Business angels in life science

Deciding the value of start-ups

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Abstract

Although research in business angels investment process is increasingly catching the attention of scholars, how business angels establish the value of start-ups is relatively unexplored. Furthermore literature on business angels investment process has never focused on analysing angel investors within a specific industry. Therefore, the purpose of this study is to explore the business angels' investment process in life sciences and analyse how they value start-ups.

An exploratory multiple case study was carried out in order to gain understanding on the business angels investment process and their approach to valuation of life-sciences start-ups. Semi-structured interviews were done to a total of 6 business angels who invests in life-sciences start-ups in Norway.

The findings suggest that the most important criteria for business angels investing in life science are the team, the technology, the intellectual property and the upside of the investment. In addition, business angels rely on their experience in order to assess the investment criteria, pointing towards the investment process being subjective and heterogenous.

Regarding valuation this study has found that business angels investing in life science start-ups do not use valuation techniques. The main reasons are the lack of trust in the reliability of valuation models and the perception that they are too complex. Instead of using valuation techniques business angels use the upside of the investment as reference to determine what should be the share value to obtain the returns they expect.

This study contributes to the overall business angels research literature by confirming some of the findings of previous studies and by pointing towards new lines of research that can increase the overall knowledge about this topic.

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1 Introduction and research question

Capital is the source of sustenance for the life science industry. The long development time to bring science to the commercialisation stage and the high costs of the regulation requirements force companies to secure funding from the very early stages. In fact, access to financing can make or break a company regardless of whether it has Nobel Prize winning science or a top management team (Boris & Ralph, 2010). For this reason, failing to secure investment is the highest risk that life science start-ups face. Business angels are in a key position to become one of the main sources of capital for early stage companies in the life science industry.

Venture Capital firms (VCs) together with public funding schemes have been the most common forms of financing for early stage companies in the life science industry. However, VCs are continuously moving towards later and bigger investment rounds, seeking more mature companies with less risk and shorter exit cycles (William, et al., 2014). This new trend is creating the so called "equity gap" and forcing life science start-ups to look for alternative sources of capital (Festel, et al., 2013; William, et al., 2014). This is a particularly concerning trend because a decrease in the funding available to life science start-ups threatens the emergence of innovative products in the future. Established life science companies already have difficulties to meet their growth strategies via internal R&D. The way they have been able to fill that gap historically is by buying novel start-ups that can hopefully drive growth. But if those early-stage opportunities dry up, there are going to be fewer companies available for the large players to harvest, thus affecting the overall profitability of the industry (EY, 2017; The Boston Consulting Group, 2012; EY, 2018; Evaluate, 2016).

Business angels are individuals with high levels of competence who invest private capital in non-listed ventures (Sørheim & Landström, 2001; Politis, 2008). Business angels are in a good position to contribute to close the "equity gap" in the life science industry because one of their differentiating aspects is that they invest smaller and earlier in time (Festel, et al., 2013). For this reason, gaining understanding on the business angels investment process is of crucial relevance for start-ups and entrepreneurs who want to secure financing.

Many studies focus on the business angels investment process (Maxwell, et al., 2011; Carpentier & Suret, 2015; Mason & Stark, 2004; Mason, 2006; Mason & Harrison, 1995; Landström, 1993). From these studies, we know that the investment process has multiple stages

(Paul, et al., 2007) and is based on an heuristic decision making where different criteria have to be fulfilled and that business angel's experience plays a key role (Smith, et al., 2010).

Other studies have focused on what are the most significant criteria for business angels. We know that angel's criteria are subjective and vary across different investors but there is consensus in the importance of the team, the business plan and trustworthiness of the entrepreneur being the most important criteria (Tenca & Croce, 2018).

Although a considerable amount of studies have been published on business angels investment process, the field is fragmented, with many areas that have been barely addressed. For example, there are few studies that address how business angels decide the deal price of an investment opportunity, which is of critical importance for any entrepreneur willing to attract an investor's interest. Similarly, there are no studies focusing on how the investment process is affected by the characteristics of the industry where the investment is done.

1.1 Problem statement and research question

In this study I will start with the notion that start-ups in life science need to access capital in order to succeed and that business angels are one important source for obtaining such capital (Boris & Ralph, 2010; William, et al., 2014). Then I will investigate the investment process of business angels who invest in life science start-ups and more specifically how do they evaluate an investment opportunity and how do they decide the price or value of the investment. Hence the research questions:

RQ 1: How do business angels investing in life science evaluate start-ups?

RQ 2: Do business angels investing in life science start-ups use valuation techniques?

I decided to put forward two research questions in this study because it is very difficult to find and meet business angels who invest in life science (Whitehead, 2003). Consequently I wanted to use the opportunity to obtain as much information as possible about the whole investment process, but at the same time be able to focus on a narrower unexplored area: the use of valuation techniques and deal pricing.

1.2 The importance of this research project

Through an extensive literature review, I have uncovered a lack of knowledge on how business angels are valuing companies within the life science industries. This paper aims to add knowledge on the business angels' investment process in life science and particularly contribute to the understanding of how they decide how much a company is worth.

This knowledge can be of relevance for entrepreneurs willing to gain understanding on how to attract investment and develop successful strategies to maintain a reasonable ownership of the company. In addition, it can help business angels to reflect upon their strategies and develop new approaches to improve their rate of returns. I hope that my findings can add knowledge to a relatively unexplored, yet important field of study, and serve as a basis for future studies.

1.3 Layout of the research project

This study will first present a literature review where I introduce the different concepts that are being assessed, define a theoretical framework and then analyse what other scholars have done in the field. Next, I describe the research design together with the methodology followed throughout this project. Finally, I will present the results, discuss my findings and give some implications and conclusions.

2 Review of the literature

2.1 Overview

In this section I present a review of the 3 main areas of literature that are relevant for this study. First I address research on business angels, particularly on their investment process and identify its gaps. Second I analyse the literature on valuation techniques in early stage companies and the implications of previous findings. Third I focus on the life science industries, providing the definition that will be used throughout this thesis and reviewing the literature about valuation in life science. The aim of this section is to provide an overview of all previous literature that can be of relevance for understanding how business angels investing in life science startups decide the deal price, given the fact that there is no existing literature on this topic.

2.2 Business angel research

2.2.1 Definition

The term "business angel" refers to a wealthy individual who invest private capital in non-listed ventures and entrepreneurs with whom he or she has no family bonds (Politis, 2008). In addition, according to (Sørheim & Landström, 2001) business angels are also a sub-category in the informal investment market that is characterised by having a high level of investment activity and competence.

Business angels play a central role in the entrepreneurial ecosystem because they contribute to bring innovation to the economy by investing in early stage ventures long before other institutional investors would (Festel, et al., 2013; Carpentier & Suret, 2015; Tenca & Croce, 2018). According to (Sohl, 2007) business angels are the most common financing source for early stage ventures; compared other investors they invest 16 times more in seed ventures. In 2011 the total business angels market accounted for $18.3 billion and $5.3 billion in US and Europe respectively (Organisation for Economic Co-operation and Development, 2011).

Therefore in this thesis business angels will be defined as individuals who invest private capital in non-listed ventures and characterised by having a high level of competence and high level of investing activity.

2.2.2 Business angels previous research

"Business angels' research lies at the intersection of economics, finance and business management and it has evolved rapidly thanks to the important role that angel investors play in facilitating the growth of new ventures" (Tenca & Croce, 2018). As mentioned by (Madill, et al., 2005) business angels are not only important for start-ups and economic development, but also for other later stage investors (venture capital or private equity firms) because business angels' investment is often a pre-requisite to obtain further funding.

Existing research in business angels can be divided into three main areas: business angels characteristics, market and investment process (Tenca & Croce, 2018).

Business angels characteristics was the first area of literature that emerged, it accounts for approximately 25% of all publications on business angels research and it is mainly descriptive in nature (Tenca & Croce, 2018). Business angels characteristics literature include studies that examine business angels' typical profile and categorize them into different typologies (Mason & Harrison, 2000; Kelly, 2007; Mason, 2006; Wetzel, 1983); studies that compare business angels across different countries (Landström, 1993; Sohl, 2007; Harrison & Mason, 2007); studies that focus on gender differences and studies about business angels networks and groups (Carpentier & Suret, 2015). In general, findings in this area point towards business angels being male individuals with high net worth and entrepreneurial experience who invest in high-tech early stage companies and that are driven by non-financial motivations (Wetzel, 1983; Maula, et al., 2005; Wetzel, 1987). However these studies also recognise that business angels can be heterogenous in their characteristics and investment behaviours. Some sources of differences amongst business angels that have been pointed by previous literature are income, region, education, experience and competences (Szerb, et al., 2007; Freear, et al., 1994). In relation to gender differences, literature suggests that women are slightly more likely to invest in women-owned businesses and that they seek angel financing at lower rates than men (Becker-Blease & Sohl, 2011).

The second thematic area of business angels research is business angels market. It accounts for 23% of all business angels research publications (Tenca & Croce, 2018) and it addresses topics as demand and supply of angel capital (Wetzel, 1987; Gaston, 1989), effectiveness of angel financing on regional growth (Harrison & Mason, 1991; Mason & Harrison, 1995) and policies to foster the risk capital market (Christensen, 2011; Harrison & Mason, 1991; Mason, 2006; Mason & Harrison, 2000). Findings suggest that the business angel market is self-regulated because the entrepreneurial activity generates its own supply and demand (Burke, et al., 2010). Furthermore business angels are key to fill in the equity gap left by Venture Capital investors in seed and early stage investments and stimulate entrepreneurship in a regional level (Mason & Harrison, 1995; Harrison & Mason, 1991).

The third area studies the business angels investment process. This line of research attracts the highest number of studies, accounting for 54% of all angels research. Studies on business angels investment process address four main topics: selection, evaluation and funding, impact on investee's performance, post-investment and overview of the entire process (Tenca & Croce, 2018). Findings on selection, evaluation and funding suggest that tangible characteristics of the start-up (i.e. strength of the opportunity, technology readiness) are more important at the beginning of the selection process whereas intangible (i.e. passion, commitment, persuasiveness) are more relevant at later stages of the investment decision making process (Maxwell, et al., 2011). Other relevant findings point to the human capital of the entrepreneur and the business opportunity as the most important criteria that business angels look at, followed by the business plan, the investor fit, trust or empathy with the team and external referrals (Carpentier & Suret, 2015; Landström, 1993; Mason & Stark, 2004; Mason & Harrison, 1995; Mason & Harrison, 2000; Argerich, et al., 2012). Furthermore business angels use a short-cut decision making heuristic known as elimination by aspects in order to reduce the available investment opportunities to a manageable size (Maxwell, et al., 2011). This is particularly interesting because contradicts the previous believe that business angels use a compensatory decision model by weighting a large number of characteristics. Literature also suggest that the investment process is not a linear process but that it has different stages (Paul, et al., 2007). There seem to be different opinions about how many stages, however one of the most accepted interpretations is the one from (Paul, et al., 2007) who used semi-structured interviews with a total of 30 business angels to end up proposing a model of 5 stages, familiarization, screening, bargaining, managing and harvesting.

Studies on investee's performance main findings are focused on how business angels approach affect their returns on the investments. For example (Wiltbank, 2005) finds that investing in earlier stages and having a high degree of involvement with the company results in fewer negative exits. On the other hand a more thorough due diligence results in higher number of failures but also higher returns.

Literature on business angels has moved from an early emphasis on business angels characteristics towards their investment process and the number of authors has been constantly increasing over the years, indicating that there is a growing interest on business angels (Tenca & Croce, 2018). Business angels investment process research has several areas that can be further explored. For example, the negotiation phase and specifically the deal terms and deal pricing. Both of crucial importance for entrepreneurs and business angels, as they determine their relative control over the company and influence the investor's returns at the exit. Another area with significant gaps is the relationship amongst business angels and VCs and how their interaction affects the investment decision process (Tenca & Croce, 2018).

2.3 Valuation as a tool for deal pricing

Valuation is defined as the "determination of the current worth of an asset. The asset to be valued can be either a real asset, such as a business, or a financial asset, such as a bond or an option" (Oxford Dictionary of Economics, 2013). Valuation is at the heart of finance and business decision making, whether it is corporate investments, portfolio management, project assessment or capital, and is needed to take informed and precise decisions. Valuation techniques are widely used to determine the value of a company in any acquisition or investment transaction. For this reason, valuation methods are generally the tool used in any investment transaction.

Nowadays there are many valuation techniques ranging from simple to more complex and sophisticated. Each technique uses different measures in order to calculate the price or value of an investment opportunity. For example some techniques are based on how much cash an asset will generate while other techniques focus on comparing it with other similar assets to stablish a range of acceptable prices. Because of these differences each valuation technique will perform differently according to the nature of the asset that is being priced (early stage companies, stablished MNEs, projects with different risk profiles, listed companies).

Valuation methodologies can be classified into four main approaches (Damodaran, 2006):

- Liquidation and accounting: It is based on valuing the assets that a company owns at a given point in time and adding them to obtain a global value. This approach is good for companies that expect few growth or are very stable, but it undervalues companies with high growth expectancies because it fails to recognize the firm potential to acquire new assets (Damodaran, 2006).

- Relative valuation: Estimates the value of an asset by looking at the price of 'comparable' assets relative to a common variable like earnings, cashflows, book value or sales. This method is versatile and can be used in many situations or in combination with other approaches, however it relies on the fact that assets are comparable and in some cases, as for example start-ups it is difficult to find another company that can be comparable (Damodaran, 2006).

- Discounted Cash Flow (DCF): In discounted cashflows valuation, the value of an asset is the present value of its expected cash flows discounted back at a rate that reflects the risk of the asset (Damodaran, 2006). This approach is based on the fact that assets with high and predictable cash flows should have higher values than assets with low and volatile cash flows and introduces the Net Present Value (NPV) concept, which has been a broadly used technique within the history of valuation. The NPV is based on the fact that money you have in hand now is more valuable than money you collect later on. That's because you can use it to make more money by running a business, or buying something now and selling it later on, or simply putting it in the bank and earning interest. Future money is also less valuable because inflation erodes its buying power (Harvard Business Review, 2014). Through years this method have been modified and adapted in order to be able to accurately measure the price of assets that are difficult to measure (Damodaran, 2006). One example is the model proposed by (Festel, et al., 2013), that modifies certain components of the DCF equation to be more precise in measuring high technology start-ups.

- Option pricing models: This technique assumes that assets that hold high level of uncertainty are dynamic and their risk will decrease during the investment period.

Therefore the value of an asset is its NPV plus the value of the future option (Zeng & Zhang, 2011). This method, even theoretically proven to be more precise for pricing highly risky projects than other methods, is not broadly adopted by practitioners (Damodaran, 2006). In a survey of Fortune's 1000 largest companies, only 14.3 % of respondents reported using real options in their capital budgeting process (Block, 2007). The main reasons are that option pricing models are difficult to implement and very complex. The most widely used alternative for pricing high uncertainty assets are the DCF methods, which have proven to be easier to implement and sufficient (MacMillan, et al., 2006).

Each approach has its drawbacks and as mentioned some will assess better the value of a specific type of asset while not performing very good in other assets.

2.3.1 Valuation of start-ups

Despite many years of research and perfecting of conventional valuation methods it is still a challenge to find one that provides a precise value for start-ups. According to (Cumming & Dai, 2011) valuation of a start-up company is key for both investors and founders, but given the few or inexistence track of record of start-ups their valuation is particularly complicated (Festel, et al., 2013). This may be due to a lack of accounting data (short history, i.e. the company has neither profits nor revenues), the lack of market data (there are no comparable companies or no direct competitors) or the fact that most of the company's assets are intangible. According to (Elnathan, et al., 2010) there is a general lack in research about experts valuations of private companies. More specifically, there is an insufficiency not only in the research about the determinants of valuations in private equity (Cumming & Dai, 2011), but also about BAs and their investment decisions (Paul, et al., 2007).

Research on start-up valuation suggest that informal investors rely on the experience of the entrepreneurs, the "hype of the products", credibility of the entrepreneur, potential sales or good fit between the entrepreneur and the investor (Carpentier & Suret, 2015; Mitteness, et al., 2012; Dusatkova & Zinecker, 2016). These findings triggered the adoption of new approaches that consider qualitative aspects for valuation and propose models that incorporate qualitative traits into conventional valuation methods such as the DCF. For example, (Festel, et al., 2013) introduces a modification of the Capital Asset Pricing Model (CAPM) that takes into account

five areas: technology, product, readiness and sophistication of the business plan, organization and finance. The CAPM is a modification of the DCF technique that assumes that the cost of capital equals the cost of equity, which is valid in the start-up setting because start-ups are only financed through equity (Festel, et al., 2013).

On the other hand evidence suggests that business angels generally do not use valuation methods because they are complicated, time consuming and they are perceived as not precise (Maxwell, et al., 2011). Is therefore a mystery how business angels decide the deal price and value start-ups.

2.4 Life Science

2.4.1 Definition

The 'life science' term refers to "the application of biology and technology to health improvement, including biopharmaceuticals, medical technology, genomics, diagnostics and digital health" (UK Parliement, 2017). The life science industry includes several sub-industries that develop, manufacture and commercialize products and services for medical purposes. Its major sub-industries are medical devices, biotechnology, pharmaceutical, generics and the specialty pharma (EY, 2018).

Within life science innovation is typically created by small biotechnology or medical device companies who base their technology on novel patented discoveries coming from public and private funded research. Due to the high development and commercialization costs of this industry small biotechnology and medical devices companies usually seek major deals with bigger stablished pharmaceutical and medical device companies. For this reason the highest concentration of start-ups is found within the biotechnology and medical devices industries (Boris & Ralph, 2010; Cairns, 2019; Cairns & Armstrong, 2016; John Wiley & Sons, 2011).

2.4.2 Valuation in the life science industry

As the life science industry responds to market pressures, declining productivity, increasing regulatory burdens, looming patent expiries and generic competition, industry leaders are increasingly seeking externally oriented strategies to augment pipelines, secure finance, expand portfolios and drive long-term revenues. Start-ups, on the other hand are focused on discovering

new technology but are not capable of gathering enough resources to develop and commercialize new technology. For this reason their goal is to get a licensing deal or a trade sale via acquisition. In order to attract capital, life science start-ups must elaborate a lucrative value proposition that captures investors' attention. Venture capital and business angels are tough partners in negotiations; for this reason having a sound idea of the company's value is a prerequisite for the founders to keep a respectable ownership stake. Similarly, when licensing, a company's management should not underestimate the importance of valuation as pharmaceutical companies will not start negotiating without a solid valuation, based on thorough due diligence, showing the leeway of the negotiations (Boris & Ralph, 2010). For this reason, valuation of life science assets is key for the industry leaders, entrepreneurs and investors (Mayhew, 2010).

Despite the high proportion of early stage transactions across the industry the reality is that there is no consensus on how to apply valuation methodologies. According to (Boris & Ralph, 2010) the majority of early stage investors do not value at all, arguing that it is not possible to get realistic and objective numbers out of it (Boris & Ralph, 2010). A commonly cited reason for this contention is that the high degree of uncertainty and risk relating to the necessity, commercial applicability and useful lifetime of early stage technology (such as preclinical and early clinical phase R&D projects) leads to differing perceptions about early stage valuations. As a consequence, the practice of early stage valuation is viewed by many as indeterminably vague, imprecise and often meaningless (Mayhew, 2010). In addition, research into valuation practices among life science professionals suggest that the disagreement does not come from uncertainty or risk per se, but from the commonly held view of valuation practices as highly quantitative and strongly dependent on well-defined assumptions. Such a narrow perspective of valuation as a tool invariably places significant emphasis on the precision of the valuation output, which is exquisitely dependent upon the assumptions that are used in the valuation process (Boris & Ralph, 2010; Mayhew, 2010).

According to (Boris & Ralph, 2010) there are two major quantitative valuation approaches applied in the life science sector, DCF and real options. While DCF is the gold standard, real options valuation is gaining grounds and is regarded as a possible alternative in life science. Both methods have their advantages and drawbacks. DCF, when applied to early stage projects, generally yields negative values; nevertheless the industry is profitable (Doganova, 2015). Consequently, managers do not trust their valuations and disregard the recommendation

retrieved from the valuations. Projects in early development are continued despite their negative DCF values.

Real options valuation on the other hand has been developed to overcome the shortfalls of DCF but it is still regarded as too complex and highly theoretic, compared to the easy to use DCF method (Zeng & Zhang, 2011). Today, there is no standard on how to apply the method to life science valuation (Boris & Ralph, 2010). According to (Boris & Ralph, 2010) the Real Options methodology has been harmed by previous research studies that have applied the methodology in unappropriated ways and if properly understood and applied, this method could represent reality much better than DCF does.

In an intend to unify previous knowledge on life science valuation and overcome some of the problems that valuation presents for investors in this industry, (Boris & Ralph, 2010) developed a framework for valuating life science established companies and start-ups. Their framework uses conventional valuation theory but specifically tailored for the life science. In their work, (Boris & Ralph, 2010) identify success rates, peak sales and costs to be key areas in the life science industry that need to be addressed precisely and provide publicly available data to find industry ratios for each therapeutic area. The notion behind (Boris & Ralph, 2010) study is that life science is a very complex industry, where development costs are difficult to predict, success rates along the regulatory pathways are generally unknown and that peak sales should be precisely estimated understanding how many people will be able to receive or use a product and how the competition landscape will look.

After the efforts by researchers and life science professionals on developing and improving valuation tools it is still not known if investors use valuation techniques, especially in the start-up scene. In addition, compared to research on business angels and valuation in start-ups, valuation in life science does not address qualitative aspects such as the team composition and characteristics. It would be interesting therefore to analyse if the current state of the art in life science valuation is used or not and see if a higher focus on the qualitative aspects of early stage valuation could improve the results and popularity of valuation in life science.

2.5 Summary – Review of literature

In conclusion, literature on business angels research is growing and gaining interest, however there are still areas where additional knowledge is needed. This thesis focus on overall

investment process and valuation, something that has been out of the focus by most of the literature, but that is of high relevance for entrepreneurs and investors. The current literature that addresses company pricing is mainly related to valuation methodologies. However, evidence shows that when moving towards early stages valuation methodologies are not widely used. A reasonable amount of researchers have tried to address this topic by proposing different methods to quantify the qualitative aspects that influence the value of a start-up. In addition, life science represent a field where valuation is especially important but also difficult due to the industry characteristics. Business angels investment process and valuation in life science is an area where there is practically no literature yet it is of high interest due to the increasingly important role of business angels and the difficulties that entrepreneurs find to get funding.

3 Methodology

In this section I will present the research design of the study, how I addressed reliability and validity issues and why this is the best suited methodology to study how do business angels evaluate life science start-ups and if they use valuation techniques. Then I will introduce the data collection method, the sample selection and the sample criteria. Last I will discuss how the data has been analysed what are the limitations that this research methodology might present.

3.1 Research design

This study was done using a qualitative, exploratory multiple case study design. A qualitative type of study was chosen because any quantitative approach would have been extremely complicated due to the high confidentiality of the data being treated. The exploratory research setting was needed because there is very little literature addressing business angels investment process and valuation in life science. Consequently, an explorative or inductive setting allowed me to first gather data and analyse it, leading to the development of a set of hypothesis that can be tested in future research studies (Wilson, 2014; Tenca & Croce, 2018). In this case, I collected data and analysed it in order to develop a better insight into how business angels who invest in the life science industry evaluate early stage companies, with special focus on their valuation techniques. Other approaches such as a descriptive study would have been difficult to implement due to time limitations.

The case study design was selected because this study investigates "a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003). The choice of this research design came along very natural, since the main point of the case study is to provide an in-depth analysis of an individual or a group of individuals as it is also the goal of this thesis (Wilson, 2014). Other designs as for example a comparative design could have been interesting, for example comparing the view of both of entrepreneurs and business angels. However, finding variables for comparison at this stage would limit the study because more understanding about investment process would be required.

I decided to choose a multiple case design and analyse 6 different business angels in order to secure a higher level of robustness (Wilson, 2014). A single case study would have been less robust because differences on experience, behaviour, culture etc. create many differences amongst business angels and their investment process. This is something that has been pointed by previous research (Tenca & Croce, 2018; Maxwell, et al., 2011) but that I have also observed while conducting my research.

In total there are 6 cases being analysed in this study, each of them corresponds to different business angels and therefore different investment cases. The study was based on an semi-structured interview, followed by an inductive analysis to generate a set of categories on business angels investment process that were then compared to previous findings from literature and used to answer the research question.

3.2 Reliability and validity

In order to maintain reliability I decided to interview business angels with different degrees of experience and capital availability for investing. The rationale behind this was that if patterns were observed they could be attributed to a general behaviour in the investment process and not to previous experience or a certain sub-group of angel investors. In addition, to avoid subject error reliability (Wilson, 2014) I designed an interview model with neutral questions based on collecting information about subject's experiences. For this purpose the interview model was analysed and reviewed by two external persons; one with relevant business research experience and one with extensive life science industry knowledge, Steffen Korsgaard and Henrik Lund former CEO of Regenics AS, respectively.

Some of the investors interviewed had experience as founders of several companies or also investment activities in later stage investment firms such as Venture Capital funds. This presented a challenge since interviewees would jump from one point of view to the other in some cases. For this reason I decided to maintain a semi-structured interview format to be able to re-frame questions when needed and increase the sample size to 6 subjects as opposed to 5 that was the initial goal.

Another reliability risk was time bias (Wilson, 2014). As I was looking at a phenomenon that happens over a period of time it would be optimal to study several investment cases over the

time from the new investment opportunity being presented until the decision is made and the term sheets are signed. However due to time limitations this was not an option. Therefore I interviewed subjects about past and present events. This might have had an impact on my results.

In order to ensure validity I designed the interview to explore the whole investment process as opposed to focus only on how valuation is achieved. This was important to understand which are the variables affecting the investment process and their relevance in the final decision. Otherwise findings could be very precise on what valuation techniques are used but fail to achieve a comprehensive understanding on valuation being an important criteria or not in the whole process of investing.

Mortality, understood as number of participants dropping out of a study, was high. A total of 11 business angels were contacted, from those 9 agreed to interview and only 6 were interviewed. Since this was not a longitudinal design study and subjects were interviewed only once, mortality bias does not represent a big risk on the results but it affects the number of cases studied, decreasing the robustness and generalizability of the results (Wilson, 2014).

Despite reliability and validity risks, the study is still relevant as its main goal is not to establish generalizable theories or concrete conclusions about business angels investment process and valuation in life science. Instead, it aims to increase the global understanding of this phenomenon and point to topics for further studies.

3.3 Data collection method

The first step of data collection for this study was to find relevant literature to review. The literature reviewed was mainly from three big areas business angels research, business valuation techniques and valuation techniques within life science. To provide an additional grounded understanding of the life science industry I also analysed several reports from well-known consultancy companies (EY, 2017; EY, 2018; The Boston Consulting Group, 2012; Kearney, 2013). The literature in the area of business angels research was obtained through two previous literature reviews (Tenca & Croce, 2018; Politis, 2008) and related articles. Literature on valuation techniques and valuation within life science was collected from two main sources (Damodaran, 2006) and (Boris & Ralph, 2010) respectively and combined with multiple articles on specific cases of valuation examples as for example (Johal, et al., 2008; Festel, et al., 2013;

Jimenez & Blanco Pascual, 2008; Kellogg & Charnes, 2000; MacMillan, et al., 2006). Some articles were found through google scholar searching or the University of Oslo library searching engine and some additional literature was provided by the supervisor. The relevant literature was selected on the basis of its relevance to the research topic and theoretical framework. The quality of the used articles was measured by citations.

I decided to collect qualitative data as opposed to quantitative because I wanted to gain understanding on the business angels investment process, a field that is highly subjective and barely documented in any available database. Furthermore investing transactions in early stages are highly confidential. For this reason, even though a quantitative analysis could be interesting on providing information about the effectivity of a certain approach, it is very complex and not suitable for the scope of this study.

The second step was to find relevant candidates for the qualitative data collection. In order to do so I contacted several business angels that had invested in Norwegian life science companies. I found relevant candidates by asking people within my own network for recommendations and through Norway Health Tech web page, where I could find a comprehensive list of Norwegian life science start-ups (Norway Health Tech, 2019). Once a group of interesting companies were identified I looked at their webpages to find information on their investors and contact them through LinkedIn or email. The following criteria were used in selecting interview candidates:

1. Active business angel investor.
2. Having at least one investment within early stage life science companies.
3. Having done at least 3 investments.
4. Having invested in a Norwegian early stage life science company.

Criteria 1 was selected because I wanted the interviewee to be up to date and avoid time reliability issues. Hence interviewees talked about present and past experiences. In addition interviewees needed to fit within the definition of business angel used in this study.

Criteria 2 was selected for two reasons. First I wanted to assure that the investor was familiar with the life science industries and talked specifically from his or her own experience. Second I wanted to focus only in early stage companies since business angels are the group of investors

who invest the most in early stage and also valuation techniques in early stages are specially complicated due to the lack of financial data and track record of the companies.

Criteria 3 was selected to ensure that the information provided by the investor was grounded in a minimum degree of experience and was not subject to big changes over time.

Criteria 4 was selected for two reasons. On one hand differences in taxes, public funding schemes and competition makes the landscape for early stage investments slightly different from country to country. In Norway for example public funding availability is higher than in other European countries and the US, this means that more businesses are able to finance the seed stage and first years with public funds. This could influence the investor behaviour. On the other hand due to the difficult availability of business angels and the benefits of having interviews in person I decided that it was better to focus on a single area where I could have the most chances doing face to face interviews.

The interviews were held between 1st of February of 2019 and the 23 of April of 2019. This setting allowed to interview each business angel once and have time to analyze the findings. Most of the interviews were conducted face to face, one of the interviews had to be conducted by phone. The interviews were done using a semi-structured interview method (Wilson, 2014) with a pre-defined set of questions but with the freedom to raise additional questions in particular themes that were not clear or that seemed particularly interesting. In order to collect relevant and valid data and avoid biases through questions that could push the interviewees in a certain direction (Ericsson, et al., 1993), I decided to implement open-ended questions in combination with minimal information provided before and during the interview. I used previous literature as basis for the design of the interview that once done was reviewed by the thesis supervisor and Henrik Lund, former CEO of a Norwegian biotechnology company. The interview guide is attached in the appendix 1.

All interviews were taken in English and recorded in order to give a more accurate interpretation.

3.3.1 Sample selection

Table 2 presents information on interviewees. Due to issues of anonymity and identifiability certain details of the subjects (names and companies where they have invested) are left out.

	Relevant experience positions	*Years of experience*	*Investment Industries*
1	Board member of 7 Norwegian life science companies & CEO.	More than 5 years of investing experience	Pharmaceuticals & Biotechnology
2	Founder and owner of VC firm, board member of more than 5 Norwegian start-ups, including one leading Norwegian biotechnology company.	More than 5 years investing experience	Electronics, high-tech & biotechnology
3	Investor of two biotechnology Norwegian start-ups. More than 20 years of senior positions in the pharmaceutical industry. COO of a leading Norwegian biotechnology company.	More than 5 years investing experience	Pharmaceuticals & Biotechnology
4	Investment analyst at a Norwegian VC fund. More than 3 years of research within life science.	At least 2 years of investing experience	Pharmaceuticals & Biotechnology
5	Board member of at least 8 Norwegian start-ups. Investor in at least 3 life science start-ups.	More than 5 years investing experience	Life science & Marine
6	Board member of at least 7 start-ups. Founder of an early stage investment and advisory Norwegian firm.	More than 5 years investing experience	Deep-tech

Table 1: Presentation of interviewed business angels

3.4 Anonymity and identifiability

All interview candidates chose the option of anonymity to avoid that any effects on their current investments.

In order to respect candidate's anonymity all investors are presented without names and giving as little background information as possible so they cannot be identified. Some non-specific information about investor's experience is provided in table 2 for legitimacy issues, so the readers of this study can be aware of the level of expertise and experience of the subjects interviewed.

3.5 Data analysis

Before starting the analysis all the interviews were transcribed and reviewed twice to ensure a correct transcription.

Once the transcription was done I started to code the transcripts by using an emergent coding approach (Wilson, 2014). First I generated free codes or categories by examining the text and identifying recurrent topics that business angels mentioned during the interviews. This was done until no data from the interviews could be linked to any existing or new code. Second I analysed the codes and grouped them into higher level codes by doing axial coding. In a third round I identified a single central code that group all the identified codes. With the central code then the focused was on analysing the relationship between all the codes (Braun & Clarke, 2008). By doing this I created a group of propositions about the business angels investment process and deal pricing in life science investments. Last, in a final round I evaluated the relevance of each of the first level codes by assessing how many investors mentioned them and selected only the codes that were mentioned by at least 4 of the 6 investors. As literature on business angels research says the business angel investment process is very heterogenous (Politis, 2008), by adding this last step I ensured that the topics selected were shared by the majority of my sample, avoiding single-case singularities.

The result was a total of 25 first level codes that were grouped into 3 second level areas investment methodology, investment criteria and valuation, all englobed by the central code that is business angels investment process. The reason why the focus was put on the investment process and not just valuation was because my goal was to get an overall picture of the investment process and narrow down to valuation and company pricing. With this approach I gathered much more useful information that could tell me how the business angels' investment process work and what is the role that valuation plays in it (Yin, 2003). Figure 1 offers a representation of the coding process and some examples of the categories generated.

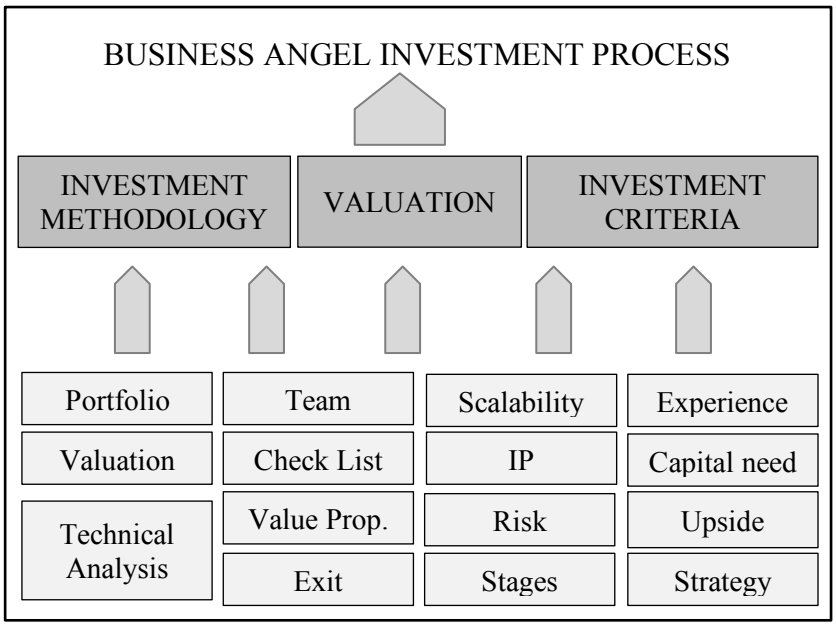

Figure 1: Representation of some of the categories identified through the first coding process.

Investment methodology was related to the investors approach to the assessment of an opportunity. *Investment criteria* was associated with the areas that the investor would consider critical for investing. In other words *investment criteria* were the key aspects of a start-up the business angel would review and *investment methodology* was how the investor reviewed them. Finally, *valuation* was anything that could be related to how the investor would assess the price of the start-up, including everything that linked to valuation techniques.

Finally, I interpreted the findings in accordance with the literature reviewed for this study. To ensure triangulations the empirical evidences and findings of some of the articles reviewed were used as secondary data (Yin, 2003). These findings were also used while interpreting the results as they gave some additional understanding on what are the main criteria used by business angels when analysing a start-up company.

4 Results and analysis

In total 6 business angels were interviewed. In tables 2 to 6, I summarise the main information provided by business angels on investment methodology, investment criteria and valuation.

4.1 Results on investment methodology

Table 2 represents the frequency of the interviewees talking about a specific method when investing. This gives an idea of the most commonly used approaches by the sample of this study.

Investment methodology codes	*Investors mentioning it*
Check list	2, 4, 6
Portfolio*	1, 3, 4, 5, 6
Risk assessment and management*	1, 2, 3, 4, 5
Experience*	1, 2, 3, 4, 5, 6
VCs and BAs	1, 2
Investment stages**	2, 4
Availability	2
Involvement	1, 2, 3
Dilution	1, 3, 4, 6

Table 2: Coded concepts for business angels investment methodology.

**Key codes with major consensus.*

***Investment stages refers to the investment process being divided into different stages of assessment, due diligence and negotiations. Even though not all the investors specifically mentioned it, it has been shown by literature that the business angel investment process is a multi-stage process (Feeney, et al., 1999; Haines, et al., 2003; Mason & Stark, 2004) and none of the interviews done during this study pointed in the opposite direction.*

Table 3 presents the 3 key themes on investment methodology mentioned by the majority of the investors and its most important quotes.

	Portfolio	*Risk Assessment & Management*	*Experience*
1	"About 50% of my investments are within biotech, the rest in more low-risk type of investments, like large public funds or index funds where I have no role"	"It is very judgemental, there is no arithmetic, it depends on how well do I know the field, investigating the competition players, the actual unmet medical need, whether the particular invention is novel and differentiated and that is making my best guess"	"The benchmarking I do is based basically in my own experience and the deals I have seen so far" - "I invest in life science because I am a pharmacologist and I worked in the pharma industry for a very long time, here I have the knowledge and the network"
*2**		"It is very dangerous, a lot of unknowns, in order to be successful you need to have an approach where you can handle all the uncertainty you haven't thought about that could happen and happens" - "A big part of the game is how you deal with the companies when a lot of unforeseen events will happen" - "One of the biggest risks in life science is fundraising"-"It is a huge risk that the company does not get fundraising for the whole development phases, a pharmaceutical company will go through at least one financial crisis, so having long term financing is actually a critical success factor. What happens if you have a lot of private business angels they will likely say I put a bit of money now and if I like it I follow on, but what they fail to see is that all of them think like that and this can kill the company. So it is a huge risk so when I was investing through a VC fund we never had angel investors and if we had them we would kick them out and make sure it was long term funding because otherwise they can create a negative dynamic"	"The first assessment is Your first assessment is pretty much based on experience you basically read the material, you pretty much see if this is attractive or not because you have seen a couple of thousands and it doesn't take you a long time" - "The very first screening is if this look like a solid team, is the market sufficiently big, is it protected with patents, how far the product development has develop, how is the market opportunity is this global, you basically take a fast overview to decide if you will have a meeting or not"- "Valuating early stage companies is not an exact science, it is a lot of experience"-"In my experience only 10% of the companies will pass the first screening and then again 10% will go through the second screening, because you don't have time"

3	"Around 40% of my investments are in life science because I have a deeper knowledge in that area. Not all of them are early stage though I distribute it between early and late stage"	"Generally I use Data Bases that tell me the specific risk of failure through clinical trials, I also do some benchmarking in order to know the risk of failure of a drug in a specific area"-"In the pharmaceutical industry you have several tools and studies that has been done and allow you to determine the risk of failure of a specific drug in a specific indication moving from phase to phase, so you are somehow helped by these coefficients, so at least in phase one you build the DCF and introduce those coefficients" - "If you can't do that then you need to look at "analogs", at whether you are moving into unknown territory or not if it is new you need very good data to move forward and if you are in a space that have already been validated you need to know how the competitive landscape look" - "In the early stage it is more a science than a mathematical assessment"	"When I invest money that I don't need and it also depends on my knowledge of the business the industry and the therapeutic area"
*4***	"In pharmaceutical a project can fail for many reasons, so it is a matter to diversify, it is hard to assess the risk of a single project"-"It is very likely that eight or nine out of ten projects fail, when you go so early stage it is very difficult to predict success, so in a sense what you have to do is to distribute risk, invest across different areas and spread it out"-"You should not invest money that you need, you should expect at least 10 years of development"	"It is very likely that eight or nine out of ten projects fail, when you go so early stage it is very difficult to predict success, so in a sense what you have to do is to distribute risk, invest across different areas and spread it out"	"When I look at companies forecasts and assumption I try to understand them and detect if there are any flaws"
5	"Before people would maybe invest all their money in one place, now more and more you look at your portfolio and that is how I do my investments as well, so in early stage life science I		"When I look at the projections presented by the team I do some internal analysis and my experience tells me if it is realistic or not"

	would maybe invest just 10% of my money"		
6	"To handle the risk I have a portfolio of around 50 companies" - Healthcare represents around 25% of our capital commitment"	"In start-ups if you don't get the next financing round you are dead, the risk is pretty high so we go and talk with other potential investors in the later stages to see what are their circumstances" - "In the early stage investments everything is risk, is like skiing down the mount Everest, only a very particular type of people is able to handle this" - "As ways to de-risk you try to do a very deep DD or find ways to add value by involving yourself and providing network and so forth, and also having a portfolio"	"We have 10 investment themes that we invest in and those are based on areas where we are experts and we think we can add value and Norway has world class expertise"

Table 3: Selection of the most important quotes for the 3 most mentioned concepts on investment approach.

**Investor 2 comments on risk assessment and management seem to be more from the point of view of a Venture Capital fund than a business angel, however I decided to include the information because it is still useful and give some information on the relationship between business angels and VC funds in life science ventures.*

***Investor 4 quote for portfolio and risk assessment and management because the strategy to manage risk is through diversifying the investment and having a portfolio.*

4.2 Results on investment criteria

Table 4 presents all codes generated on investment criteria and how many investors talked about it.

Investment criteria concept	*Investors mentioning it*
Technology*	1, 2, 3, 4, 5, 6
Team*	1, 2, 3, 4, 5, 6
Emotional appealing	3, 5, 6
Value proposition	1, 4, 5

Intellectual property*	1, 2, 3, 4, 5, 6
Other investors	1, 3, 5, 6
Upside of the investment*	1, 2, 3, 5, 6
Idea	1, 5
Exit	1, 2, 3, 6
Therapeutic area	3
Scalability	5

Table 4: Coded concepts on business angels investment criteria.

**Criteria or topics that were mentioned the by most investors and selected as relevant for the study.*

Table 5 presents the most relevant codes on investment criteria and the relevant quotes.

	Team	*Technology*	*Intellectual Property*	*Upside of the investment*
1	"The team behind it is the third pillar" - "So I really need to feel that the idea is good and that the people behind it have a reasonable understanding what are their products proposition"	"I spend some time digging into the technology" - "I invest in pharmaceutical and biotech companies because I have been in the industry for many years and with my pharmacology background I am able to understand the technology"	"The protection set up is number two" - "The first is whether I think the idea is good, the idea, the business plan, the invention, whether it is credible or not or likely to succeed. And that depends on what do they have built, where are we in the patenting process, how likely is it to get protection"	"In pharma compared to other industries the upside is very big so it is important for me to know what is the endgame if this is successful"
2	"After the first screening based on your experience the team is the first to look at, does it look like a solid team or not?"	"You actually dive deep in the technology to understand what you need to understand and how it can be applied to the industry" - "I am very interested in understanding what do they need to prove in order to bring this technology to the market" - "You could spend a couple of weeks to understand better the technology but in the end innovation it often comes in waves or clusters, so when a new innovation arrive you	"As part of the first assessment you look at the patent portfolio and try to figure out if it looks interesting or not"-"Is the Intellectual Property protected? do they have an attractive patent portfolio"-"In pharmaceuticals the protection of the IP is one of the most critical factors"	"Part of the first assessment is based on reading the material and based on experience figure out how big and global this can be"- "The upside has to be so big, like a factor of 10 for example, otherwise you don't take the risk" - "But when it comes to how much can this be worth you look at a couple of things, first you look at how big can this be, how much revenue can it have, how many customers can it have, what is the margins, how much bottom line EBITDA can you have some time in the future and

		already have heard a couple of conferences about it"		then you do basic multiple analysis"
3	"Number two is the team because just having scientist is usually a good opportunity for failure" - "Because if you don't have a team that can bring different expertise and move the project forward and transform it into something more significant down the road it is going to fail" - "You want people who is able to move the project forward and have a development plan" - "It is a combination of the science and the team" - "Do this team understand what they are targeting? Have they developed a target profile? Are they developing something there is demand for or it is their baby and they don't care about anything else"	"It depends on the stage of the project, but when you have a very early stage project, where there is no clinical data then the science is the most important to look at" - "Are you talking about a validated target or a target that can impact to multiple diseases or not and then you really need to look at the science" - "And the quality of the data is very important as well" - "How this target can potentially impact to more than disease without treatment current treatment" - "It is all about science"	"The IP is very important as well but I consider that as part of the science it is basic and it is part of your target profile. Strong IP is a very important element"	"If you come to me with a product for hypertension is not going to trigger my interest so much but if it is for a very severe type of cancer or rare disease because even that is maybe smaller number of potential patients there are shorter routes to market and opportunity for higher profits, but again that is not the main element I look at, first is the science, the team and the strategy"
*4**	"Then I of course look at the team and their competence" - "I also consider what are their needs because they also often want an investor who can bring in some expertise"	"I consider myself one of the few that has the competency to understand the technology" - "My investment strategy is two folded, first I look at the science" - "I think it should be easy to understand because if it is too complicated then future customers will also have problems on understanding it" - "For me it is very important to understand the technology and challenge companies"	"Second I look at the Intellectual Property, because in this sector if you don't have good IP any other big company can come and do what you do"	No related comments
5	"And the other thing is, do you believe the management of the company can pull it right" - "And the third thing would be do you trust the people who is running this" - "In most cases you will have to trust the person and the numbers" - "Do the management understand what the products are for and if there is a need for them?"	"I only invest in a market that I can understand myself or that I think it has huge potential" - "To me the basics are first the technology"	"Second the protection, are there patents is it easy to copy?"	"The market or industry where I invest should have a big potential" - "Once the company have gone through the basic public funding schemes then you demand projections, what are you going to build, what are you going to do to get there, how much volume would the market have and what would be the profit and working capital need"

*6***	"We invest in teams rather than individuals" - "We do a big due diligence on the individuals and other investors" - "The fundraising risks are very high in these type of projects so you really need to make sure that the team will be able to attract both the right talent and the right capital through all of these rounds" - "Has this team historically published in this area? Is this their big area of interest? have they started companies before? Are they transparent? And also of course I talk to people who has worked with them before" - "I also look for people who are coachable, have strong believes but they are also open to input and reconsideration" - "Are they so authentic and committed that they will stay in and work 24/7 and forgo their own salary to save the company"	"We have 10 investment themes that we invest in and those are based on areas where we are experts and we think we can add value and Norway has world class expertise" - "We also look at the technology to make sure it is cutting edge"	"How much does it take to arrive to a point where it can be patented"	"In order for us to invest the total addressable market should be around 1 billion euro, which with a 10% of market share would mean around 100 million euro revenues" - "Instead of financial modelling I am more after what is the total addressable market"

Table 5: Main areas mentioned by business angels during the interviews.

**Business angel number 4 did not make reference to the upside of the investment as an important criteria for investing.*
***Business angel number 6 is a private investor but also runs an investment fund who invest in very early stage projects for this reason some of the answers used first person plural (e.g. "we invest in teams rather than individuals").*

4.3 Results on investment valuation

All investors were asked about valuation methods and their approach to price the companies. Table 6 presents the quotes on the two concepts grouped under investment valuation.

	Quotes on valuation	*Quotes on mathematical modelling for valuation*
1	"I would try to understand how big is the upside here, but there is no exact arithmetic that I would do" - "Clearly you need to see if successful what is the end game, the upside, the potential market value, but because things are so early you need to discount so much" - "Then it is just as interesting to see bottom up approach how much money has been putted so far, what is the shareholders structure, how much have been putting, are there any funding external that they have, what kind of past fundraising what prices they had" - "If there was a previous round I want to see a reasonable relationship between the price at that stage and when I enter" - "An then you have a third	"More than any mathematical approach I do a more judgemental assessment, I look at how well I know the technology, what is the unmet medical need, what is the novelty and differentiation and try to do my best guess" - "Then you would have the bottom up approach, where I look at how much money has been put into this so far. That gives me an idea of the value" - "I don't mind seeing DCF in presentations but more than the final number I am more interested in the assumptions they made to get there and then how well they have thought through this"

	approach, the benchmarking let's say a company ready to go in to the first phase, classical Norwegian company and then it is price generally in a certain range and I base that in my own experience" - "Where are they, what do they need, how far they have come and what is the upside and so on"	
2	"But when it comes to how much can this be worth you look at a couple of things, first you look at how big can this be, how much revenue can it have, how many customers can it have, what is the margins, how much bottom line EBITDA can you have some time in the future and then you do basic multiple analysis" - "So the critical things are how many customers, what is the average basket value for this, what is the costs you need to operate with what are the fix margins so the key number you end up with is EBITDA and then you multiply for enterprise value" - "You don't need so much detailed mathematical valuation, you are after the order of magnitude, the upside has to be so big around 10 times for example"	"The company has to present a cash flow budget in order for you to understand the capital need and it need to be detailed enough to understand it but it does not need to be super precise you need to know how much money you need at each stage of the development because you need to understand how to build the financing round and also to design the spreadsheet so you can design the deal. But generally I don't use it to calculate the value"-"In order to understand the value I basically try to look at how big this can be. What are the margins and what is the bottom line EBITDA and then do very simple multiple variations to get an idea" - "You don't need so much detailed mathematical valuation, you are after the order of magnitude, the upside has to be so big around 10 times for example"-"You know investing in early stage and life science is very difficult and there is many things you can do regarding evaluations or assessments upfront, because there are so much unknowns, so to be successful you need to have an approach to handle or that uncertainty"
3	"The principles I follow are, when you have a pre-clinical asset it is difficult to come up with a positive NPV because the costs are so high, but again the fundamentals are building a DCF and introducing risk and that is very well defined in the biotech or pharmaceutical industry, maybe not that much in the medical device and this is generally true for the round A and also when investing in the stock exchange"-"If the project is in phase 1 I build a DCF spreadsheet with the probabilities to success and the NPV" - "If the project is too early to build a DCF model then I look at analogs, other companies that could be comparable"- "For me it is very important to create a good cash flow sheet and do it in a thorough manner, looking at the epidemiology, prevalence, penetration rate, peak sales, the reasonable price for the product development and the costs" - "And the second thing I look at are the analogs, nowadays there are many databases and you can compare assets within the same indication"	"If the project is in phase 1 I build a DCF spreadsheet with the probabilities to success and the NPV" - "If the project is too early to build a DCF model then I look at analogs, other companies that could be comparable" - "It is more a science than a mathematical process, because there are many elements that you can 't reliably count. Therefore it is more a matter of scientific assessment, idea protection, previous experience, peak sales..."- "For me it is very important to create a good cash flow sheet and do it in a thorough manner, looking at the epidemiology, prevalence, penetration rate, peak sales, the reasonable price for the product development and the costs" - "And the second thing I look at are the analogs, nowadays there are many databases and you can compare assets within the same indication"
4	"Generally if he company has had any investing round before I try to understand what has been achieved and if the valuation seemed fair" - "Sometimes you don't feel expert enough to put a value and you know there will be a bigger round in the future, so you just ty to participate there with a discount"-"I generally like to use convertible notes, that avoids the hassle of putting a value, that is very often done by business angels in Norway"-"I have never valued a company that has not been valued before, so in a sense I use previous rounds to have an idea of the value. If I had to put a value then I would ask someone in my network to do so or generally what I have done is to use convertible notes and put a valuation cap which I think is realistic"	"I don't use any mathematical tool I generally look at the science, the team..." - "One thing I do is to invest via convertible notes and then I avoid valuating the company, because I don't consider I have the financial knowledge to do that" - "Unless you have a financial background you won't be able to do financial modelling as a business angel"-"As a business angel I generally don't use any mathematical tool, I usually prefer to look at the team and so on..."

5	"I do some internal analysis based on the presentations and projections that the team give me" - "But again if you find any flaws in the numbers or the projections you will automatically not invest, there are several other places where you can put your money"	"The numbers are generally pretty straight forward and then it is soft issues that will pull it in one direction or another" - "But the numbers that I calculate are basically using the iPhone calculator in the same moment of the presentation I don't do much more than that"
6	"My valuation is more judgemental rather than mathematical"	"I don't do my own financial modelling, and remember we invest so early that you can kill this whole thing with too much analytics without having the basis for them. In a sense you can create whatever outcome you want from those models"

Table 6: Business angels' comments on general valuation and use of more complex mathematical models for early stage investments.

4.4 Investment process

In this section I analyse the results of the interviews. First I provide an in-depth analysis on the 3 second level codes (investment, methodology, criteria and valuation) and their main first level codes. Then I present the relationships I found amongst them and its implications on the investment process and company pricing, which will be further discussed in the section 7. Finally I answer the research questions.

Investment methodology is the first area I address because it regulates the overall investment process and the approach followed by investors. Then I discuss about the investment criteria, which presents the main aspects that business angels evaluate when presented with a new opportunity. Last I discuss valuation, which comes at a later stage in the investment process and is influenced by both methodology and criteria.

4.4.1 Investment methodology

According to the interviewed business angels the investment process is subjective and is mainly based on their experience. When talking with the interviewees, experience was mentioned several times as their way to evaluate different aspects of the investment opportunity. In addition to experience, two other relevant areas arise from the interviews: portfolio and risk assessment and management. All investors diversify their investments into different areas with different risk profiles so they can control how exposed to risk they are in overall. Likewise, interviewed business angels also have specific strategies to handle the risk for a specific investment. Experience, portfolio and risk assessment and management are all codes that regulate the manner in which business angels invest and influence their decisions.

Experience

All interviewed business angels rely on their experience to evaluate investment opportunity. One other element that points to experience as key in the investment process is the lack of structured and objective frameworks. Business angels admitted that investing in early stage life science is not an exact science and it is highly complex.

> *"Valuating early stage companies is not an exact science, it is a lot of experience" (Investor 2).*

> *"When I look at the projections presented by the team I do some internal analysis and my experience tells me if it is realistic or not" (Investor 5).*

> *"In the early stage investments everything is risk, is like skiing down the mount Everest" (Investor 6).*

Experience is used in different aspects and moments during the investment process. Some examples are benchmarking, to assess what would be a rational deal price, evaluating the technology of a given venture, assessing the technology of the start-up or determine the validity of the forecasts presented by the entrepreneurs.

> *"The benchmarking I do is based basically in my own experience and the deals I have seen so far" (Investor 1).*

> *"When I invest money that I don't need and it also depends on my knowledge of the business the industry and the therapeutic area" (Investor 3).*

> *"When I look at the projections presented by the team I do some internal analysis and my experience tells me if it is realistic or not" (Investor 5).*

Angel investors are presented with many investment cases and they have very limited time to evaluate them. Assessment through experience is seen as a reliable and efficient approach to evaluate investment opportunities. Results from the interviews suggest that business angels use their experience to do a first screening of the opportunity.

> *"The first assessment is… Your first assessment is pretty much based on experience you basically read the material, you pretty much see if this is*

attractive or not because you have seen a couple of thousands and it doesn't take you a long time" (Investor 2).

"In my experience only 10% of the companies will pass the first screening and then again 10% will go through the second screening, because you don't have time" (Investor 2).

In overall, experience has a very important role in all business angels' investment methodology. The manner in which experience is used differs from investor to investor, but there is consensus on deal pricing and detection of flaws in the entrepreneur forecasts. An assessment based on experience is also seen useful by business angels because it is fast and very suitable for a the first screening phase of the investment process.

Portfolio

Five out of six investors in this study use a portfolio strategy. This means they invest in different areas in order to minimize risk[1]. An interesting finding during the interviews was that all investors who have a background related to life science, have a higher portion of their investments in life science. This suggests that business angels with life science background have a higher affinity for this industry. A reason that could explain this findings is that in technologically complex industries, as for example the life sciences, it is important for the investors to understand well the technology and how it will fit in the industry. *Investors 1, 3 and 4* had a higher percentage of their investments in life science and their portfolio strategy was to invest in different stages of development. Typically the portion allocated for early stage start-ups in life science amongst the interviewed investors was between 10-20 % of the total invested capital. Except in the case of *investor 6,* who had all the investment in early stage distributed across different industries, where life science accounts for 25% of the total portfolio.

"About 50% of my investments are within biotech, the rest in more low-risk type of investments, like large public funds or index funds where I have no role" (Investor 1).

[1] A investment portfolio strategy refers to having different investments in different areas, each one with different risk-reward profile. One example could be having 50% of the capital in bonds, 30% in real estate and 20% in life science start-ups.

"Around 40% of my investments are in life science because I have a deeper knowledge in that area. Not all of them are early stage though I distribute it between early and late stage" (Investor 3).

"Before people would maybe invest all their money in one place, now more and more you look at your portfolio and that is how I do my investments as well, so in early stage life science I would maybe invest just 10% of my money"(Investor 5).

"To handle the risk I have a portfolio of around 50 companies" – "Healthcare represents around 25% of our capital commitment" (Investor 6).

In conclusion, all business angels have a portfolio approach and investments in early stage life science projects represent a small portion of their total investments. Furthermore, investors with life science background show a higher affinity to keep investing in the life science industry

Risk assessment and management

When asked about how they assess and manage the risk of a start-up investment, business angels recognized that this is a critical issue and that risk in early stage is always very high. Consequently, it is important to have some strategies to handle risk. Their approaches towards risk assessment and management are very different, again pointing towards heterogenous investment methodologies amongst the study sample. It is important to differentiate between risk assessment, which comes generally before the investment is done, and risk management, which includes taking actions to reduce the risk.

Regarding risk assessment the majority of the investors use due diligence procedures on the team and the technology.

"As ways to de-risk you try to do a very deep DD or find ways to add value by involving yourself and providing network and so forth, and also having a portfolio" (Investor 6).

Other approaches mentioned include using publicly available databases with information about therapeutic areas and success rates for certain indications.

"Generally I use Data Bases that tell me the specific risk of failure through clinical trials, I also do some benchmarking in order to know the risk of failure of a drug in a specific area" (Investor 3).

Regarding risk management, the most common approach adopted by business angels is to get involved in the development of the company.

"A big part of the game is how you deal with the companies when a lot of unforeseen events will happen" (Investor 2).

"As ways to de-risk you try to do a very deep DD or find ways to add value by involving yourself and providing network and so forth, and also having a portfolio" (Investor 6).

In overall assessing and managing the risk is a subjective matter. However, thorough due diligence in the evaluation process and involvement on the development of the company is perceived as helpful on eliminating risky projects and reducing development risks respectively.

4.4.2 Investment criteria

Interviewed business angels suggested a long and diverse set of criteria for the evaluation of a life science's start-up. However, there is a clear consensus on four main aspects are considered by almost all investors: team, technology, intellectual property and upside of the investment.

Team

All business angels mentioned the team as one of the most important criteria to evaluate a company. The fact that projects are very early stage and development times so long makes it very important to have a team that will be able to go through all the phases until commercialization.

"The team behind it is the third pillar" (Investor 1).

"After the first screening based on your experience the team is the first to look at, does it look like a solid team or not?" (Investor 2).

"Number two is the team" (Investor 3).

"And the other thing is, do you believe the management of the company can pull it right" (Investor 5).

Investors perceive the team as a key component for success for different reasons. On one hand, as *investor 1* reflects, in order to succeed the team needs to understand how the technology they are developing will affect all the relevant stakeholders. Similarly, *investor 3 and 4*, mention that the team should be aware that there is demand for the technology developed.

"So I really need to feel that the idea is good and that the people behind it have a reasonable understanding what are their products proposition" (Investor 1).

"Are they developing something there is demand for or it is their baby and they don't care about anything else" (Investor 3).

"Do the management understand what the products are for and if there is a need for them?" (Investor 5).

On the other hand investors also consider that the team composition and relationship is very important. As *investors 2 and 6* say, the team should look solid and they should be committed. The team will go through good and bad moments and they will have to deal with situations of uncertainty constantly. Furthermore the complexity of the life science industry requires experience and a very specific combination of skills. For this reason business angels want to see that the team will go through what is needed and that the combination of their abilities are sufficient to reach their goals.

"does it look like a solid team or not?" (Investor 2).

"You want people who is able to move the project forward and have a development plan" (Investor 3).

"Then I of course look at the team and their competence" (Investor 4).

"Are they so authentic and committed that they will stay in and work 24/7 and forgo their own salary to save the company" (investor 6)

Some other factors considered in the assessment of the team are their expertise in the technology and other capabilities such as honesty, transparency, openness to feedback and previous experience building companies.

> *"Has this team historically published in this area? Is this their big area of interest? have they started companies before? Are they transparent? And also of course I talk to people who has worked with them before" (Investor 6).*

> *"I also look for people who are coachable, have strong believes but they are also open to input and reconsideration" (Investor 6).*

In summary, there is complete consensus amongst investors that the team is a key criteria to consider during the investment process. The general traits business angels want to see in the teams they invest are a combination of skills and experience that can lead towards the project goal and a reasonable understanding of the company's value proposition and its fit in the market. The level of due diligence business angels use to investigate the team's characteristics is highly variable but is basically based on publicly available information and network.

Technology

All business angels considered the technology a key element that will influence their investment process. Regardless of their area of expertise investors look at the technology, try to understand it and assess its potential.

> *"I spend some time digging into the technology" (Investor 1).*

> *"You actually dive deep in the technology to understand what you need to understand and how it can be applied to the industry" (Investor 2).*

> *"It depends on the stage of the project, but when you have a very early stage project, where there is no clinical data then the science is the most important to look at" (Investor 3).*

> *"To me the basics are first the technology" (Investor 5).*

> *"We also look at the technology to make sure it is cutting edge" (Investor 6).*

The reasons why investors look at the technology are two folded, on one hand business angels want to be able to see the potential of the products being developed. This means understanding if the technology can affect one or more diseases, if there is an unmet medical need, what are the current treatments with whom they will compete and if there is a clear regulatory pathway for this technology. On the other hand they also want to assess the minimum requirements that the technology needs to prove in order to be in the market and be attractive for customers.

> *"I am very interested in understanding what do they need to prove in order to bring this technology to the market" (Investor 2).*

> *"Are you talking about a validated target or a target that can impact to multiple diseases or not and then you really need to look at the science" (Investor 3).*

> *"How this target can potentially impact to more than disease without treatment current treatment, it is all about science" (Investor 3).*

> *"I only invest in a market that I can understand myself or that I think it has huge potential" (Investor 5).*

The interviewed business angels have different approaches to how they do due diligence on the technology. From digging deep and spending some time looking at the technology to expect that it should be easy to understand. An interesting remark mentioned by *investor 6* is that the he/she only invest in technological areas where Norway has world class expertise, arguing that this increases the probabilities to replicate previous success stories.

> *"You actually dive deep in the technology to understand what you need to understand and how it can be applied to the industry" (Investor 2).*

> *"I think it should be easy to understand because if it is too complicated then future customers will also have problems on understanding it" (Investor 4).*

> *"We have 10 investment themes that we invest in and those are based on areas where we are experts and we think we can add value and Norway has world class expertise" (Investor 6).*

Very often business angels contribute to the evolution of the company by sharing network and know-how. In this sense *investors 1, 2, 4 and 6* mention that they have to be experts in the of technology that they invest. This makes it easier for them to understand the it and to contribute to the development and commercialization.

In conclusion, technology is one of the key areas that all investors consider relevant for the evaluation of an investment opportunity. Business angels specially assess it because it helps realizing what is the potential and what is the industry outlook. Investors have different approaches to study the technology. It also seems that angel investors with background related to life science are more likely to invest in start-ups within this industry because they can understand their technology easier and they can also contribute more to the project.

Intellectual property

Intellectual Property (IP) is regarded as a very important criteria for all investors. There is consensus in that IP is a key element for any life science business. The perception is that due to the high development costs start-ups are much more sensible to imitation by any established company that has more resources. If the technology is proven to be successful IP offers not only protection against imitation but commercialization with a sufficient competitive advantage for a certain period of time.

> *"The protection set up is number two" (Investor 1).*
>
> *"In pharmaceuticals the protection of the IP is one of the most critical factors" (Investor 2).*
>
> *"The IP is very important as well but I consider that as part of the science it is basic and it is part of your target profile. "Strong IP is a very important element" (Investor 3).*
>
> *"Second I look at the Intellectual Property, because in this sector if you don't have good IP any other big company can come and do what you do" (Investor 4).*
>
> *"Second the protection, are there patents is it easy to copy?" (Investor 5).*

"How much does it take to arrive to a point where it can be patented" (Investor 6).

Despite this, none of the investors acknowledged to have a specific procedure to assess the quality of the IP portfolio. This is surprising given the importance of intellectual property in this industry. One explanation for this could be that IP is perceived as very complex and business angels do not feel comfortable or expert enough to look at it.

In conclusion, IP protection is a key criteria for business angels investing in life science yet interviewed business angels do not mention performing due diligence on the intellectual property. This is an issue that needs further analysis, the results obtained in this study are not clear enough to conclude if investors simply believe the entrepreneur or use a third party to analyse the IP.

Upside of the investment

From the six business angels interviewed 5 mentioned the importance of the upside of the investment. Investors acknowledge that early stage life science investments involve high risks and that a small portion of their investments may generate large returns. For this reason they look for projects with high potential so in the case of success they can compensate the other loses.

"In pharma compared to other industries the upside is very big so it is important for me to know what is the endgame if this is successful" (Investor 1).

"Part of the first assessment is based on reading the material and based on experience figure out how big and global this can be" (Investor 2).

"The market or industry where I invest should have a big potential" (Investor 5).

"Instead of financial modelling I am more after what is the total addressable market" (Investor 6).

Business angels assess the upside of the investment differently. Some, as for example *investor 2,* focus on a quantitative approach using the EBITDA as reference. Others, as *investor 3,* look

at the targeted therapeutic area, the competition, the regulatory pathway and the opportunity to set up high margins.

> *"But when it comes to how much can this be worth you look at a couple of things, first you look at how big can this be, how much revenue can it have, how many customers can it have, what is the margins, how much bottom line EBITDA can you have some time in the future and then you do basic multiple analysis" (Investor 2).*

> *"If you come to me with a product for hypertension is not going to trigger my interest so much but if it is for a very severe type of cancer or rare disease because even that is maybe smaller number of potential patients there are shorter routes to market and opportunity for higher profits, but again that is not the main element I look at, first is the science, the team and the strategy" (Investor 3).*

Some investors also specified exactly what should be the size of the opportunity for them to invest, *investors 2 and 6* for example have very specific requirements on this matter.

> *"The upside has to be so big, like a factor of 10 for example, otherwise you don't take the risk" (Investor 2).*

> *"In order for us to invest the total addressable market should be around 1 billion euro, which with a 10% of market share would mean around 100 million euro revenues" (Investor 6).*

In summary, there is almost complete consensus amongst all interviewed business angels on that the upside of the investment is a key criteria for the evaluation of the investment opportunity. Investors have different approaches and criteria to measure the upside but the potential market and the ability to have high margins seem to be main analysed aspects. In addition business angels have a minimum requirement for the size of the upside.

4.4.3 Valuation

5 out of 6 business angels interviewed clearly stated that they do not use any valuation method when investing in early stage companies within life science. Only *Investor 3* mentioned that if the project analysed is in clinical phase 1 he/she uses a DCF valuation approach:

> *"If the project is in phase 1 I build a DCF spreadsheet with the probabilities to success and the NPV" (Investor 3).*

However most of the start-ups in life science who seek investment from business angels are in pre-clinical stages. Those who arrive to clinical phases 1 and 2 already look for larger rounds, generally financed by VCs (Whitehead, 2003; Boris & Ralph, 2010). In this case, the same investor, states that if the start-up is in a very early stage then he uses other methods, as for example comparing the company to other similar projects that had been priced in the past:

> *"If the project is too early to build a DCF model then I look at 'analogs', other companies that could be comparable" (Investor 3).*

Investor 3 is the only investor that seems to use a specific valuation technique. Despite this, 'analogs' or relative valuation according to (Damodaran, 2006) only gives the investor with an idea of what is the upside of the investment (e.g. what has been the acquisition price for a certain biotechnology start-up) as opposed to what is the share price the investor will pay at the moment of the investment.

When examining the reasons why business angels do not use valuation techniques the general answer is that at a very early stage valuation techniques can lead to different outcomes and it is very difficult for them to assess which one is the most accurate.

> *"I don't do my own financial modelling, and remember we invest so early that you can kill this whole thing with too much analytics without having the basis for them. In a sense you can create whatever outcome you want from those models" (Investor 6).*

> *"You know investing in early stage and life science is very difficult and there is many things you can do regarding evaluations or assessments upfront, because there are so much unknowns" (Investor 2).*

Another important reason that hinders business angels from using valuation techniques is because they are complex and difficult to interpret. The perception is that you need a good financial background in order to be comfortable using valuation.

> *"Unless you have a financial background you won't be able to do financial modelling as a business angel" (Investor 4).*

In overall, the fact that the outcome of the valuation models is highly dependent on the initial assumptions, moves the focus from the model towards the ability of the investor on formulating the right assumptions. This, in combination with valuation techniques being perceived as very complex, results in business angels deciding to look at other factors that seem to be better predictors on later success.

> *"More than any mathematical approach I do a more judgemental assessment, I look at how well I know the technology, what is the unmet medical need, what is the novelty and differentiation and try to do my best guess" (Investor 1).*

> *"As a business angel I generally don't use any mathematical tool, I usually prefer to look at the team and so on..." (Investor 4).*

> *"My valuation is more judgemental rather than mathematical" (Investor 6).*

Instead of using valuation techniques, the interviewed business angels look at other features that can give them an idea of the value of the asset. Amongst all the answers, the most common approach is to look at the upside of the investment. In other words, how big will the company become in the best case scenario. This gives the investor an idea of what will be the return of the investment. Due to the high risk and uncertainty of early stage life science start-ups investors expect a very high upside scenario that will compensate the risks. Business angels are after the order of magnitude rather than a very precise valuation.

> *"I would try to understand how big is the upside here, but there is no exact arithmetic that I would do" (Investor 1).*

> *"Clearly you need to see if successful what is the end game, the upside, the potential market value, but because things are so early you need to discount so much" (Investor 1).*

"But when it comes to how much can this be worth you look at a couple of things, first you look at how big can this be, how much revenue can it have, how many customers can it have, what is the margins, how much bottom line EBITDA can you have some time in the future and then you do basic multiple analysis" (Investor 2).

"You don't need so much detailed mathematical valuation, you are after the order of magnitude, the upside has to be so big around 10 times for example" (Investor 2).

Another element that is often considered is the previous rounds that the company have had and use them as a reference for valuation. Not all the companies that business angels will invest in have had previous financing rounds. For this reason it is not the first aspect interviewees look at, but it is information that, if available, will influence the company pricing.

"If there was a previous round I want to see a reasonable relationship between the price at that stage and when I enter" (Investor 1).

"Generally if he company has had any investing round before I try to understand what has been achieved and if the valuation seemed fair" (investor 4).

Other elements considered include looking at the assets owned by the company and calculate the current value of the company excluding future projections or using convertible loans. Convertible loans are loans that will be converted into ownership of the company at a later stage, for example at the next financing round. Generally, at the moment of conversion from loan to shares a discount that has been previously discussed is applied, meaning that the business angel will pay a reduced share price. With convertible loans investors also define the valuation cap, which is the maximum value at which the loan will be converted. In a sense the valuation cap is the valuation of the company. When asked about convertible loans the rest of the investors said that they are in general negative and they try to avoid them. The main reason is because they put the entrepreneur in a debt situation and can create conflicts between the entrepreneur and the investor.

"Then it is just as interesting to see bottom up approach how much money has been putted so far, what is the shareholders structure, how much have been

putting, are there any funding external that they have, what kind of past fundraising what prices they had" (Investor 1).

"I generally like to use convertible notes, that avoids the hassle of putting a value, that is very often done by business angels in Norway" (Investor 1).

"If I had to put a value then I would ask someone in my network to do so or generally what I have done is to use convertible notes and put a valuation cap which I think is realistic" (Investor 1).

"I hate convertible loans, there is nothing good about them. They are not good from a tax point of view, but also as an investor I want to sit in the same side of the table as the entrepreneur. If we use different instruments that is not going to happen. Also as an early investor I live from the increase of value of the company, if all of that is capture in convertibles then it is a completely unattractive asset" (Investor 6).

In conclusion, valuation models are not used and are widely considered as a tool that can give any result, therefore not reliable. Instead, business angels who invest in life science start-ups prefer to use other criteria as a reference for pricing. In addition, the process of valuation is highly subjective with different approaches for each individual investor. The upside of the investment is the only aspect that is considered by the majority of the investors.

4.5 Relationship amongst codes

Investment methodology regulates all the investment process. Business angels rely on experience and that has a direct effect on how the criteria are assessed and how the investor decides the value of the start-up. Portfolio additionally has an impact in both criteria and valuation. Business angels who invest in life science allocate around 10% of their capital for early stage companies, they know that the investments are very risky but also expect potential for high returns. Risk assessment and management will determine how the angels will evaluate the opportunity and their post-investment relationship. For example if the investor has an approach for risk assessment that includes thorough due diligence of some aspects of the investment criteria, as for example the team and the technology these two aspects will be carefully evaluated. On the other hand if the investor will manage risk by being actively

involved in the project a more important factor could be assessing the gaps that the investor can fill and evaluate if there is a good fit between the entrepreneur and the business angel.

Investment criteria is regulated by investment methodology and at the same time enables investment valuation. Investment criteria is at the core of the investment process representing the variables that the investor look at when doing the first assessment, but also the areas where the investor will spend time evaluating in later phases of the process. Once criteria is evaluated the investor can proceed to plan the investment, value the company. The upside of the investment criteria influences directly the pricing by providing the investor with an idea of what can be the maximum return of the investment. Generally business angels have a minimum requirement on the upside of the investment.

Valuation is influenced by both investment methodology and by investment criteria. Methodology regulates how valuation is performed while the criteria enables valuation of the opportunity and provides necessary input for the valuation process.

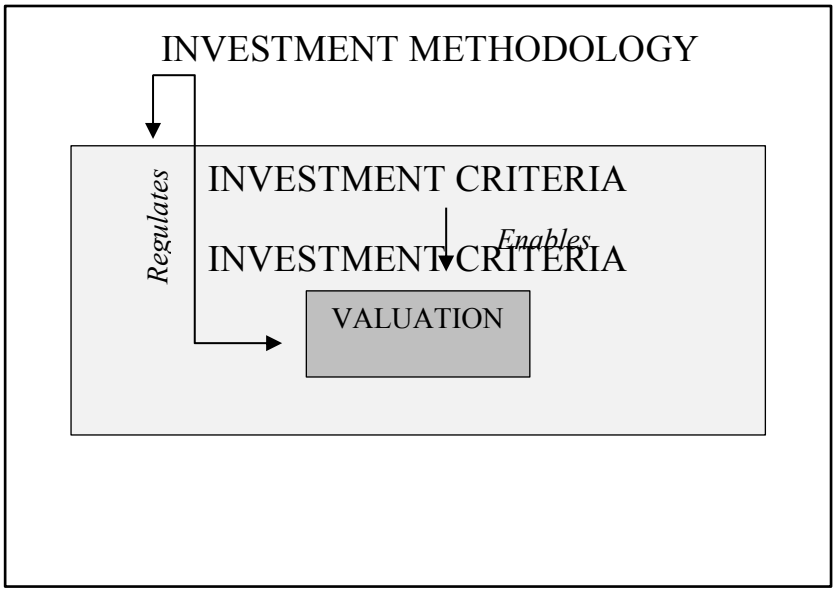

Figure 2: Relationship between investment methodology, criteria and valuation.

4.6 Answer to the research questions

4.6.1 Research question #1

RQ 1: How do business angels investing in life science evaluate start-ups?

Building up on previous literature we know that evaluation of life science start-ups by business angels is a multi-stage process. This thesis suggests that in addition the investment process is highly influenced by the investor's experience where there are four key elements that the investor look at: the technology, the team, the intellectual property and the upside of the investment. The investor will first do a fast assessment based on experience of the key elements, if there is any flaw identified the evaluation process will stop. If no flaws are identified the investor will go on, meet the team and do a more thorough analysis of the investment opportunity, again putting special emphasis on the four key elements and planning carefully the financing. In this study I also have identified that business angels with life science background have a higher affinity towards investing in the same industry as opposed to investors with different backgrounds. Another singularity of the life science industry is that IP is a very important for the evaluation process yet interviewed business angels do not have a system to assess it.

4.6.2 Research question #2

RQ 2: Do business angels investing in life science start-ups use valuation techniques

Business angels investing in life science start-ups do not use valuation techniques. They don't use them because they consider that in early stages there is no sufficient data to support the assumptions needed for applying valuation models. Instead, business angels use a more judgemental approach where they consider various factors and take a final decision based on their experience. According to the data obtained in this study the factors they consider are the upside of the investment and the capital need, comparing them to the current situation of the company and its risk. Again, this is a process where the experience plays a crucial role on the decision making process, is for this reason that the valuation and deal pricing in life science start-ups is a very heterogenous process.

5 Discussion

5.1 Investment process

5.1.1 Relation to theory

As discussed in section 3, the business angels investment process has different stages and business angels adopt a heuristic short-cut decision making, the so called "elimination by aspects" (Maxwell, et al., 2011; Paul, et al., 2007). The data collected in this thesis supports this view, showing that this is also true for business angels who invest in the life science industry. Even though the focus of this thesis has not been to identify and define the number of stages of the investment process, from the interviews we can say that there is a very clear and differentiated initial assessment stage. In this first assessment the investor tries to figure out if the opportunity is interesting by spending the minimum possible amount of time and it generally happens before meeting the entrepreneur.

Results from this study also confirm the previous findings from (Maxwell, et al., 2011), business angels have limited time and are presented with many opportunities, thus an heuristic decision making approach helps on reducing the investment cases to a manageable size. In addition, in my study there is a clear link between time efficiency in decision making and assessment through experience. This suggests that using an experience-based approach saves time to business angels, at least during the first screening phase.

Another finding from this study that is supported by previous literature is that business angels are an heterogenous group with different investment behaviours amongst investors (Wetzel, 1987; Maula, et al., 2005). During the analysis of the data 25 first level codes about different topics were generated, nevertheless only 9 were shared by at least 5 out of 6 investors.

5.1.2 Differences from theory and implications

Experience

As mentioned in section 5, I found that the investment process is highly based on experience. This is something that literature fails to mention. It is true that there are some studies that focus on how business angel decision making change with experience. This points towards a relationship between the investor experience and the decision making (Schulz & Schmücker, 2017). However, there are no studies that focus on what are the implications of an experience-based assessment. For example it would be very interesting to know what is the reliability of evaluation based on experience or if this makes investors vulnerable to information asymmetry and persuasive techniques (given the lack of objectivity of experience). On the other hand, this have also important implications for entrepreneurs, who should, in the same way that business angels do, investigate the background of the investors and tailor their message for the best fit. This can save time for the entrepreneur in the fundraising process. Another association that can be inferred from the importance of experience is the entrepreneur-investor fit. Some studies suggest that one of the criteria used by business angels is "the investor fit", meaning how well the investor fits the entrepreneur team and vice-versa (Carpentier & Suret, 2015; Landström, 1993; Mason & Stark, 2004). For example an investor who has been in the same university as the entrepreneur might be more likely to invest in the start-up. The key role that experience plays through the investment process could suggest that the investor fit is in fact a more important criteria than what is mentioned by both literature and the business angels interviewed in this study.

Last, an experience-based decision making process makes it very difficult to establish methodologies to measure performance. It is easy to know when an investment have been successful, but it is impossible to know if all the break even or failed projects could have been rejected early on. A well-established framework could help on professionalizing the early stage investment process and also avoid problems due to information asymmetry amongst the parties involved in the process. In my opinion, both researchers and investors should work towards a more standardized process that leads towards a higher number of successful investments.

Portfolio

This thesis suggest that investors with life science background are more likely to invest in the life science industry. This could be because it is easier for them to understand the technology but also other factors should be considered, as for example life science being its passion or the ultimate goal of helping people through new medicines and therapies. One important

implication for entrepreneurs is that looking for investors with a background related to their technology or target therapy might increase their chances of success in the fundraising process.

Criteria

A central part of the research on the business angels investment process focuses on understanding what are the criteria that investors evaluate to decide if they invest in a start-up (Tenca & Croce, 2018). As discussed in section 3, literature on this matter suggests that the main criteria are the team, the business opportunity, the business plan and the investor fit (Tenca & Croce, 2018). Findings in this study support the team as one of the key aspects that business angels evaluate. In my study the data indicates that angel investors assess if the team will be able to accomplish the milestones successfully and that the team understands what is their value proposition and how it fits in the industry.

However, in this study I could not find any information that supports other criteria pointed by previous business angels research. According to my thesis, business angels in life science look at the technology, the intellectual property and the upside of the investment as the key criteria together with the team. These differences with previous literature are not surprising considering that criteria such as business opportunity or business plan are broad and can include several elements. In this sense the criteria mentioned by previous literature is not very accurate and lacks consistency on its definitions.

On the other hand, studies related to life science valuation (Boris & Ralph, 2010) support the criteria mentioned by the interviewed investors. As it is acknowledged by (Boris & Ralph, 2010) some of the key elements that have to be considered for investing in life science are the peak sales and the rates of success within specific therapeutic areas; both concepts that are closely related to the upside of the investment, the intellectual property and the technology.

These findings could suggest that the investment evaluation process is different depending on the industry we are looking at. This makes sense considering that in life science intellectual property is a very important element for success whereas in e-commerce for example, intellectual property protection would not be an efficient solution to prevent competition and imitation.

5.2 Valuation

5.2.1 Relation to theory

As it has been mentioned in section 5, interviewed business angels do not use valuation techniques to decide the company price of their investments. This is also supported by findings from previous literature (Maxwell, et al., 2011; Mayhew, 2010). According to literature the some of the reasons are its complexity and the lack of track of record of start-ups. In my findings I also observed that there is a lack trust in the outcomes of the valuation techniques, investors say that a model can lead to any result and they are not reliable. Instead of valuation techniques interviewed business angels suggest that there are other more judgmental elements that are better predictors of success than valuation. These findings seem to resonate with those of (Festel, et al., 2013), who indicates that one of the problems of valuation techniques is that they fail to address qualitative characteristics of the investment opportunity such as the technology, readiness of the project or the IP amongst others. That was the reason why research on early stage valuation started developing modified versions of the DCF that integrate the qualitative elements. However in this study there is no evidence of any investor using any similar tool, that could be due to a lack of trust or awareness.

This can be the reason why experience play such an important role in the investment process. Through experience the investors can recognize patterns, characteristics or signs that they saw in previous successful cases. Nevertheless we have no manner to know if this is the best approach for valuing early stage start-ups.

5.2.2 Differences from theory and implications

In my study one of the factors that seems to be an starting point for establishing the valuation of a company is the upside of the investment. It seems that investors have an expected minimum return on the investment and assessing the upside gives them an idea about if the opportunity is within their accepted range. One of the implications that this have is that start-ups who cannot justify abnormal returns have to consider accepting prices that can be compatible with business angels expectations or look for other sources of investment. The reason for this investor behaviour is probably be related to portfolio strategies. Business angels interviewed view early stage investment in life science as highly risky. Assuming a high risk of course means that investors also expect high returns and that the amount of capital they will allocate to this type of investments is between 10-20% of their total portfolio.

During this study one of the findings that was shocking was the lack of information on the valuation process. It seems that business angels do not have any methodology in place to decide the company price. The lack of information points towards the deal pricing being a process highly subjective where the negotiation abilities of both parties can play an important role. According to (Paul, et al., 2007) business angels consider the deal pricing one of the most complicated parts of the investment process where the only way of getting an agreement was deciding a price that "feels right" for both parts. The implications of this is that pricing is very uncertain and can generate insecurity to both parties in a moment that is crucial for the entrepreneurs. It also puts the entrepreneur at a vulnerable position and despite the fact that the entrepreneur is valued as one of the most important assets for the start-up to be successful. Developing frameworks that could guide both parties to reach consensus in an easier manner will contribute to a healthier development of the business and to attract more investment in to the life science.

In this sense, the valuation model proposed by (Festel, et al., 2013) seems to fit very well with the interviewed investors and particularly the life science. It seems that the approach followed by studies who try to include qualitative elements into the valuation techniques are in the right direction. One additional remark that has to be considered is that time and complexity are very important to the eyes of the investors, thus any proposed valuation model should take it into account.

Considering both previous research and this study it is evident that there is a need for assessing the accuracy of the models proposed by literature in order to help for the development of valuation frameworks.

6 Concluding remarks

The purpose of this study was to gain an overall understanding of the business angels investment evaluation process in life sciences and to know if they use valuation techniques. Hence the research questions:

RQ 1: How do business angels investing in life science evaluate start-ups?

RQ 2: Do business angels investing in life science start-ups use valuation techniques?

To answer the research questions I did a review of literature on business angels investment process, valuation techniques and valuation in life sciences. Then I designed an interview guide and interviewed 6 business angels with current investments in life science's start-ups. Last I analysed the results of the interviews.

First, the business angels evaluation process in life science start-ups is based on the assessment of four key criteria, the team, the technology, the intellectual property and the upside of the investment. Business angels use their experience to evaluate the criteria, converting investment in early stage life science companies in a heterogenous and subjective process. This partially contradicts the literature on business angels investment process but resonates with life science valuation previous research. In addition, Business angels that have life science background tend to invest more in the life science industry than other investors. Despite recognising IP as one of the most important criteria for evaluation business angels do not perform due diligence on it, at least not according the data collected in this study.

Second, business angels investing in life science start-ups do not use valuation techniques. Instead they assess the company value by considering the upside of the investment. More than looking for a specific value business angels want to determine the order of magnitude and estimate if that fits their expected return on the investment. This findings suggest that negotiation skills and other soft elements are very important at the moment of deciding the price of a start-up.

6.1 Implications for entrepreneurs

The study may provide entrepreneurs in the life science industry with basic understanding on business angels' criteria and behaviour. Entrepreneurs should be aware of the criteria that investors consider as critical and how they evaluate them. By being prepared they can be more efficient on raising funds or on identifying problems in their projects.

Given the high influence of experience in the business angel approach, founders should consider the background of the business angel and use that to articulate a value proposition that can capture their interest. Having an idea of the approximate price of the company, fall-back positions and evidence supporting the assumptions can help entrepreneurs to maintain a healthy ownership of the company.

6.2 Implications for business angels

This study may help business angels investing in life science start-ups to reflect upon their approach to both evaluate and valuate companies. Working towards more objective frameworks can improve their rates of success in their investments.

On the other hand, despite it is very difficult to estimate the price of a start-up, investors should accept that in any investment there will be a moment where the value of the start-up will be decided. Arbitrarily deciding the price is not more accurate or reliable than using valuation techniques. For this reason, having strong basis for the final price can help them to reduce complications on reaching a consensus with the entrepreneur.

6.3 Limitations

One of the biggest limitations of this study is the sample size and selection criteria. On one hand the sample is not big enough to claim that the results can be generalisable to all business angels investing in the life science. On the other hand, all the investors generally invest in Norwegian start-ups and it could be that the group studied behave differently than investors investing in other regions.

Another limitation is the fact that except investor 3 all investors in this thesis claim not to use valuation techniques. It could be that my sample of study represents a sub-group of investors who do not use valuation techniques.

In addition, having done only one interview can be compromising the results of this study. A design where 2 interviews at different points in time are done with every investor would have allowed for further analysis into unclear areas. This was of course very difficult both due to time limitations and investor availability.

6.4 Future research

An interesting line of research for future studies could be to evaluate the performance of different approaches to investment valuation. One way to do this could be to compare two groups of investors valuating the same companies using different methods (Festel, et al., 2013). It seems that in order to move towards more objective frameworks in start-up valuation any new method should prove to outperform already existing approaches. Another interesting topic could be to investigate how business angel's investment process change in different industries.

Last, I have observed throughout this study that business angel's research lacks a theoretical framework. After having done this thesis it seems very likely that business angels evaluation process could be partially explained by using the resource-based view theory but further theories should be explored. As in any other field, finding theories that could explain business angels' behaviour could serve to increase the robustness of the current knowledge on this topic.

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8 Appendix

8.1 Interview guide

1. First I would like you to talk about your approach when evaluating an investment opportunity, what information do you require to make a decision?
2. How do you try to assess the risk of an investment?
3. Are there any specific tools that you use?
4. Do you use any mathematical model, ratios or combination of both?
5. Which mathematical model, ratios or combinations?
6. Do you think your method has any limitation or bias?
7. Do you do any type of technology assessment?
8. How do you plan your exit strategy? (insight on their mindset)
9. How many of your investments you expect to fail? (expectations and efficiency of their methods)
10. Do you like to invest in few companies or many? (how do they like to invest)
11. Do you consider the companies you invest in to require more money along the way? And how do you face this? (more cash vs dilution)
12. Why do you invest in Medical Devices industry?
13. Do you look at things like how the proceeds are used or the cash liquidity of the company?
14. Do you think about the future burn-out periods of the company through the development phase?