the entrepreneurs as important. Industrifonden point out that all factors considered when examining a proposal are interdependent and continuously changing.

Itact point out that among the many factors that need to be regarded before investing, one is to see whether there is any authority that has founded the project. For example, if a proposal is received through a university Itact look at which professor is involved in the project. If the professor is a known authority in that area of research Itact feel the credibility of the project is higher. Itact further stress the importance of investing in growing markets, the investment should also have a global potential. They also check foreign markets to avoid investing in technology that is already in development.

The respondents, in accordance with Caselli and Gatti (2004) and Mainprize et al. (2002), engages in an extensive screening process. The different routines carried out by each firm are similar and closely related. All respondents agree, in accordance with Golis (1998), that the management team is seen as a key aspect of success and previous track records of good performance are highly valued. A factor not taken into account by Golis (1998) is personal chemistry which LinkMed and FöretagsByggarna underline. They indicate that engaging in a close partnership calls for people to cooperate well under all circumstances.

Caselli and Gatti (2004) and Golis (1998) describe the market due diligence process as establishing whether the entrepreneur can commercially sustain the product. All respondents claim to examine both the target market and technological development closely. They believe, in accordance with Caselli and Gatti (2004) and Golis (1998), that the future potential of existing markets are of great importance for the growth possibilities.

4.2 Use of valuation methods

All respondents, in accordance with Golis (1998), put emphasis on the importance of valuating the investment and give it much thought. The use of valuation techniques varies significantly among the respondents. Based on previous experiences and personal preferences different methods are favored above others.

Industrifonden applies a variety of different models in order to valuate their investments. They mention the use of DCF models like NPV. Industrifonden mentions that although they acknowledge the worth of these models they realize the inherent limitations they hold. The limitations Industrifonden refers to are the lack of accurate cash flow predictions and that they are only simplifications of the real world. In order to better estimate the value of

their investment Industrifonden also applies methods like comparables and multiples. Still they underline that they do not trust their models blindly and have in the past gone through with investments their models have rejected.

LinkMed, in accordance with Industrifonden, also use calculation methods. They apply NPV calculations and combine them with probability assessments when uncertainty is high. LinkMed mentions that when it is especially hard to predict future cash flows, historical data can be of good use. They clarify that they have a database containing over 400 cases available, helping them to estimate future cash flows. Another assisting tool used by LinkMed is scenario planning. LinkMed, in contrast to Industrifonden, points out that when the models deem an investment unprofitable the investment will not be done.

Itact claim not to use any calculation methods. They extend their motives by saying that it is impossible to valuate early stage investments with traditional calculation methods. Itact considers future predictions as useless, because their previous experience has shown that they will not be accurate. Itact mentions that they do use comparables to get a hint about the size of a future exit, whether it will be four millions or four billions. They point out that knowledge and previous experience have a larger impact on the valuation than any calculation method.

Företagsbyggarna as well as Itact do not use budgeting tools to assist them in their valuation. They believe their long experience is a far better tool for valuating investments. As an indicator for when to invest or to sell they look at the state of the market. When the market is in a recession they look for investment opportunities and consequently when it is in a boom they want to sell.

Golis (1998) explains that the valuation of a start-up firm can prove to be very difficult. There are no obvious answers to which method to use. The respondents, all acting within the same field, have chosen different valuation techniques. Industrifonden and LinkMed trust the traditional budgeting tools whereas Itact and FöretagsByggarna rely on their personal experience and expertise.

Both LinkMed and Industrifonden use DCF techniques which Caselli and Gatti (2004) recommends when valuating firms dealing with R&D. Caselli and Gatti (2004) further expands their argument to involve the accurateness of the data available. They argue that when making predictions about the future the traditional cash flow based methods can be very subjective if the data available is not reliable. Olsson (2003a) is of the same opinion and states that the DCF technique was developed to be used when future cash flows are known with certainty. This lack of accuracy and reliability are the main reasons why Itact and FöretagsByggarna do not apply them. LinkMed try to reduce the uncertainties by using historical data derived from previous investments, in order to strengthen their predictions.

The fact that Itact and FöretagsByggarna do not use the traditional methods can be traced to the inability, mentioned by Trigeorgis (1996), to capture the flexibility that market investments involve. Traditional DCF methods assume that management will pursue a passive commitment to a predetermined operating strategy. Industrifonden recognize as well that predictions made by passive models can not be entirely trusted which is shown by the fact that they have carried out investments their models have rejected. LinkMed is the only respondent that fully commits their decisions to the results presented by their models.

4.3 Real options embedded in the investment

After reaching the decision to go through with the investment, all four respondents mentions that they put together an investment plan that outlines future commitments and strategies. Some common characteristics about their investment plans are that they include the goal of the investment and milestones to reach along the way.

When it comes to the actual investment none of the respondents provides it in a single payment. They all mention that they stage it in future optional investments. This is in line with Botteron & Casanova (2003) that argues that venture capital firms will favor dividing the investments and further funding after the first is optional. The respondents describe the contractual agreement in a similar way. Normally they invest a small size initially and receive a part of the company in return. After that another investment should take place when a milestone is reached but the decision to do so is optional. The structural outlay of the agreement is in line with the example given by Botteron & Casanova (2003) that handles the option for further investments as a real option.

LinkMed decides to do the subsequent investments depending on the information available at the time. Depending on the current situation, taking into account market conditions and future projections, LinkMed can change course for the investment. LinkMed describes it as an ongoing process with revaluations and positional changes. This view is also shared by Industrifonden that mentions that they revise their decision when new information arrives. FöretagsByggarna explain this by saying that they let the market decide how much and when to invest. Further they claim that they never lock their investment to pre-set time tables because of unexpected problems that is not considered in the plan always occur. This belief is shared by Itact, they mention that it is good to use staged investing under uncertainty because it provides the ability to adapt to new information.

The respondent's way of handling uncertain future events involving decisions to commit to future investments is in line with Trigeorgis (1996) theories about managerial flexibility. Trigeorgis (1996) argues that over time new information will arise and uncertainty decrease which will lead management to have the flexibility to revise its initial strategy.

Trigeorgis (1996) mentions that staging the investment implies that you view the investment as a series of options, with each stage granting the possibility to either abandon or continue with the investment. Neither of the respondents were familiar with the term real option when asked about it, but share the view that the investment is embedded with a series of different alternatives. The respondents point out that if the outlooks are good or in line with their previous estimations they acknowledge the possibility to increase their investment. Further they mention that they do not have any difficulties abandoning the investment if they see it necessary. Industrifonden express this view by saying:

> *"Staging the investment is good in the sense that you can stop the investment if it goes wrong, and at the same time increase the investment when conditions are favorable".*

Additionally, LinkMed mentions that they never invests in single product developments, instead their perspective is more industrial. As a result, this allows them to alter their product line. Trigerogis (1996) refers to this as the option to switch, which provides management with the possibility to change the output product when prices or demand change.

5 Conclusion

- **What factors can be important when venture capital firms examine possible investments?**

All four respondents have mentioned the importance of the market, described as present market condition, growth potential of the market, competition and uniqueness. Another common factor found with all respondents is that they emphasize the importance of the entrepreneur. The respondents mention aspects such as previous experience, ability to co-operate and credibility. The authors believe that the main important factors when examining the possible investments are market and entrepreneurial aspects.

- **Which valuation methods can be used by venture capital firms?**

The authors have found that the valuation techniques chosen vary among the respondents. LinkMed and Industrifonden use traditional valuation tools such as NPV, comparables and scenario planning when valuating investments. In contrast Itact and FöretagsByggarna rely on personal experience and expertise.

- **What limitations can be found in the traditional models by venture capital firms?**

The respondents all mention difficulties with predicting future cash flows which is assumed by DCF methods. The lack of accuracy and reliability in these estimations are the main reasons why Itact and FöretagsByggarna chose not to apply them. LinkMed tries to reduce the uncertainty of cash flow prediction by using historical data derived from their database. LinkMed believes that the models limitations are not significant enough to discard the models. The inability to capture flexibility and assumptions about passive management is inherent in the DCF model. This limit combined with the difficulties of predicting accurate cash flows has led Industrifonden, in some occasions, to overrule the model criterion.

Neither Industrifonden nor Itact put any real significance to their use of comparables due to difficulties with finding comparative investments.

- **Can the real option approach be suitable for venture capital firms?**

The inability described by the respondents to use traditional methods under uncertainty and the fact that alternative actions is embedded in their investments, makes the authors believe that there is a need for finding new valuation techniques that are more suitable. These alternative actions provide flexibility to alter their scope as new information arise, which the real option approach captures when evaluating investments. Real option is suitable when uncertainty and flexibility affects the investment.

By examining the respondents structural outlay of the investment the authors have found that is in line with the real option approach suggested by Botteron and Casanova (2003).

The authors have also found real options, as described by Trigeorgis (1996), embedded in the respondent's investments.

The authors highlight the importance for the venture capital firms to identify these options and acknowledge their value. The fact that the respondents think of the investment in a way the real option approach favor, which is to see every situation as an initial investment against future possibilities, should imply that a real option approach is suitable for them.

5.1 Further studies

Towards the end of this study new questions arose that would be of interest to investigate.

- A study taking a quantitative approach investigating insufficiencies with traditional valuation methods within other fields of business.
- Further, to apply a real option approach to a real investment. This would surely prove to be both difficult and time-consuming but yet an interesting study to conduct.

References

Amram, M., & Kulatilaka, N. (1999). *Disciplined decisions: Aligning strategy with the financial markets*. Harvard Business review

Anthes, G.H. (2003, February 17). Internal rate of return. *Computerworld, 37*(7).

Arksey, H., & Knight, P. (1999). *Interviewing for social scientists*. London: SAGE publications Ltd

Bergemann & Hege (1997, October). *Venture capital financing, moral hazard, and learning*. Retrieved October 10, 2005, from http://campus.hec.fr/profs/hege/papers%5Cventure.pdf

Botteron, P. & Casanova, J-F. (2003). Start-ups defined as portfolios of embedded options. *Fame research paper series, 85*.

Bowman, E.H., & Moskowitz, G.T. (2001). Real options analysis and strategic decision making. *Organization science, 12*(6), 772-777.

BVCA. (2004, October). *A guide to private equity*. Retrieved October 26, 2005, from http://www.bvca.co.uk/

Caselli, S. & Gatti, S. (2004). *Venture capital: A euro-system approach*. Berlin: Springer-verlag.

Copeland, T.E., & Keenan, P.T. (1998). How much is flexibility worth. *The McKinsey quarterly, 2*.

Corbin, J, & Strauss, A. (1998). *Basic of Qualitative research – Techniques and procedures for developing grounded theory*. California: SAGE Publications

Coy, P. (1999, June 7). Exploiting uncertainty: The "real options" revolution in decision-making. *BussinessWeek online.*

Covitz, D., & Liang, N. (2002). Recent developments in the private equity market and the role of preferred returns. *Board of governors of the federal reserve system.*

Davila, A., Foster, G., & Gupta, M. (2003, February). *Staging Venture Capital: Empirical Evidence On The Differential Roles Of Early Versus Late Rounds*. Retrieved October 10, 2005, from http://www.olin.wustl.edu/workingpapers/pdf/2003-07-003.pdf

Davis, M., Schachermayer, W., & Tompkins, R. (2003). The evaluation of venture capital as an instalment option: Valuing real options using real options. *Journal of Financial Economics.*

Eriksson, L.T., & Wiederheim-Paul, F. (1997). *Att utreda forska och rapportera*. Malmö: Liber ekonomi

EVCA. (2005). *Comparables*. Retrieved October 15, 2005, from http://www.evca.com

Företagarguiden. (2005) *När kan riskkapitalbolagen gå in?*. Retrieved October 15, 2005, from http://foretagarguiden.nutek.se/sb/d/324/a/1748

Golis, C.C. (1998). *Enterprise and venture capital: a business builders' and investors' handbook*. (3rd ed.) St Leonards: Allen & Unwin.

Isaksson, A. (1999). *Ett PM om venture capital i Sverige och USA*. Umeå: Handelhögskolan.

Holme, I.M., & Solvang, B.K. (1997). *Forskningsmetodik – Om kvalitativa och kvantitativa metoder*. Lund: Studentlitteratur.

Hosmer, L.T. (n.d.). A venture capital primer for small business. *Financial managament series, 5*

Lekvall, P., & Wahlbin, C. (2001). *Information för marknadsföringsbeslut*. Göteborg: Högsbo Grafiska AB.

Leslie, K.J., & Michaels, M.P. (1997). The real power of real options. *The McKinsey quarterly, 3*.

Lundahl, U., & Skärvad, P-H. (1999). *Utredningsmetodik för samhällsvetare och ekonomer*. Lund: Studentlitteratur.

Mainprize, B., Hindle, K., Smith, B., & Mitchell, R. (2002). Toward the standardization of venture capital investment evaluation: Decision criteria for rating investee business plans. *Frontiers of entrepreneurship research*.

Mauboussin, M.J. (1999). Get real: Using Real options in security analysis. *Frontiers of finance, 10*.

Miller, L.T., & Park, C.S. (2002). Decision making under uncertainty - Real options to the rescue?. *The engineering economist, 47*(2).

Olsson, K.O. (2003a). *Extract from the report: "New evaluation methods for rail and road investments – An approach based on real options"*. Retrieved 2005-09-29, from Gothenburg university website http://www.hgu.gu.se/files/foretagsekonomi/ife/real%20options/real%20options%20analysis%20-%20karl%20o.%20olsson.pdf

Olsson, K.O. (2003b). *Extract from the report: "New evaluation methods for rail and road investments – An approach based on real options"*. Retrieved 2005-09-29, from Gothenburg university website http://www.hgu.gu.se/files/foretagsekonomi/ife/real%20options/evaluation%20methods%20for%20projects%20with%20substantial%20uncertanty%20-%20karl%20o%20olsson.pdf

Peterson, G.D., Cumming, G.S., & Carpenter, S.R. (2003). Scenario planning: a tool for conservation in an uncertain world. *The Journal of the Society for Conservation Biology, 17*(2)

Raynold, M., Tremblett, K., & Schmidt, R. (2005). Long Term Strategic Thinking Placing the Pembina Institute in Divergent Scenarios of the World for 2025. *The Pembina Institute.*

Ross, Westerfield & Jaffe. (2002). *Corporate Finance*. (6th ed.) New York: McGraw-Hill Companies Inc.

Silvermann, D. (1993). *Interpreting Qualitative data: Methods for analysing talk, and interaction*. London: SAGE Publications Ltd.

SVCA. (2004). *Rikskapitalbranschens utveckling i Sverige*. Retrieved October, 15, 2005, from http://www.svca.se/home/page.asp?sid=337&mid=2&PageId=10881

Svenning, C. (1997). *Metodboken*. Eslöv: Conny Svenning och Lorentz förlag.

Teach, E. (2003, July 1). Will real options take root?. *CFO magazine*.

Trigeorgis, L. (1996). *Managerial flexibility and strategy in resource allocation*. (5th ed.) London: The MIT Press.

Welman, J.C. & Kruger, S.J. (2001). *Research Methodology*. (2nd ed.) Cape Town: Oxford University Press

Yeo, K.T., & Qiu, F. (2002). The value of management flexibility - a real option approach to investment evaluation. *International journal of project management, 21*, 243-250.

Appendix A: Interview guide

1. Personal information
    - What is your position within the company?

2. Background of the company.
    - History
    - How do you find investment proposals?
    - In what stages do you invest?
    - How many investments turn out to be successful?

3. Investment process
    - Describe your screening process
    - Factors that are important

4. Engagement
    - In what form do you engage in the company?
    - Time frame
    - Exit form

5. Use of valuation methods
    - Do you use any valuation methods?
    - Which methods?
    - For what?
    - Advantages/disadvantages?
    - Why are you using them/ why are you not using them?

6. Outlay of the investment?
    - Describe how the investment is done
    - Do you invest the entire investment capital initial? Why? Why not?
    - Do you conduct a plan about the future?
    - Do you change course when time elapse?
    - You work different when there is high uncertainty?

7. Have you ever heard about the valuation method, real option?
    - If yes, do you work with it?