Business valuation methods in the context of the Healthcare technology industry from the perspective of Finnish venture capital investors – Master’s thesis

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ABSTRACT

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The goal of the thesis is to study valuation methods including quantitative and qualitative (investment criteria) when Finnish venture capital investors valuate and select their investments in the category of healthcare analytics startups. I will first research how the venture capital works and different valuation methods they use at valuation stage and then focus more on healthcare sector and especially healthcare analytics. 

As explained in the literature review concentrates solely on venture capital in healthcare analytics. While researching I noticed that no such research has been done but luckily few researchers have dedicated their work to healthcare or medical technology relation to venture capital valuation methods. In the empirical part I will connect existing literature with interviews with 8 venture capital investors from Finland. The method is semi-structured interview for the sake of its advantaged to explore the unknown field.

At the end I can say that Finnish venture capitalists provide (also in the environment of healthcare analytics) same results as their peers internationally by preferring traditional valuation methods mostly multiple and DCF methods. Regarding investment criteria entrepreneur and team criteria with market rose to be the top two criteria. Product-related criteria especially related to patents and regulatory environment stood up in importance scale. Financial measures became important when talking of more mature stage startup (startup life-cycle) investors. In other criteria one can see special features of healthcare analytics. In general, Finnish VCs tend to valuate their target companies in the similar manner in comparison to international peers. All in all, the results provided great important insights information about valuation of healthcare analytics companies. None of the investors are entirely focusing on healthcare analytics sector so therefore one could say that the answers are generalistic about different startups from different industries.
ABSTRAKTI

Tekijä: Niklas Wasama

Otsikko: Terveysanalytiikka yritysten arvostaminen suomalaisten pääomasijoittahien näkökulmasta

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Hakusanat Pääomasijoittaminen, yrityksen arvostaminen, sijoituskriteerit ja terveysanalytiikka

Tämän pro-gradun tavoite on tutkia arvostus metodeja niin kvantitatiivisia kuten kvalitatiivisia (sijoituskriteerit) kun suomalaiset pääomasijoittajat arvioi terveysanalytiikka yrityksiä. Ensimmäiseksi tutkin, mitä kirjallisuus kertoo pääomasijoittamisesta and arviointimetodeista, joita he käyttävät sijoitusprosessin arviointivaiheessa erityisesti, kun kohteena ovat terveysala and terveysanalytiikka yritykset.


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Education has been a great journey from comprehensive school, to high school to universities in Tallinn, Vienna and finally Lappeenranta. I want to dedicate this thesis to all the people who I have met and supported me through this journey. Education itself with everything what I have learned I see as important. However, education does not have to end here but learning continues throughout the life we live. Especially I want to thank to LUT University that has given me the opportunity of learning what the spirit of working together can achieve. I want to thank you Mikael Collan for your guidance through the thesis and my whole time as a student at LUT.

Finally, I want to thank my mother who has always been there for me in good and bad times. She is someone who I can call a role model. She always says never stop believing in yourself. I took the advice and now I stand here, proud and happy.

17.01.2019 in Helsinki
1 Introduction

As start-ups are becoming more important for future development in technology sector it is vital to research how investors especially venture capital companies are valuing them. Valuing technology is a challenging task as we are going to explore later, and therefore it is important to dig deeper into different valuation methods.

Healthcare technology is wide-spread business field that is related to new innovations in healthcare like diagnostics and monitoring. Artificial intelligence and machine learning are the newest versions of this field. (Healthtech Finland. (n.d.)) Healthcare analytics, on the other hand, is about using health data for better decision-making. (Evariant.com, 2015)

Why healthcare analytics exactly is so important to explore? Saranen Consulting (2016) tells that TEKES (Suomen teknologiakeskus) has supported Finnish health technology development with 10 million euros. More and more global companies like Microsoft, Nokia and GE are interested into funding this growing industry. Not only is the development focused on Finnish capital area, many other university cities are thriving health technology and for example exporting already their appliances and services to Far-East. Finnish IT students are expected to be hired, thanks to their competences, to health technology ventures. The greatest challenge is to recruit the right people into right positions in these companies. (Saranen Consulting, 2016)

Healthtech Finland (Healthtech.teknologiateollisuus.fi. (n.d.)) and Talouselämä (2017) support the fact mentioned earlier that healthcare technology industry has brilliant potential in Finland. According to Healthtech.teknologiateollisuus.fi. (n.d.). the statistics, exporting of health technology gadgets increased by 9,7% in 2016 in comparison to 2015, and in the same year the export value was amounted to 2 billion euros. The Figure 1 reveals that exporting of health technology gadgets to the United States of America was the largest one and after that come Europe and China / Hong-Kong. The statistics is based on gadget exports so no services, intangible assets like IT software nor Resource & Development are included here. Also, IT licenses and other intellectual property are excluded. However, it is safe to say that Health technology as an industry is very high-tech because many companies are having R&D expenses more than 10% of their revenue. (Healthtech.teknologiateollisuus.fi. (n.d.))
We would like to focus in this thesis on robotics, big data and other IT-solutions with IPR features. Immaterial rights there are very important in today’s business environment and hence very important in the role of valuation. This will be discussed later on.

Damodaran, A. (2009) tells that startups are in a large sense important for innovative ideas and striving economy for better future, below there’s the figure of startup life cycle presented by him:
Although startups are little in size sense, they still have a positive impact on the economy as a whole (Damodaran, A. 2009):

1. Two thirds of new jobs created is because of small companies and startups account large part of this trend.
2. Startups tend to be very innovative in comparison to traditional bigger corporates that have a lot to lose if the experiment goes wrong.
3. In the USA and India, it has been evidenced that startups have created economic growth.

Because of lack of revenues and operating losses they make, they are in search of financing. Unfortunately, startups tend to lack own financing and running a company requires capital so they seek finances from private capital i.e. venture capital and private equity. This results into thoughts that standard valuation methods that need to measure cash flows, growth rates and other valuation factors are not working for startups. (Damodaran, A., 2009)

All in all, in this research we are striving to look for answers on how venture capital investors are valuing especially healthcare analytics startups. There are numerous other researchers like MacMillan (1987) and Tyeberjee & Bruno (1984) who have studied VC investment criteria and valuation methods brought by VCs. Our focus, however, lies in especially healthcare analytics startups and how VCs make investment decisions especially in this context. This special topic has not yet been covered although there are some researches regarding medical startups (close to healthcare) like Keppler, S.B. et al. (2015) that I am going to use as a reference and background knowledge.

1.1 Purpose and focus of this research

Lauriala (2004, 51-61) describes the investment process of a venture capital investor. There is usually feeling of a horror movie between the target companies and venture capital investors. Company value is not a simple task as it has been described earlier. Venture capital investor needs to get to know the company as best as possible to measure all the risks correctly and protect itself by contract negotiations that are described later. This is very important since it is difficult to cancel a contract of non-public company even though the company invested in was not fulfilling the expectations of a venture capital investor. Below in picture 2 (modified from Lauriala, 2004), we can see the investment process from
beginning to end starting from contacting. During the investment process, venture capital investor needs the get as wide and deep picture of the company’s state. Negative surprises like contract details of customers and IPR rights are things that might end the negotiations. (Lauriala, 2004)

As further research will show to us, there are many ways to view the process. Our focus in this research is to grasp the concept of valuation and especially valuation methods. There are, however, other stages briefly conceptualized in this thesis. Simic, M. (2015) points out that some researches like Zacharakis & Mayer (1998) view that there is no strict way how the VCs are doing their decision-making and hence even for VCs it is sometimes hard to justify their investments.

Because of lack of revenues and operating losses they make, startups are in search of financing. Unfortunately, startups tend to lack own financing and running a company requires capital so they seek finances from private capital i.e. venture capital and private equity. This results into thoughts that standard valuation methods that need to measure cash flows, growth rates and other valuation factors are not working for startups. (Damodaran, A., 2009)

We are further represented by Damodaran, A (2009) that startups have different life cycles and methods for valuing startups are different because they grow and factors that affect

![Figure 3 Investment process - modified from Lauriala (2004)]
valuation change. Lastly, it is important to view different valuation methods for healthcare analytics companies. We can assume that since it is a fairly new subject to study since there are not that many researches done for especially healthcare analytics startups and their business valuation.

The scope of research will look like this, as the research will go deep in healthcare analytics, venture capital and VC’s valuation methods:

![Figure 4 Research scope](image)

1.2 Research objectives and research questions

The objective of this study is to explore the different valuation methods used by venture capital investors. We must identify various stages of startups to see how different VC investment criteria and other valuation methods work at each stage. Startups are difficult to evaluate due to shortage of information available and lack of business model structure with sales and costs to do evaluation (Damodaran, A., 2009).

Therefore, it’s vital to explore different methods in literature review to find out the most suitable valuation methods. Because of its enormous potential as becoming the Finland’s fastest growing industry, we decided to explore Healthcare analytics startups. At the time of researching there should be continuous monitoring of similarities and also variations in research results.

The first is to identify through background what are the most important investment criteria used by Finnish venture capital investors for startups. Secondly, we must identify the key valuation methods for startups. After this we can continue to the actual literature review where we concentrate on the special criteria and valuation methods for healthcare startups.
At the interviews we must connect similarities and differences for information received from literature review.

The method of research is qualitative research done with interviews. The research questions are:

- What are the most important valuation methods for startups in the eyes of venture capital investors found in literature review?
- What are the most used valuation methods by Finnish venture capital investors when they value healthcare startups?

1.3 Research methods

The method I am using in this thesis is called qualitative research. Since I had some difficulties finding healthcare analytics startups valuation methods, I need to reflect the background research and especially VC activity in healthcare as my basis. First of all, we have different investment criteria and quantitative valuation methods from literature.

The literature found in literature review and background is wide consisting of many aspects of venture capital, startups and valuation methods. These parts are then connected to the research conducted.

I interviewed 8 VC investors from Finland who have some or close experience in healthcare analytics startups. Through the method of semi-structured interviews, I am finding out answers to my research questions. Since those who are been interviewed may have different understanding of some of the valuation methods or criteria, one needs to be extremely careful that they truly capture what is meant by the question.

As there was no prior research, according to my knowledge (based on different databases I searched at) about valuation methods on healthcare analytics startups, I base my knowledge and assumptions on the background information about startup-valuation discussed further on in chapter 3.

1.4 Structure of this thesis

The thesis is structured so that we have firstly the Introduction where I explain the purpose of this study, the structure and research method. This is followed by general background
about venture capital, healthcare analytics and startups and valuation methods. This is reviewed in section 2. The background section is extensive about the topics discussed. After this is section 3 we will be still focusing on general background but more detailed into venture capital investment process and valuation topics. After that, in chapter 4, I will go deeper into venture capital and valuation methods of VCs (literature review) concerning healthcare analytics startups. After that I will explain the research methods and go in detail about the qualitative research regarding the topic. At the end there is space left for conclusions and limits of the research and references I have used for this thesis.

Figure 5 Research process

2 General Background

In General background I am aiming to define some of the key concepts related to the thesis from startup to healthcare analytics and to venture capital. This chapter will give an overview about the topics that are important for this thesis until we specialize more into valuation.

2.1 Defining a startup company

Before we can do a valuation on a company we first must ask ourselves what is a startup and what are the characteristics of startups. Helsinki Chamber of Commerce (2015) discusses different definitions of startups. People from Twitter were asked about the matter two following definitions stood out: Start-up is an organization that is looking for concentrating (scaling) business model. For example, Uber is not a startup since the scaling business model has already put into action and it has worked. A regular barber shop is not
a startup unless it develops new shampoo. Fresh commercialized business that seeks to be defined as a startup.

In summary, definition focus is on scaling the business. Most importantly, startups tend to focus on solving a problem and try to make money out of the innovation (Helsinki Chamber of Commerce, 2015). Startup can also be thought as a phase of something for example in company’s path to go public. There is no specific measurement in terms of revenue of when a startup is not startup anymore. But with lack of better measurement, when a startup has its place in the world and can be seen as continuous business it can no longer be seen as startup. (Helsinki Chamber of Commerce, 2015)

Damodaran, A., (2009) characterizes startups as young companies with very little history behind them. Therefore, measuring objectively value of the business is hard. Secondly, due to short time-span, startups have usually generated very low revenues and usually costs are related to pay the business founding instead to putting them to increase revenues. Thirdly, startups are usually highly dependent on private sources rather than public. Firstly, persons like family members and friends are important in asking for money for business. After that venture capital comes along when the business is stable and revenues are to grow. Venture capital will be part of the ownership of the business by owning shares. (Damodaran, 2009)

Other characters of startups are multiple equity claims. Different investors make different contracts with the companies because these investors want to be safe in case of share dilution, or that they will get their investment back first in case of liquidation. Investments are illiquid because Investments are non-public and in many cases, differ in sizes. (Damodaran, 2009)

Damodaran’s, A (2009) view is backed up by Goldman (2008). A notable example of a growth opportunity is if a fast food chain like McDonalds would like to test a franchise store in a new market, and this fits into startup scene. But since we already have knowledge about the business and markets it’s easier to valuate. However, startups in general are as described by other authors: “no history, an unfathomable market, untested products, unknown cost structures, unknown implementation timing, unknown market acceptance, untested market channels, unknown competition, unsophisticated management, and unrealistic expectations.” (Goldman, 2008)
Naturally, these characters might be tempting for entrepreneurs themselves but can be very difficult for valuator to do valuation. In eyes if a valuator, the most key features to understand are the market size, how well does the company compete against others in the market to get a market share, costs of R&D and the technology itself behind the service/product (Goldman, 2008)

Because of lack of revenues and operating losses they make, startups tend to lack own financing and running a company requires capital so they seek finances from private capital i.e. venture capital and private equity. (Damodaran, 2009)

2.2 Healthcare analytics

European Union (2016) emphasizes the technology and digitalization of health. According to that research (European Union, 2016) the growing business employs over 10 0000 people and 300 companies around it. In 2015 Finland’s export of health technology was over 1,9 billion euros that is the largest piece of export in high technology sector. Finnish Government has decided to support healthcare technology in its agenda. Healthcare technology has two drivers: We live longer and Digitalization. Even though we are expected to live longer, this does not mean healthier life when we are old. In the whole EU over half a million people die because of chronic diseases and this results in costs on 115 billion euros. This indicates that there have to come changes. Healthcare systems must have better efficiency in order to save lives by investing more into people’s health and preventing diseases. Healthcare systems should be at hands easier including less expensive systems, waiting times and reachability must be better in the future. Healthcare systems must be more flexible in terms of expectancy of dealing with issues like aging, chronic diseases and budgeting. This calls for re-organizing by development of eHealth, mobile solutions and digitalism in healthcare.

Finnish exports to healthcare technology grew up to 2,2 billion euros in 2017. The purpose of healthcare technology is shared with EU (2016) article. Especially Koivikko, K (2018) emphasizes that bigger companies work as drivers and use startups as suppliers in innovations, especially opening doors to sales and marketing function is important for startups. Venture capital is especially needed when the business goes global scale. Entrepreneur and the management team must be aware of the risks and forecasts need to
be realistic to be competitive for the funding process. Also, market knowledge is crucial. These factors are the most usual problem fields with startups. (Koivikko 2018)

Thanks to internet, people can view and ask for help in health issues and it does not restrict on one spot or time of the day. Yet you can test your blood sugar for example and analyze the results but today patients want to observe and control their own health for example through a mobile app. This transition can be viewed as “from providers to patients”. Now more interestingly, people are having more and more connection to their health records and options whether they want to share that information to anyone. (The Economist, 2018)

In their research Wang et al. (2018) found five capabilities of analytics in healthcare. We will list them and discuss more about them in table below:

<table>
<thead>
<tr>
<th>Capability</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical capability for patterns of care</td>
<td>It helps to process a large amount of data that can be different in dimensions like style or variety and velocity. Patterns are found in EHRs through different links as a show of evidence. These tools are helpful in analyzing patient data volume vise and visualize it. This will serve again as a tool of better efficiency in health care organizations. Additionally, this will help organizations to take part in different experiments and market research for new ventures.</td>
</tr>
<tr>
<td>Unstructured data analytical capability</td>
<td>Organizations gather data in and out of health care sector. This data is put into for example NoSQL databases. Then filters are used by defined criteria. Finally, you analyze the results. Unstructured data is not simple to store by orthodox ways so improving storage systems for unstructured data is very important. This ability is crucial since almost 80% of data gathered in health care sectors are unstructured. The applications could be better marketing, customer segmentation and analyzing revenue. One hospital found 30 cases through unstructured file analysis that are to be improved in the future.</td>
</tr>
<tr>
<td>Decision support capability</td>
<td>This capability has the purpose of presenting day-to-day reports to support managers in their work. Decision support contains among others comparing times series and past summary. The usage is by greatest in gathering evidence for better medication i.e. better patient service. Dashboards are used widely to visualize the analysis.</td>
</tr>
<tr>
<td>Predictive capability</td>
<td>Machine learning are neural networks among others are the tools to connect historical and today’s data to predict future better. This way has diminished uncertainty when managers are planning resources of health care organizations for example. Texas Health Harris Methodist Hospital Alliance has taken predictivity to follow patients movements in elderly. Additionally, predictivity helps to identify and seek solutions for better financial and efficiency management for patient care. Also, this has helped in analyzing patients’ dietary, how he/she lives and disease control.</td>
</tr>
<tr>
<td>Traceability</td>
<td>Health care data are gathered real (or near) from health care service providers and in order to locate the output data one should use big data analytics tools. This is definitely needed as data masses are so large nowadays. One of the tools is Telehealth response watch that can identify the place and patients’ live health data etc. This information is stored at NoSQL and Hadoop databases. In the same way works also data through RFID to tackle future actions better.</td>
</tr>
</tbody>
</table>

Table 1 Five capabilities of analytics in healthcare sector, Source: modified from Wang et al. (2018)
Raghupathi & Raghupathi (2014) supports Wang et al. (2018) in seeing similar and additional advantaged analytics could provide (Raghupathi & Raghupathi 2014):

- Giving to patient the information they need to follow up their health and make decisions based on the information
- Search and find treatments and processes that bring value and are cost-effective
- Research events and risk factors that could lead to negative outcomes and how to treat them in the best manner
- Utilize the usage and information from health monitors at home
- Identify risks to be treated in case of sudden disaster.

When we are thinking of concrete usage place for healthcare analytics, Belle et al. (2015) summarizes various groups of usage of big data analytics especially in Healthcare industry: One is image processing where X-ray and MRI (magnetic resonance imaging) and ultrasound are perhaps among some other best known for acknowledged images in medicine. They are used to identify for diagnosis and treatment and its planning. (Belle et al. 2015)

Second one is signal processing. It can be described as monitor devices are attached to people and these devices gather enormous amount of data from patients. Amount of data is not the only concern in this field but also that signal processing needs to be more connected into actual state and situation of the patient. This would help in predictive medicine. The trend of today is that healthcare programs tend to apply only one source of data in predicting emergency-needed cases but the author argues that there should be more R&D in multidimensional time series. (Belle et al. 2015)

Edwards, J (2016) writes that Stanford university has figured out a way (MOZART) of applying signal processing in finding tumors in different layers of your body for example blood and skin. It can detect variety of diseases and several types of each illness. It tackles a key issue that is separating healthy cells from bad ones. (Edwards, 2016)

Third one is genomics that can be translated as medical research based on each patient’s genes has been under a great reform in the field of healthcare analytics. P4 (predictive, preventive participatory and personalized) initiative is on its way to help to analyze various
stages of illness, blood analytics, come up with issues in big data masses and programming personalized profile from all the data. (Belle et al. 2015)

However, Mehta and Pandit (2018) identified and summarized in the table 2 below they several cases and purposes of health care analytics in the history.

<table>
<thead>
<tr>
<th>Application Area</th>
<th>Studies By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genomics</td>
<td>Maia et.al. [70]</td>
</tr>
<tr>
<td>Drug Discovery &amp; Clinical Research</td>
<td>Szlezak et al. [15]; Taglang &amp; Jackson [46]; Wong et al. [72]</td>
</tr>
<tr>
<td>Personalized Healthcare</td>
<td>Viceconti et al. [73]</td>
</tr>
<tr>
<td>Precision Medicine</td>
<td>Leff &amp; Yang [9]; Weng &amp; Kahn [35]; Huang et al. [43]</td>
</tr>
<tr>
<td>Elderly Care</td>
<td>Jiang et al. [74]</td>
</tr>
<tr>
<td>Mental Health</td>
<td>Geerts et al. [75]</td>
</tr>
<tr>
<td>Cardiovascular Disease</td>
<td>Asante-Korang &amp; Jacobs [3]; Rumsfeld et al. [11]; Mandawat et al. [76];</td>
</tr>
<tr>
<td></td>
<td>Kim [77]</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Bellazi et al. [68]; Kumar Sarvana [48]</td>
</tr>
<tr>
<td>Gynecology</td>
<td>Erecson &amp; Iglesia [78]</td>
</tr>
<tr>
<td>Nephrology</td>
<td>Nandkarni et al. [79]</td>
</tr>
<tr>
<td>Oncology</td>
<td>Mandawat et al. [76]; Maia et al. [70]; Naqa [80]</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>Clark et al. [49]</td>
</tr>
<tr>
<td>Urology</td>
<td>Chani et al. [36]</td>
</tr>
</tbody>
</table>

Table 2 Big data applications in Healthcare, Source: modified from Mehta and Pandit (2018)

2.2.1 Examples of Finnish healthcare analytics companies

Blueprint Genetics Oy is a company focusing on genetics testing and data-analytics related to that. Genetics testing is based on NGS technology. The basic idea is that Blueprint Genetics is receiving DNA-samples and thereafter clarification if the person has genetic diseases. (Blueprint Genetics, 2018)

In the publication revealed by Blue Print Genetics in 2017 they announced a 14-million-euro funding round and previously a new venture funds have joined in. By the 2017 Blueprint Genetics has raised 23-million-euros. With the new funding the company is willing to enter new markets and strengthen their R&D. (Blueprint Genetics, 2017)

Kaiku Health Oy is a Finnish healthcare technology company that has developed a software application. This platform enables to follow patients and measures the most important things
among others about efficiency of treatments and communication between patients and healthcare organization. The current market place spread is in Europe in 40 different hospitals and clinics. (Kaiku Health accessed 22.9.2018)

Kaiku Health was found in 2012 and today the focus is, in addition to patient monitoring, also on preventive healthcare. In publication 8.4.2018 announced that Kaiku Health raised 4,4 million Series A funding and international venture capital investors participated. (Pääomasijoittajat, 2018a)

Digital patient monitoring can lead to better quality of life and at the same time save healthcare costs. Kaiku Health had 64 000 users in Europe in March 2018. The company has also been the driver of setting up projects at university hospitals in Finland where the Kaiku Health platform is used to determine its effectiveness to different segments of patients. (Pääomasijoittajat, 2018a)

2.3 The venture capital business

The history of venture capital can be related nearly 600 years ago when queen of Spain financed the exploration (venture) of Kristoffer Columbus to America. This is clearly one of the first remarks of possible high risks idea financing coming from outside source, in the case the queen. (Lauriala 2004, 21)

In the upwards and recessions of markets investing becomes a topic of discussion. Tulip mania in the 16th century, 1920s credit bubble, 1970s oil crisis and 1990s dotcom mania are to say only a bunch of those times. However, today’s theme has been startups and breakthrough of small technological companies in many sectors. Even if the first Slush event was organized almost 10 years ago, the author still believes that rising of startups is till at its baby steps. Upwards and downwards have offered both wins and losses, some of them lasted long and some shorter time. (Parviainen 2017, 9)

There are four drivers (Parviainen, 2017, 10-11) of why startups and investing into them have risen: First one is digitalization. There has been significant amount of changes in business processes nowadays. Removing the “middle man” has been a trend in for example finance and travelling businesses. Also, digitalization has made it possible to replace
physical products for example in advertising and saving a document. Second one is that world is becoming smaller: Innovations are easier to copy today, which leads to more efficient competition and development. Thirdly is the easiness of founding a business whether the business is about accounting, marketing or administration the cost of business is smaller than what it used to be. Final one is respecting entrepreneurship and entrepreneurs: This has been a trend largely among young people while in the past (event 20 years ago) entrepreneurship was identified as a sign of failure. When there are successful startups, they become influencer and hence have a positive impact about entrepreneurship on people. Also, earlier salary was determining success, however nowadays corporate culture and success by own are thought to be more important. (Parviainen, 2017, 10-11)

Investors are trying to predict megatrends and best investments; most investors are following successes. As startups have become famous worldwide, investors have woken up. First time, investors themselves and small bunch of angel investors enjoyed high profits. At the second stage (we are there now) are been enjoyed also by many other angel investors. In the future, author predicts to see that all people in different nations are seeing startup-hype and make their move to act. 10 years ago, it was harder for private person to invest into growth companies. This is true even if venture investing (equity investing into early stage companies) came to Finland in the middle of 1990s. At that time most of the investments came from family and friends. No systematic angel investment network was at sight. (Parviainen, 2017, 11)

Pääomasijoittajat (2018b) defines venture capital as professional investing for equity stake at a company. Normally, startups and growth companies are at venture capital investors’ hands. Among other than capital, VC offers the company know-how and contacts so that the company can drive to success. VC’s most important task is to increase the value of the company. (Pääomasijoittajat, 2018b)

In the United States of America story of VC (Gompers & Lerner 2001) started by setting up American Research & Development in 1946 in short ARD. The goal was to invest into high-risk projects in promising companies that had the background of developed technology dating back to world war 2. After ARD was found, only some new VC funds were established but VC business did still not start. (Gompers & Lerner 2001)
In 1957 ARD invested into Digital Equipment Corporation and with under 70 000 dollars investment it got 77% of all company shares. After that DEC became successful and ARD realized 5000% increase in value, this became as an example of how VC can turn starting businesses into flourishing state. (Lainema 2011, p 51) This changed at end 1970s and beginning of 1980s when Small Business Investment Companies (SBICs) system fell due to too much control. (Gompers and Lerner, 2001)

When year 2016 ended there were 898 venture firms with 1562 funds together with 333-billion-dollar asset management. (NVCA, 2017) So there is quite a significant growth in the number of members in NVCA throughout its history.

There are over 60 members at Finnish Venture Capital Association. (Pääomasijoittajat, 2018c) Finnish VC funds raised in 2017 169-milion-euros to be invested which is 35% more than in 2016. They invested 80-million-euros (-30% in comparison to 2016). Sadly, only 118 Finnish startup companies (28% less than in 2016) from Finnish or foreign VC fund. Looking at the stages VC funds are investing, the period of “Starting” (between seed and early growth stages) has increased. From Finnish VC funds, 2016-2017 30% of invested capital went to foreign startups. (Pääomasijoittajat, 2018d)

Gladly 62% of all IPOs happened in Finland in 2017 had a VC firm backing them up, this shows how important VCs are on the road of starting up the business until IPO. Between 2015-2017 over 2 billion euros were invested into Finnish startups and half of it came from buyout funds from abroad. This shows how important VCs are on the road of companies’ way to being public limited companies. (Pääomasijoittajat, 2018e)

Suomen pääomasijoitusyhdistys (FVCA) et al (2017) tells about VCs in Finland that especially in 21st century it has developed to be an important part of financing Finnish companies. VC investments fulfill bank and stock exchange as provider of finance. Furthermore, private VC investors tend to take active role in developing the target company. (FVCA et al., 2017)

2.3.1 VC Funds and their structure

VC investors invest through funds that are financed by collecting money from investors that are usually pension and insurance companies. VC funds are usually temporary and their
investment targets are non-public companies with good prospects for growth. These investors are not target company’s owner forever but are determined to walk away typically after 3-7 years after investment. (FVCA et al., 2017 and Lauriala, 2004, 35)

VC funds according to Lauriala (2004, 34) are funded 99% of investors who are limited partners, which means that they only are responsible for their equity stake. These limited partners typically get 75-85% of profit realized from investment plus their investment stake. The others get 15-25% of the profits plus yearly administration bonus that is 1,5-2,5% out of the all capital in the fund. (Lauriala, 2004)

VC firms do not have many employees according to Gompers et al. (2016) survey, since there are on average 14 people working at the fund, and 5 of them have a title senior partner. (Gompers et al. 2016, p 32)

NVCA (2017) Yearbook goes, however, deeper into the fund structure. Example of Limited partners are public pension fuds and insurance companies. For each fund a separated partnership is created. One investment for a target startup, leads to reserve of 3 or 4 times the amount of first investment. Again, 3-8 years is the time of investment.

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**Figure 6 VC Fund structure, Source: modified from NVCA (2017)**
At time exit comes and this is mostly done by Initial Public Offering (IPO) or M&A-deal. Next the fund can redistribute the profits from deal to investors and set up a new fund for future ventures. When comparing IPOs and acquisitions, IPOs overcome the alternative since it is believed to be better for the economy in three ways: more employment, higher returns and greater capital raised. (NVCA, 2017) Grakow, J. (2018) from Ernst & Young agrees that even though IPOs may be a harder route due to regulations and greater costs among others but points out that when trying to maximize shareholder wealth companies like Facebook comes into mind at raising the shareholder value in multiples. Gompers et al. (2016) report that exits happen a bit over half in the cases through M&A, 15% via IPOs and almost one-third are considered to be failed exits.

These funds are by structure and nature very different by nature. Venture capital funds invest as minority investors for early development stage companies. So-called buyout funds tend to be more active in M&A (mergers and acquisition) deals. In the latter case the target companies tend to be already cash flow positive and stable companies. (FVCA et al, 2017)

In this research I am more interested into actual venture capital funds and not buyout fund-related matters although one of the interviewee is more involved in the private equity side.

2.3.2 Why are VCs different to other investors?

![Private Risk Investors - Map](Image)

*Figure 7 Private risk investors map of motives. Source: modified from Lainema (2011)*
As seen from a picture of Lainema (2011, 52-53) there are differences in risk investors, they are investors at the beginning of the business, and especially in their motives towards the companies. FFF do not participate actively into ordinary business neither they have high targets in earnings. Private risk investors are divide into two clearly seen groups: business angels / life style investor and professional investors. Between these two groups although some differences are to be seen all are very attached to the entrepreneur they have invested into. Lifestyle investors make their financing decisions very intuitively. Because professional investors live on their earnings their earnings targets are stricter than non-professionals’. All private risk investors want to work in the Board of the company and often the first gathering of the Board is done when the first risk investor comes in. (Lainema, 2011)

VCs do not invest unless they are seeing an opportunity of earning 10 times more than they invested in. Very quickly their targets move to exiting as soon as possible, which is not always in the interest of an entrepreneur. Despite of all this, they bring contacts and business expertise. If they are not happy with the results how the company is doing, they might ask for CEO change, but on the other hand with their knowledge they can represent a more credible image of the company and can attract new employees easier than the entrepreneur. (Lainema, 2011)

Lauriala (2004, 19-20) explains that in Finnish language and culture venture capital or private equity do not include buyouts where the expected return is lower since the companies (investment targets) are already positive in cash flow and have proven their business concept. Venture capital markets target only companies just to begin their business. (Lauriala 2004, 19-20) Therefore in this thesis we are not including buyout markets.

Lauriala (2004, 18) sees that VC investments into high-tech companies have been underlined since 1990s. VCs have encouraged entrepreneurs to start businesses and thus created jobs and increase exports. During economic downturns VCs are more passive but there are already structures through which general economic activity VC investors increase their activity.
Venture capital is a form of active ownership. As spoken before these have the goal of raising company's value by strategy, financing arrangements and active board membership and marketing. These funds have additionally many experts in them for example in marketing, budgeting and management. Investment's value is determined at the time when fund is selling its stake away usually to an industrial company or by IPO (initial public offering). (PwC, 2006 and FVCA et al., 2017)

Advantages of equity investments and how they differ themselves from other investments (PwC, 2006), which are also presented in a table below.

<table>
<thead>
<tr>
<th>Private Equity Investment</th>
<th>Bank Loans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle long</td>
<td>Short or long</td>
</tr>
<tr>
<td>Investor is involved until possible exit</td>
<td>Not that involved especially if paying the loan back is problematic</td>
</tr>
<tr>
<td>Trustworthy and flexible finance base that reflects to target company's growth plans</td>
<td>Practical financing way if the company has moderate level of debt and the company's cash flow is positive enough.</td>
</tr>
<tr>
<td>Good for cashflow since equity return, dividends and possible interests are subject of negotiation based on company's payback ability.</td>
<td>Enough and regular cashflow is needed to pay interest and loan back</td>
</tr>
<tr>
<td>PE investor's income is dependent on company's growth and success.</td>
<td>Bank’s income is depended on interest level and the development of value of the asset that is as security.</td>
</tr>
<tr>
<td>If company fails PE investor are after banks, tax authority next in the list of getting their investments “back”</td>
<td>Banks are first to get their money back if the company is liquidated.</td>
</tr>
<tr>
<td>If the company is in bad shape, PE investor tries to do everything to get it back on track.</td>
<td>If company’s ability to pay back its loans lacks, can bank set debt collection and bankruptcy is another method.</td>
</tr>
</tbody>
</table>

Table 3 Advantages of equity investments, Source: modified from PwC (2006)

and at that time the value of investments is to be expected to raise hugely. VC funds are to be found for 10-13 years' time: first five years goes by identifying the investment targets and finally doing the investment decision. After this next couple of years will be spent by monitoring the value growth and the company's business. After that 3-7 year most of the investments are sold or realized and the profit is shared by investors of the VC fund.

2.3.3 Venture Capital – Finnish story

Many startups tend to fail in their attempt to establish a successful company (Knaup and Piazza, 2007). This has been noticed in Finland where Lappalainen, E. (2018) started to follow from 2012 startups in their path to become unicorns. In six years there has been 604 financing rounds for as many as 425 companies. The total amount of venture capital accounts about 1 billion euros during these 6 years. One company example is MariaDB that has raised 60 million euros during its years of existence but compared to its competitor (not Finnish) Mongo DB raised over 300 million euros before listing. Out of the 20 biggest stakes of raised capital, all made huge losses in 2016 due to large investments in R&D and market entry internationally. Big investments – big responsibilities: This is how it can be characterized when large capital investments come, revenue growth and profit margin must go hand in hand. “Investors want to see growth; the results of early years are for them indifferent.” This is a translated quote from Mr. Petri Järvilehto from game studio Seriously. He says also that marketing and R&D expenses are increasing in gaming industry and for example Rovio spent about 300 million euros on marketing whereas most gaming companies spend 20-30 million. In case of Seriously, in 2016 company spent 80% of its revenue to marketing. (Lappalainen, E., 2018)

Lappalainen, E. (2018) tells about Mendor that claimed itself bankrupt in 2017. Mendor was a health technology company that invented a diabetes measuring gadget capable of running the entire process and follow the results and development in a phone application. The story is vital for both VCs and entrepreneurs. In short there were too many owners and variety of shares that it got too complicated to refinance the whole company. Finnish startups tend to raise capital with small finance rounds about every second year. When they have raised capital, it all goes to paying the debt that has accumulated over the past few years. This does not sound smart at all when in Silicon Valley the amounts raised are 20-30 million euros for 5 years. Therefore, in Finland there should be better planning regarding the financing process and how to use the funding in the startup. (Lappalainen, E. 2018, 28-31)
Sorvisto, P. (2016) in claims that the funding amounts (for example in R&D mentioned by Lappalainen, E. (2018)) are just not enough in Finland. The risk-taking attitude is much lower in Finland than competitors’ like the USA. Therefore, it is necessary to seek funding outside from Finland. Another thing is that companies should first of all understand needs and investment criteria. Companies should see VCs as customers and like supermarkets have their customers whose needs need to be solved and traced. The difficult part is that VCs are not some kind of homogenous group with similar investment criteria, investment focus area or business model. The entrepreneur him or herself should be more active in gaining market understanding and different trends in addition to investment criteria to communicate better and foremost sell the opportunity to invest in a more attractive manner. Marketing and R&D require a lot of external capital and the company should work in long-term and systematically. As mentioned, there is not enough capital in Finnish VC market, government could step in to provide support to get Finnish knowledge in healthcare technology and other fields into the markets. (Sorvisto, P. 2016)

2.3.4 Venture Capital – Startup lifecycle

In the picture below from NVCA Yearbook (2017) we can see that Venture capital comes along at development stage of venture capital. They connect companies in their portfolio to customers and give strategic guidance. Target companies at the beginning of investments need typically 5-8 years to mature. (NVCA, 2017)

![Venture Capital plays a vital role in a startup’s growth](image)
At the beginning (pre-seed) the company starts from zero and there turnover and costs are low. Of course, costs are growing faster than turnover itself and therefore company’s cashflow is negative at the beginning. This is called Death-Valley (kuolemanlaakso in Finnish). Company’s mission is to get more funding or cut costs to have more time to change the cash flow into positive. Third option naturally is to focus on increasing turnover without thinking of costs and hope that the investors give funding. (Parviainen, 2017, 21 and Etula, 2015)

At beginning (startup / survival) angel investment is usually used for product development and R&D or working capital (Etula 2015).

At Seed stage funding rounds fluctuate from tens of thousands to coup of hundred thousand euros. Here company normally does not have any turnover yet and the product/service is under development, sometimes the idea is on the way. Financing is usually made by employers themselves or contact network 3Fs (family, friends...) and angel investors. Additionally, there are some seed capital funds. Also, Tekes and ELY as state institutions are funding these projects again equity. (Parviainen, 2017, 21-22)

First professional rounds are called pre-A or A round. At this stage the company already has the product, service and proof of concept. Company must have strong evidence about competitive advantage and scalable product associated with technological innovation, and business model. They have some revenue and proof of its growth; net income may still be negative and the company is targeting additional investments and for that it needs funding. After A come B, C and D round where company’s growth is already more stable and profitability grows. The value of the company goes higher. Company’s R&D however requires funding that its own earnings cannot finance those. The biggest number of companies lay still at seed stage and these companies are becoming more and more uncompetitive and therefore week cases end quickly. A moto here is: The earlier stage the more supply for different investment targets there are for investors. (Parviainen, 2017)

Etula (2015) and Parviainen (2017) emphasizes that at later growth stage (early and later growth state is venture capital state. Sometimes company moves from just competing at home markets to foreign markets where revenue grows and exceeds costs. At expansion phase company tries to expand to new markets and company’s turnover is substantial. Although there are several types of investors at various stages, there are some common
factors among them. The most crucial factor is to do syndicates which means two or more investors’ common investment and the group is represented by one person. (Etula, 2015 and Parviainen 2017, 21-24)

These syndicates are preferred because (Etula, 2015):

- Better risk management and more diversified portfolio at the same investment amount
- It is a way to go into bigger investments
- In Finland it is common that business angels and venture capital investors are doing cross syndicates.

Syndication is very important for VCs because it is motivated by several factors. On the other hand, small VCs have very limited funds and hence not being perhaps able to diversify. Larger VCs, however, are motivated by the need for larger deal-flow strategy. It was found out that location or specialization of VCs have no significant effect on motive for syndication. (Manigart, S. et al., 2006)

Gompers et al. (2016) see that syndicates as collaboration widens the range of expertise in the investment team and many VCs tend to make quite specific selection process for finding the most suitable partners.

2.3.5 Venture capital – return and risk

VC investor’s expected return levels are higher in non-listed companies in comparison to regular industrial companies or just listed companies in general (Lauriala, 2004, 67 and Parviainen 2017, 41). High expected return correlates negatively with pre-money value. Pre-money value is the value of share capital before investor invests, and post-money value is the value of share capital after VC investor has invested. For example, if target company’s pre- money value is 10 million euros, VC investor invests 10 million euros, VC investor now has 50% of all the shares. Post money value is now 20 million euros. The higher the expected return, the lower the pre-value of the share capital in the company. VC investor has a great incent of negotiating the pre-money value as low as possible to maximize its investment value and return. However, VC investor must take into consideration the founders in the sense that if they have too small stake of the company their risk-taking
willingness is much smaller. Vice versa, founders are trying to negotiate maximize the pre-money value. (Laurila 2004, 66-67)

Higher risk comes with higher return. VCs invest into highly uncertain companies and industries so they are willing to earn a higher return on their investment i.e. ROI (Zider, B. 1998 and Parviainen 2017, 41)

High expected return is based on a few arguments (Parviainen, 2017, 67-68).
- High risk
- The lack of liquidity
- Added value

High risk is compensated through high discount rate with which the cashflow to the investor is discounted. When the target company grows, its risk for failure becomes smaller, and so does the discount rate. (Parviainen, 2017, p 67)

<table>
<thead>
<tr>
<th>Startup stage</th>
<th>Discount rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed stage</td>
<td>Over 80%</td>
</tr>
<tr>
<td>Startup stage</td>
<td>50-70%</td>
</tr>
<tr>
<td>Extension stage</td>
<td>40-60%</td>
</tr>
</tbody>
</table>

Table 4 Discount rates of VCs by startup stage, Source: modified from Parviainen (2017)

Moral hazard and adverse selection are the reasons why investors make choices – whether it is that they invest too much or too little. VCs are better at analyzing young companies than regular investors because regular investors hardly have the expertise over VCs. This shows particularly when exit time occurs. Because of uncertainty in early stage young companies, VCs are more and more focused on after seed – stage companies. (Amit et al. 1998)

Liquidity is a way of turning shares into cash in a time frame. With startups because they are not public limited companies their shares are hard to sell or make any other transactions and therefore the liquidity is very low in these investments. These are reasons why the buyer of the startup company shares does not need to pay the full price for the shares. (Parviainen, 2017, p 67)
VC brings to the company a large amount of added value with connections to suppliers and other experience from venture business. (Parviainen, 2017, p 67)

Damodaran (2009, 9) and Lauriala (2004, 67) explain that as young companies (startups included) are not publicly traded and hence have no public traded bonds outstanding. Therefore, it is impossible for us to use regression on past returns, get equity beta nor market interest rate on debt. Equity in startups is normally invested by investors who have 100% (usually founders) invested into that company or partially diversified (venture capitalists). This means that it is probably difficult for investors to accept that the “only risk” i.e. non-systematic risk cannot be diversified away and hence demand risk premium to cover this specific risk. (Damodaran, 2009 and Lauriala, 2004, 67)

This means that WACC (weighted average cost of capital) does not work as a measurement of risk for VC investors. WACC comes from adding cost of equity to cost of debt.

Nordnet (2014) explains that the return measured at VC funds is done by IRR a.k.a internal rate of return because VC investor is not a long-time partner so therefore effective return is used to measure the how well the fund is returning. Tesi (2018) says that in comparison to 2002-2008 and 2009-2015 venture capital funds in Finland investing into technology startups the difference is positive as after the financial crisis VC funds have managed to bring a return 11% based on IRR method. Positive sign is also that write-offs of investments have decreased in time frame 2012-2017 from 40% to 20%. (Tesi, 2018)

Hege, U et al (2003) says that measured by IRR, American VC funds’ returns better than European VC funds’ and this might be due to the reason of better adjustments of good and bad investments.

Gottschlag et al. (2004, 8-9) sees however three points why IRR fails as a measurement of VC fund performance:

1. IRR assumes that before reinvesting possible liquidation of investment firstly capital distribution comes.
2. IRR can be manipulated by reporting investments’ residual values and the time when cash flow happened.
3. Inflows and outflows of fund are seen as the same risk which is not true.
3 What we know about start-up valuation

In the next chapter we will start digging deeper into valuation of startups and introduce a large sample of different valuation methods. Firstly, we will cover up investment processes of VCs and after that raise few points regarding issues of startup valuation. Finally, I am introducing investment criteria and quantitative valuation methods.

3.1 Startup value as a process

Silva (2004) has collected different VC investment processes (picture below) other researches have illustrated in their research. Firstly, is deal origination followed by screening, third evaluation and finally deal structuring. Different researchers see the investment process a bit differently than Lauriala (2004) but basically, they have the same features. VCs begin by getting to know with the companies / investment targets and start screening them by keeping in the most promising ones. Large differences can be seen in the screening phases since three researches divide the screening phase usually into two phases. After this, the evaluation begins and there are the largest differences as some researchers have different meetings and evaluations like due diligence process included. (Silva, 2004)

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<tbody>
<tr>
<td>Search for investment</td>
<td>Deal origination</td>
<td>Generating a deal flow</td>
<td>Deal origination</td>
<td>Generating a deal flow</td>
<td>Origination</td>
</tr>
<tr>
<td>Screening of proposals</td>
<td>Screening</td>
<td>Proposal screening</td>
<td>Firm-specific screen</td>
<td>Initial screening</td>
<td>Generic screen</td>
</tr>
<tr>
<td>Evaluation of proposal</td>
<td>Evaluation</td>
<td>Project Evaluation</td>
<td>First phase evaluation</td>
<td>Second meeting</td>
<td>First phase evaluation</td>
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<td>Board presentation</td>
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<td>Due Diligence</td>
<td>Second phase evaluation</td>
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<td>Second phase evaluation</td>
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<tr>
<td>Deal structuring</td>
<td>Deal structuring</td>
<td>Closing</td>
<td>Deal structuring</td>
<td>Closing</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 VC investment processes, Source: modified from Silva (2004)

At the first stage according to Tyebjee & Bruno (1984) VCs face numerous companies and they tend to choose the best candidates usually in the same fields they are experts in. By
using different filters, they decrease number of proposals again. (Tyebjee and Bruno, 1984) Fried & Hisrich (1994) see that by most of the many investment proposals come by referral, only a few comes if an entrepreneur just calls. This can be viewed like networking with referrers. After that there are firm-specific screening and generic screening and after that most of the investment proposals are rejected. At the firm specific screening business plan is reviewed but not on a specific matter but most importantly (among others) firm firm’s funding stage and size of financing need are under monitoring. (Fried and Hisrich, 1994)

Bliss, R.T (1999) discusses the investment processes and especially in those countries that are shifting towards free economy. In this case Poland was the studied country. (Bliss 1999) But I think personally that this theory could be adapted into today’s emerging markets like BRIC countries, different countries in Asia and Ukraine for example. Bliss, R.T (1999) provides an updated version of Fried & Hisrich (1994) investment process, and the main differences are privatization of companies and misunderstanding of VC business.

In evaluation stage VCs are forced to value the companies based on subjective measures due to lack of history of startups. Even though it is important to value risk and return, only seldom VCs use mathematical models for example to calculate discount rate. (Tyebjee and Bruno, 1984) Fried & Hisrich (1994) opens that in the first evaluation stage is about testing the founders and executives their stress limit and get to know them better in person and knowledge wise. Also, sometimes contacting suppliers and other connections of the company to ensure the VC about the reliability towards the entrepreneur. After that is the second stage that takes longer time because there is the question about any reasons that can cancel the deal. (Fried and Hisrich 1994)

In their book Kallunki and Niemelä (2007, 23-32) are dividing the valuation of a company into three main stages and they are: Strategic analysis, analysis of financial statement and analysis of future development. Let us summarize the meanings of these three stages.

In strategic analysis the main goal is to catch factors that are affecting the success of the company. This process is divided further into two parts: inner and outsider analysis, where inner analysis focuses largely for example on the functionality of the business plan, competitiveness of products and services, pricing and team. It is safe to clear that in startups where the business idea has not yet properly been tested in the market, valuation is harder i.e. the spread of different valuation results grows. When it comes to external analysis, it
reflects, on the other hand, on the non-company based factors that have effect on company valuation like competitors and business markets. (Kallunki and Niemelä 2007, 24-30)

In financial statement analysis it is important in the context of startups and growth companies to correct the balance sheet and income statement so that it will reflect the formation what listed (i.e. publicly traded) companies’ financial statements would look like. This process will then show more reliability, financial state and comparability to other companies. (Kallunki and Niemelä 2007, 24-30)

Finally, analysis of future development contains the analysis of what the company itself has predicted and if its forecasts are trustworthy in sense of comparing previous years financial statements and what and how the current market trends for this specific business field predict. (Kallunki and Niemelä 2007, 24-30)

Tyebjee and Bruno (1984) review the closing stage by stating that there are the discussion topics following: price of the deal, the equity share and protective covenants in order the VC to step in to board of the company among other consequences. Covenants are also useful in restricting dilution of shares affecting to the value of VCs equity share. The exit usually happens through IPO or M&A deals. (Tyebjee and Bruno, 1984)

Lauriala (2004, 199-214) explain that VCs have different options to do exit from investment. They are Trade Sale, IPO and Share Buy Back and bankruptcy. 5-10 years from initial investment exit usually occurs and during those years VCs change company structures so that the value will hopefully increase in future. All the value-added elements should be recognized and valued. Initial Public Offering (IPO) is claimed to raise the value of the company higher than other exit options. There the company keeps the independency and possibility to access different markets. Trade sale means selling the company to third party. (Lauriala, 2004)

3.1.1 General difficulties of valuation of startups

What is so difficult about valuing a startup? Damodaran (n.d b) describes that usually valuation comes from three sources. Firstly, there are the financial statements telling story about profitability, its investment intensity for future growth possibilities and other factors. Secondly is the history of the company all its earnings and market prices in order to research how well the company had done and most importantly its business cycle. Thirdly one can
look at company’s competitors. Startups, however, differ a lot from “ordinary companies” and therefore their valuation may cause problems. (Damodaran, n.d b)

Damodaran (n.d a) explains that globally markets have seen the change of traditional business areas from production to service. Throughout the years it has become clear that even large companies are no longer value based on tangible assets like buildings, machinery and land. Many companies nowadays create value and they are valued by their intangible assets like technology (from R&D) and human capital (consultancy company KPMG). To value intangible assets is hard but possible. (Damodaran, n.d a)

Firstly, we must ask ourselves: Why can’t we use the same methods from tangible assets for valuing intangible ones? If we take a patent and calculate its value, it should amount to as present of cash flows with discount rate that represent the risk. The problem is that accounting standards for tangible and intangible are different. For example, when looking at a car manufacturer, it invests into new factory, record this as capital expenditure in addition to asset and depreciation recognition. On the other hand, if a technology company puts money into R&D with a goal of creating a patent, it cannot record the expenses as capital expenditures nor record any assets or amortization/depreciation. Similar story applies to a company that invests a lot of money on marketing to grow its brand name. There are number of basic inputs for valuation that are crucial and since accounting standards of intangible assets are not accordance with the basic inputs, we cannot trust book value nor current earnings: Current earnings is net value of R&D and book value does not consider investments that are made for large assets. It can be difficult in terms of capital expenditures recorded as operating expense, how much reinvestment the company is going to for its further growth. Also, getting a loan from a bank may become difficult if the company has many intangible assets because their value can fluctuate already a lot in a short time period. As a last remark, it is difficult to estimate whether and when the intangible assets the company has can become steady. Sometimes if the market entry and exit is easy but the technology fluctuates a lot, growth rate can decrease fast. But if a company has a brand name for example that has been a competitive advantage for many years, it becomes easier for other firms with no physical assets (they don’t have to have tangible assets) to stay in high growth with excess returns. When comparing two companies, analysts often make the mistake of not assessing companies (with intangible assets) in their book value without
adjusting capital expenditure. Also, it is not advisable to add premiums that come from nowhere as if it would describe the value of brand name. (Damodaran, n.d a)

3.2 Investment criteria of VCs

With the help of investment criteria, we are aiming at better understanding of the different valuation methods. It is important to understand what VCs look for in entrepreneurs, teams, product and market they invest in. This research is crucially linked to the interview questions formed.

As it was brought up by Damodaran (n.d a) we cannot use traditional valuation methods on startups and growth companies. Why can’t we use qualitative measures instead of more quantitative approaches? Can management trust and team spirit be valued? These questions and many more will be answered below.

Simic, M. (2015) tells that there are for every provider of capital different criteria how they value the risk investment. The business plan drafted should be targeted to each type of investor uniquely because of different criteria. For example, FFF (family, friends, fools) go first with instinct of trusting the entrepreneur. On the other hand, debtors value the ability of repaying the loan and for VCs and business angels market and financial information. Entrepreneurs should be ready for VCs and what they require from entrepreneur from the first stage onwards.

MacMillan et al. (1987) divided the investment criteria into three categories: Personality and Experience of Founders; Product and Market Characters and Financial considerations. All in all, we can conclude that financial criteria are least important since personality and experience of founder and market conditions are at the highest point.

When thinking of leadership qualities of the entrepreneur Macmillan et al. (1987) felt the most strongly that the intuition what VCs feel like is very important. For example, if the entrepreneur does not look like a leader and the business does not show the qualities of being able to return at least 10 times within 5-10 years, the investment does not look interesting.
Simic, M. (2015) lists several other researches like Knight (1994), Sweeting (1991) and Ray & Turnpin (1994) in different countries with own VC culture but all in all came to same kind of conclusion like MacMillan et al. (1987). However, Simic, M (2015) points out that the sample size of research is too small in many of the researches to really reflect how VCs make decisions.

This is very exciting area of study but I can see that also one of the key things to research is how the VC investment criteria have developed (if by any means) until this day. Additionally, it would be a great addition if the criteria are clarified more deeply.

Eisele, F et al. (2011) conclude that management quality is the number one criteria, after that comes product/service and market criteria. The last one is financial criteria. The capability and clearness of business plan presentation is very important in addition to market knowledge also presented by Tyebjee and Bruno (1984). These criteria are thought to be important at every stage of startup life cycle. Customer loyalty is quite high criteria ranking after management skills in early stage. Dividend potential and other financial measurements were seen not relevant in addition to entering international markets. We can say that dividend requirements are not at strong position in ranking at any financing stage. But the stake requirement is also necessary criteria and interesting is that the criteria becomes less important as further you go in stages. All in all, we can say that based on the table below from Eisele, F et al. (2011) that management knowledge of the market, risk management and goal-achievement attitude are at every stage very high. (Eisele et al., 2011)
<table>
<thead>
<tr>
<th>Rank</th>
<th>Early stage</th>
<th>Expansion Stage</th>
<th>Late Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Criterion</td>
<td>Mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>1</td>
<td>(31) High appreciation potential of acquired equity stake</td>
<td>2.97</td>
<td>0.17</td>
</tr>
<tr>
<td>2</td>
<td>(1) Business concept presented convincingly</td>
<td>2.96</td>
<td>0.19</td>
</tr>
<tr>
<td>3</td>
<td>(2) Management has high ability to perform and persevere</td>
<td>2.89</td>
<td>0.32</td>
</tr>
<tr>
<td>4</td>
<td>(3) Management detects risks, judges them correctly, and acts accordingly</td>
<td>2.81</td>
<td>0.48</td>
</tr>
<tr>
<td>5</td>
<td>(18) Customer utility of the product is apparent</td>
<td>2.79</td>
<td>0.50</td>
</tr>
<tr>
<td>30</td>
<td>(7) Management strives for independence</td>
<td>1.32</td>
<td>1.18</td>
</tr>
<tr>
<td>31</td>
<td>(28) Existing distribution channels</td>
<td>1.27</td>
<td>0.60</td>
</tr>
<tr>
<td>32</td>
<td>(29) Access to international market</td>
<td>1.19</td>
<td>0.89</td>
</tr>
<tr>
<td>33</td>
<td>(30) Access to entirely new market</td>
<td>0.77</td>
<td>0.65</td>
</tr>
<tr>
<td>34</td>
<td>(34) Dividend from acquired stake</td>
<td>0.22</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Table 6 Investment Criteria at every financing stage, Source: modified from Eisele et al. (2011)
Hollmann and Kuckertz (2010) summarized previous researches and we can concretely divide the areas of VC investment criteria in the following way: It is now evitable that there is a huge difference between criteria that are important to VCs. The broad scale of various aspects of criteria are following by Kollmann and Kuckertz (2010, modified):

<table>
<thead>
<tr>
<th>Head criteria</th>
<th>Sub criteria</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneur</td>
<td>Leadership capabilities</td>
<td>MacMillan et al. (1985), Robinson (1987)</td>
</tr>
<tr>
<td></td>
<td>Technical qualification</td>
<td>Shepherd (1999), Franke et al. (2006)</td>
</tr>
<tr>
<td></td>
<td>Business qualification</td>
<td>Shepherd (1999), Franke et al. (2006)</td>
</tr>
<tr>
<td>Product or service</td>
<td>Innovativeness (quality, style and other features)</td>
<td>MacMillan et al. (1985), Mason &amp; Stark (2004)</td>
</tr>
<tr>
<td></td>
<td>Patentability</td>
<td>Tyebjee and Bruno (1984); MacMillan et al. (1985)</td>
</tr>
<tr>
<td></td>
<td>Unique selling proposition</td>
<td>Mason and Stark (2004)</td>
</tr>
<tr>
<td>Market characteristics</td>
<td>Market volume</td>
<td>Tyebjee and Bruno (1984)</td>
</tr>
<tr>
<td></td>
<td>Market acceptance</td>
<td>Tyebjee and Bruno (1984)</td>
</tr>
<tr>
<td></td>
<td>Competition and barriers to entry</td>
<td>Mason &amp; Stark (2004)</td>
</tr>
<tr>
<td>Financial characteristics</td>
<td>Fit to investment strategy</td>
<td>Muzyka et al. (1996), Mason &amp; Stark (2004)</td>
</tr>
<tr>
<td></td>
<td>Exit possibilities</td>
<td>Muzyka et al. (1996); Mason &amp; Stark (2004)</td>
</tr>
<tr>
<td>Other characteristics</td>
<td>Business plan</td>
<td>Mason &amp; Stark (2004)</td>
</tr>
</tbody>
</table>

Table 7 Areas of VC investment criteria summarized by previous researches, Source: Kollmann and Kuckertz (2010), modified.

Franke et al. (2008) summarizes (supporting Kollmann and Kuckertz, (2010)) greatly how the criteria are being ranked (top 3) by previous scholars. It is evitable that entrepreneurial skills are put more weight in valuation of startups because in all researches in the below table show that entrepreneurial commitment, quality, experience and different skills are thought to be most important. Market and product related characteristics are also important but as one can spot that financial criteria do not show particular interest in VCs’ minds. (Franke et al 2008)
3.2.1 Detailed summary – Entrepreneur and Team criteria

Regarding management and entrepreneurial characteristics trust and reputation in addition to honesty and leadership are very much appreciated by VCs. (Panda & Dash 2013 and Carlos Nunes et al. 2014)

When thinking of more 21st century researches in the matter, Petty, J.S and Gruber, M (2011) recognized that a well-established team may be important because it affects commercialization of the product or service. Management team is also replaceable and VCs have connections with experienced managers who can replace the old managers. It is notable that no entrepreneur and team criteria were in top 3 most important criteria. (Petty and Gruber 2011)

Narayanasamy et al. (2011) see that VCs in Malaysia are more regular investors than VCs that were described by Parviainen (2017) that have the desire to be on the journey with the entrepreneur and develop the business. Personal integrity of entrepreneur and management is the most important feature since investor want to see that the entrepreneurs are realistic about the business and risks associated with that. Then second is that there should be leadership quality in the management. (Narayanasamy et al., 2011)

Specific skills in marketing, finance and management are also appreciated VCs. (Tyebjee & Bruno 1984, Muzyka et al. 1996, Bliss 1999)

Like many, Kakati (2003) saw also that team is important and here it is said that marketing, managerial and technical skills make a substantial difference between successful and unsuccessful venture.

Pintado et al. (2007) found that the most important criteria in VC investments were, among entrepreneurial characters, that the owner shows trust, knowledge of the sector and experience of employment. Others were leadership skills and understanding of the strategy.

Gompers et al. (2008) raises the point also the entrepreneur’s key knowledge in industry and background in successful stories are determined to perform better than first-time entrepreneurs or those who have failed many times.
Also, Vinig and de Haan (2002) raised that leadership skills of entrepreneur and industry knowledge are the most important features.

Berstein et al. (2015) found that the founder and team are the most principal factors attracting investments. VC with wider knowledge believe that the founding team is a strong indicator and factor of strategy through which startup is going to be let. Management team there should be replaceable so that the investors can feel safe with their rights to control. (Berstein et al. 2015)

Gompers et al. (2016) found also out that nowadays VCs tend to emphasize the importance of entrepreneur and the management teams over other criteria. It is declared that many VCs believe that they invest into people not actually into product or market, hence people are the most critical factor in terms of success. (Gompers et al. 2016)

In conclusion one can say that entrepreneur and team criteria are the most important ones and honesty and integrity, different skills, understanding and experience. But management team can also be changed.

3.2.2 Detailed summary – Product and Service criteria

When thinking of product / service characteristics Kollmann and Kuckertz (2010) are reviewing that innovativeness and patentability are key factors.

As we talk about technology and startups it is important to discuss the matter of IPR rights related to technology reflecting on investment criteria. Zhou et al. (2016) views that the better IPR rights the startup has the more funding it will get. Patents also help the company to gain new market share. When looking at the VC funding stages, those companies who applied for many patents received more funding than those who applied to just one but only at the first stage. This can be explained via asymmetric information and lack of company history. Later stages reflect that VCs value marketing and technological skills more than just patents. (Zhou et al 2016)

Mann and Sager (2007) see that IPR rights are not classified that high in financial criteria but as strategy to protect investors from rivalry investors. In this case, only 24% of young
software startups got a patent at first funding round but at this business field even out of mature companies only about 33% had a patent which brings us to few conclusions:

- Patents are not necessary for early stage companies as they become more important at mature level.
- There was no meaningful relationship between patents and positive impact on venture capital criteria.

Kakati (2003) view that when comparing non-successful and successful VC investments, few criteria are critical that VCs have looked differently. Product-related R&D investments are not as important determining success. This agrees Zhou et al. (2016) research on decreasing importance of patents.

Although Muzyka et al. (1996) does not rank product / service characteristics particularly high, it comes with a lot of different criteria related to uniqueness.

Carlos Nunes et al. (2014) ranks product/service characteristics in top 15 criteria of every criteria and they list following criteria in order of importance:

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Ranking of product/service criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product with demonstrated market acceptance</td>
<td>1</td>
</tr>
<tr>
<td>Potential foreign market</td>
<td>1</td>
</tr>
<tr>
<td>Patent</td>
<td>2</td>
</tr>
<tr>
<td>Are there raw materials to build up the product</td>
<td>3</td>
</tr>
<tr>
<td>Innovation in production process</td>
<td>4</td>
</tr>
<tr>
<td>There is a prototype</td>
<td>5</td>
</tr>
<tr>
<td>Uniqueness of product</td>
<td>6</td>
</tr>
<tr>
<td>High-tech product</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 8 Ranking of product/service criteria, Source: modified from Carlos Nunes et al. (2014)

Vinig and de Haan (2002) found same kind of product/service criteria as Carlos Nunes et al. 2014 but first two authors add that in the US patents are more important than in the Netherlands. However, innovation is thought to be more important criteria in the Netherlands.
Franke et al. (2008) table shows that product characteristics are not as highly appreciated as entrepreneur and management characters. Petty and Gruber (2011) may explain why: A well-established team may be important because it affects commercialization of the product or service. But product/service, market characteristics and even financial criteria are more important because it is the factor through which VCs get their source of earnings. This result may come from the fact that this study took also into account (unlike others) why VCs reject investments instead of just accepting them. Management team is also replaceable and VCs have connections with experienced managers who can replace the old managers. (Petty and Gruber 2011)

In product and service category of investment criteria, potential of foreign market is considered important by Carlos Nunes et al. 2014 and Vinig and de Haan (2002). A lot of other researchers like Mason & Stark (2004), Tyebjee & Bruno (1984), Zacharakis & Meyer (1998) raise market attractiveness (growth for example) as important criteria.

This is odd that internationality has not been recognized by more researchers. At the same time business and competition gets locally tougher, firms would like to go global for new markets and growth and therefore, internationality could be vital and the potentiality of business to become global is in thoughts of VCs when they invest. If the size of the market is not large enough then one would rationally be heading overseas.

Overall, most discussed product criteria –related criteria are patents and their importance. Also, internationality is important topic although perhaps more related to market. Petty and Gruber (2011) saw that product and other criteria than team determine the success of startup, which goes against general view.

3.2.3 Detailed summary – Market

Mason, C and Stark, M. (2004) see that market (in connection to growth, competition and demand) is the most crucial decision criteria. Also, Tyebjee and Bruno (1984) recognize that market growth is something the VCs like to see and stands as the second place in the whole criteria. Zacharakis and Meyer (1998) brings out that entrepreneurial factors underlined by MacMillan et al. (1987) and Tyebjee & Bruno (1984) are not that important and market characteristics are more necessary to capture the potentiality of the business.
Zacharakis and Meyer (1998) sees that especially amount and power of competitors and market size are very important criteria.

Vinig and de Haan (2002) view that in the Netherlands VCs have quite high ranking for couple of criteria related to markets:

- Product/service could create new markets and encourage development of existing markets
- Low competition level
- VCs know the market
- Supply chain channels are already existing

Muzyka et al. 1996 view that sensitivity of the product to market seasonality and economic cycles are somewhat irrelevant. On the other hand, product-market relation understanding, market growth and attractiveness and market establishment degree are seen as semi important for VCs. (Muzyka et al. 1996)

Carlos Nunes et al. (2014), like did Vinig and de Haan, T (2002) emphasize the importance of criteria of that the market has easy access to suppliers. Also, market growth rate is very important. (Nunes et al 2014)

Pintado et al. (2007) saw that market criteria are strongly related to products as researchers found that the more high-technology related product, the more market criteria are important. Especially market growth rate is in the interest of VC investors and when they perform commercial due diligence report, this factor is very crucial point of it. Ability to create new markets and growth rate of potential clients are both a bit less important than market growth rate. (Pintado et al. 2007)

In the market category research found out that it is not necessary or sensible to build up a new market but more important factors for successful venture is that the current market is growing and that the target company can stimulate the current market. (Kakati, 2003)

In conclusion one can say that a variety of different market-related criteria are used by VCs such as market, growth, size, demand. Also understanding of market is important and product-market relation is seen as important criteria.
3.2.4 Detailed summary – Finance

Financial criteria that is mostly used is rate of return, possibility to exit and fit to investment criteria. (Tyebjee & Bruno, 1984, MacMillan et al. 1985, Muzyka et al. 1996, Mason and Stark 2004)

Highly appreciated (belonging to best three criteria) financial criteria were found by MacMillan et al. (1985) and Tyebjee & Bruno (1984). These two researches highlighted rate of return.

From 21st century studies Mason & Stark (2004) and Narayanasamy et al. (2011) both found that financial criteria are really important, second and third most important. Mason and Stark (2004) highlighted rate of return, exit possibilities, cost-revenue stream and equity. Narayanasamy et al. (2011) highlighted exit opportunity but rate of return was not that much behind in the overall ranking.

Although not high Muzyka et al. (1996) found quite important criteria’s like ability to cash out, expected rate of return and time to break even.

Carlos Nunes et al. (2014) highlighted expected rate of return and this criterion was third in the overall criteria. Ease of exit was very high also. Like Muzyka et al. (1996), Carlos Nunes et al. (2014) found that break even timing was also decisive criteria. They found that the size of investment and for example target company’s fit to other portfolio company are interesting criteria to be looked at.

Regarding financial measures (for example liquidity easiness of investments) are thought not to be important themselves but for example a good return is a follow-up of a right entrepreneur and team, favorable market, good product and strategy. This leads to the fact that financial considerations are important but the aspects of where profit-risk relationship is looked at is versatile like described earlier. return on investment is the only that is regarded as significant among finance criteria. Therefore, itself there was no significance showing based solely on financial performance criteria (Kakati, 2003).

All we can say is that rate of return and exit possibilities are the most important financial criteria among VCs according to researches. But financial criteria do not show a high degree of importance.
3.2.5 Detailed summary – Other criteria and Intuition

There are numerous of other criteria including sustainability and intuition for example that we might take a look at. We must emphasize that since no specific criteria about healthcare technology startups has been set, in the interview phase we must reflect based on the knowledge we have covered and be curious by asking questions what other criteria might be important.

Carlos Nunes et al. (2014) emphasize the importance of how well the business plan has been written. After this especially intuition of VCs become important aspect of criteria.

MacMillan et al. (1987) and Zacharakis & Meyer (1998) view that VCs should have a great “gut feeling” or intuition with the entrepreneur. Since there is an information asymmetry between startups and VCs gut feeling is something VCs often lean on. Intuition tells that often VCs are not sure how to make decisions and that is why intuition is used to back up the investment criteria mentioned. (Zacharakis and Meyer 1998)

Intuition of investor be the factor that adds to relationship between investor and investee a stronger bond in addition to experience, social personality and motivation to coach the entrepreneur. (Zinecker and Wolf, 2015)

Nowadays, sustainability been a big theme around big companies and there are certifications even that can add value to the company if it has acted in the sustainable way. Randjelovic et al. (2003) explain that green VC by investments towards companies that create sustainability for their stakeholders by acts of development of eco-systems for example. This is not just charity because VCs also are interested into financial return even though these are high risk startups. There are many regulative boundaries in green VCs but also positive drivers. (Randjelovic et al. 2003)

Moore and Manring (2009) highlight that SMEs usually collaborate with each other to strive for sustainability and achieve competitive advantage through it. Bocken (2015) views also that one the key drivers for sustainable actions are gaining competitive advantage. The author wants to remind that investors should be more patient regarding their expectations for financial return and view other criteria based on sustainable business. Syndicates of many VCs is the solution for reducing the risk that VCs take. Collaboration with other
sustainable businesses related to healthcare and environment are encouraged. VCs can bring more knowledge into sustainability topic into the company. There are not enough sustainable VC investors and hence no culture. (Bocken 2015)

Shepherd and Zacharakis (2001) see that the relationship between entrepreneur and VC must be based on mutual trust. One way is to signal trust and that both are in the “project” together. Second one is related to valuation for example as both VC and entrepreneur have different views: There important is to discuss and find a fair and suitable value and go discuss through the information needed for that. Third one is the fit between entrepreneur and VC and this will help in the future when both know each other, and then VC might be able to build up a stronger team around the entrepreneur with people best suited for roles and team. Fourth one is that there should be frequent and open discussion, not so that only at the time of difficulties meetings are set up. (Shepherd and Zacharakis, 2001)

Notable is that Tyebjee and Bruno (1984) saw that for the sake of relationship between VC and entrepreneur just only a bit more than 15% use location as criteria in screening phase. Tendency, is however, that most VCs look for investment possibilities close to metropolitan areas where lawyers, banks and other contacts are nearer. (Tyebjee and Bruno 1984)

3.2.6 Summary – all criteria

Venture capital investment criteria are very versatile as can be seen from the background literature, researchers have found many ways to interpret what criteria are important for VCs when valuing startups. When shifting more to 21st century literature, still many researchers have pointed out that quality of entrepreneur and management team are important. However, some underline also that management team is replaceable, like Bernstein et al. (2017) tells. Zacharakis, A.L and Meyer, G.D (2000) shows also that there is an enormous difference between underlining and defining of criteria when they have collected previous researches.

Lahti, T (2011) revealed that one study from 1998 revealed that intuition was the largest investment criteria in Finland and no other specific criteria was found. Now, however, foreign VCs’ appearance in Finnish markets since EU membership 1995 has increased. In business angel activity foreign practices have been adopted by Finnish VCs. Human capital i.e. entrepreneur characteristics and business plans are searched most deeply. Thereafter
come sales and product information. Lahti, T (2011). Syndication and risk management also through share ownership has become more professional for example in conducting due diligence reports for investments. (Lahti, 2011)

3.3 Quantitative methods used in the valuation of startups

Valuation of startups becomes difficult because of the short history and difficulties therefore to forecast cash flows. This is not easy when talking about large public companies but still business that has had solid business cycle is easier to valuate. Some people think that startup valuation models are just parts of guessing-game and base their valuation on intuition. Financial and intuitive methods both have places in valuation but especially intuition is more subjective since it is based on the history, experience and knowledge of an investor. Financial valuation, however, makes the valuation process clearer and leads to some sort of a price that the investor is ready to pay. Different investor criteria are essential to form a value. If the price seems out of this world, set criteria are to be viewed. (Parviainen 2017, 124)

Gompers and Lerner (2000) reminds that it is widely true that startups are valued lower than companies with sustainable history of profits. This is because the uncertainty in investing into startups is so large. Age and size are positively affected to the company value. (Gompers and Lerner, 2000)

Hand, J. (2005, 613-648) examined biotechnology companies and found that venture capital backed companies should be measured with financial statements but also claims that the usage of financial information increases when company matures. Vice versa non-financial measures decrease as the firm grows. However, it is important to notice that regarding the connections. (Hand, 2005)

Damodaran (2001, 13-16) views that it is easy to view why again there is a problem in startup and technology investments. In addition to no history and growth problems, these companies’ cash flows are difficult to estimate at early stage – this is reflected at startups or idea stage. In young growth stage revenues and sales are increasing when customers are activating towards the company. Still the history of the company is very much narrow and so is the number of comparable firms and they are usually at the same stage. Value is still mostly related to growth. In mature growth notifiable is that value becomes deriving more
and more from company assets as well as growth and there are comparable at various stages. Additionally, maturity brings more revenue and history to the company, which is important for valuation. The trend is that the more mature the company goes the more information one can get do reflect it better to company valuation. (Damodaran 2001, 13-16)

![Figure 9 Startup valuation lifecycle. Source: modified from Damodaran, A (2009)](image)

This can help to understand different valuation methods (presented next) and what are their pros and cons in valuing startups you will realize in the next chapters. Most of the valuation method need parameters like cash flow and asset valuation that are very difficult to assess for startups. This helps us to understand why VCs tend to use investment criteria in sense of shortage of information but as said also financial valuation has its place since you want as an investor still “fact” based information. Therefore, we are going to be explore and hopefully this will set up a clearer picture on quantitative valuation of startups. Also, it is wise to view research what kind of valuation methods VCs tend to use all over the world and why.

The methods for this thesis have been selected by viewing of the literature and most ideas for selecting the methods were given by Parviainen (2017). As suggested earlier, the methods introduced in following sub chapters are mostly so-called traditional valuation methods but also Berkus and Risk factor methods are introduced to get more versatile picture how start-ups can be valued. At the end there are also methods for particularly
valuing intangible assets as startups are mostly technology-based and the real value can lie in the intangible assets.

3.3.1 DCF method

DCF model is one of the most used model in valuing both public companies and startups. To be fair this valuation model is more applicable to later stage companies who already have cash flow and therefore some witness that it can carry the risks what expected rate of return requires. The idea is that value of the company is based on present value of future cash flows' sum. This means that the factors are: cash flow size, time and expected return (discount rate). Discount rate is derived from WACC that we explained in the risk and return chapter previously, capital return. Typically, cash flows are calculated for the next 4-7 years, and the risk of cash flows is already considered at the discount rate. Present value of cash flows in the long future is very small and hard to predict but they are calculated in the company’s terminal value that is added to sum of cash flows. When thinking of WACC factors, startups usually do not have any debt due to banks’ restrictions but there are usually non-market-based loans that are usually backed by main shareholders or government. Cost of equity, on the other hand, is mainly 50-80% so therefore the discount rate is very high. (Parviainen, 2017, 125-128)

Parviainen (2017, 128-129) explain that the discount rate is impacted by the stage of the company, riskiness of the field and business itself. It is noticeable that usually in startups the growth rate of cash flows is higher than in traditional companies. One cannot just estimate the cash flows by trusting the company’s predictions.

\[
DCF = \frac{CF1}{1 + r1} + \frac{CF2}{(1 + r2)} + ....
\]

Where CF stands for Cash flow and r stands for discount rate derived from calculating weighted average capital cost.

The other way is by Vernimmen, P (2014, 559-560) – that is free cash flow method (below) and author points out that this method measures the ability of the company to produce cash.

Operating income (EBIT)
- Normalized tax on operating profit
- Change in Working Capital
- Capital expenditure (CAPEX)
= Free cash flow after tax

Vernimmen, P (2014, 560-562) says that a good projection for company is 10 years. Terminal value means the value at the end of forecast period, some say after maturity stage. Gordon-Shapiro formula is calculated in the following: Vernimmen, P (2014, 560-562):

\[
\text{Terminal value} = \frac{(\text{Normalized cash flow})}{(r - g)}
\]

Where \( r \) is the WACC derived cost of capital and \( g \) is the growth rate. Growth rate cannot be very much greater than the growth in market, inflation is taken also into account. (Vernimmen 2014, 562)

Damodaran, A (2009) sees the reasons why DCF model is not an attractive option to value a startup. Firstly, it would assume that we would have all the knowledge about the firm’s cash flows. Because of short history and limitations of access to details of the company’s growth rates, revenues or operating margins. (Damodaran, A 2009)

Startups are not publicly traded. Also, because it usually assumed that investors are founders who have invested their entire fortune there and VCs who have only little diversified invested into the startup company. They are hardly going believe that systematic risk is the only risk they are going to ask compensation for their investment. Different equity claims of investors can be additionally seen as variety of cost of equity. Therefore, measuring cost of equity or cost of debt to calculate WACC is hard. (Damodaran, A 2009)

Terminal value can be the largest component of a young company, almost 90-100%. Terminal value takes the presumption of stable growth and this leads to problems: There is a high failure rate of startups so one can assume that stable growth is never going to be achieved. Probability of a survival of a firm is not easy to measure and put as a component in determine terminal value. (Damodaran, A 2009)

Parviainen (2017, 128-129) says that DCF model does not provide enough flexibility to capture the amount of cash flows which are fluctuated in case of startups, which supports Damodaran, A (2009)’s claim of asymmetry lying between investor and company.
Van Schootenbrugge & Wong (2013) tell their side of the story of DCF model. High-tech companies take time to turn the project positive due to uncertainty and if projects would be measured only based on cashflows it would be impossible to participate in those because they would be negative. Additionally, the risk factors change throughout the stages of startup. Usually when the technology is approved the positive cash flow comes cost of capital lowers. This becomes an issue when investor tries to settle a discount rate that would work at any stage of a startup. Final disadvantage of DCF is that it undervalues technology options and spin-offs to lower the risk during the projects. This leads to the problem that it will not be seen at the value because the lower risk does not appear in the model. There is a flexibility issue.

Sander, P and Köomägi, M (2007) show that in Estonia different surveys have provided very different results regarding valuation methods Estonian VCs use: From using no methods at all to payback rate and DCF method. DCF is used more than multiples because of comparable transactions or lack of them more specifically. In larger and sophisticated markets like US and UK multiples can be better utilized. About a quarter of American VCs use real options but this is definitely not the same case when it comes to CEE region. Real option method is used seldom in CEE region merely in later stage investments.

Sander, P and Köomägi, M (2007) see that DCF method is problematic when determining terminal value. Growth rate used is highly dependent on human capital, without that, VCs just give money. VCs want to see that the money they have invested is used appropriately. DCF method also does not do particularly well in cash flow projections. Some VCs in the survey rearranged the cash flow projections together with the entrepreneur, usually 5 years from now. Longer is not necessary because of high degree of uncertainty. Sander, P and Köomägi, M (2007) criticizes further DCF method that its effective use requires for a particularly well estimation of cost of capital. CAPM strongly associated with DCF is not used as usually startups usually do not have market traded debt. Cost of capital in calculated there through intuition. (Sander, P and Köomägi, M 2007)

Vernimmen, P (2014, 567) concludes that the advantages of DCF include simplicity of the method and that it quantifies buyers’ and sellers’ assumptions. It also provides in comparison to multiples more conservative valuation. Additionally, it does not let you
assume too high growth (should not be too much beyond market growth rate) rate or too high valuation in general but leads you to value of “company’s real economic performance”. (Vernimmen 2014, 567)

Disadvantages are in conclusion, however, many with DCF method: There is shortage of cash flow, history and growth rates and other financial related issues. Measuring cost of equity and debt and therefore WACC as discount rates are difficult to obtain. Growth rate and therefore calculating terminal value is difficult because of instability of startups and human capital dependency. (Parviainen 2017, 128-129; Damodaran, A 2009; Sander, P and Köomägi, M 2007; Schootenbrugge & Wong 2013)

Van Schootenbrugge & Wong (2013) tells additionally that DCF undervalues technology options and spin-offs to lower the risk during the projects and adjust the NPV of the projects and therefore there is flexibility issue.

3.3.2 Multiples method

Parviainen (2017 130-131) continues that this approach can be viewed as something to compare with peer companies. Multiples are financial ratios that are derived from peer companies’ financial statements. It’s based on company’s historical data and financial ratios derive from it. Multiples are adjusted to company’s value and after that compare these numbers with peer companies. (Parviainen 2017)

Vernimmen, P (2014, 566-567) divides multiples into two groups: market multiples and transaction multiples. These multiples are derived from making comparison with market value and accounting figures, this process needs to be continuous: Enterprise value could be reflected to revenue or EBITDA for example. Equity capital could be best reflected to number after debt expenses like for example net profit. (Vernimmen 2014, 566-567)

As talking about market multiples critical thing is that it is not enough that the companies are working in similar sectors but as important is to compare their operations that are supposed to be similar. Return on capital employed (ROCE) and growth rates are examples of these figures. Additionally, it is implied that multiples are short-term viewed and therefore it is crucial that companies are fairly liquid i.e. traded regularly and there are enough analysts following these companies. (Vernimmen 2014, 567)
Parviainen (2017, 132) highlights that in case of startup companies the main principle of multiples method is the same but in comparison to listed companies’ valuations (based on “hard” figures), startups do not usually have these figures but the multiples method is rather based on soft figures. These soft figures tell a lot about companies’ potentiality and opportunities which are more critical figures when thinking about startups.

Parviainen (2017, 132) continues that the comparison of multiples helps also to estimate whether the valuation of the company is right in the first place. If according to the parameters the company is too expensive or cheap there should be a reason. For example, if the company has exceptionally competitive technology or a team behind it. If reason is undefinable then the price is wrong. Startup companies’ multiples analysis requires, likewise explained by Vernimmen, P (2014, 567) in case of listed companies, that the companies in comparison must be working in the same field, concept and also at the same stage of growth. This is not always easy since startups are based on unique innovation or business model that should bring added value to the company. Another challenge is connected to finding market values and if they are “right”: Even though a comparative company would be found, investor may not have access to find its market value. If market value is found for this comparative company it can be the case that at the financing round this company was over or under valued. (Parviainen 2017, 132)

Below is presented a multiple analysis for (Parviainen 2017, 133) two startups that are both in the same fintech sector:

<table>
<thead>
<tr>
<th>MULTIPLE</th>
<th>Innovestor</th>
<th>OurCrowd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td>2016</td>
<td>2013</td>
</tr>
<tr>
<td>Market value (pre-series A)</td>
<td>9 M euros</td>
<td>15 M euros</td>
</tr>
<tr>
<td>Size of the round</td>
<td>1 M euros</td>
<td>5 M euros</td>
</tr>
<tr>
<td>Products/services</td>
<td>Share issue / fund</td>
<td>Share issue</td>
</tr>
<tr>
<td>Employees</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Customer register</td>
<td>800</td>
<td>1000</td>
</tr>
<tr>
<td>Organized financing rounds</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Home market (venture)</td>
<td>Sweden, Finland and Russia</td>
<td>Finland (modified)</td>
</tr>
<tr>
<td>Technology in online service rating (1-10)</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 9 Multiple Analysis, Source : modified from Parviainen 2017, 133
Damodaran (2009, 55-56) highlights that when valuing startup multiples could be made for private companies. These figures are taken from the past typically same size and industry when transactions have occurred. We could create a dataset for these transaction values and after that it is important to reflect the transaction values with multiple variables like revenue and earnings. Through this we compute a multiple designed for our business case. In the past shortage of data was a problem but nowadays other problems are more relevant. (Damodaran 2009, 55-56):

- Arms-length transaction
- Timing differences
- Scaling variable
- Non-standardized equity
- Non-US-firms

First is arms-length transaction where in the acquisition price of private company is also included other factors not just the business itself. For example, if a doctor sells a practice there might be included that the doctor advices the acquiring company in the future to light the overall transition. Secondly there is timing differences: There is not enough transactions and sometimes it takes time to get enough samples. Thirdly there is scaling variable: Usually measures needed for multiple analysis require revenue and earnings. Since startups usually lack these figures mostly, they should not be used because they do not tell enough about the potential of startup. Also, variety of accounting standards across globe and this creates potential conflicts with comparing. Fourthly there is non-standardized equity: Equity claims are different in startups in case of cash flow, control claims and illiquidity. Therefore, it is difficult to compare and transact different companies’ equity stakes. Fifth there is the issue of non-US-firms: The widest data available about transaction prices of private companies is in the USA. This data is questioned if it is applicable also to other markets. (Damodaran 2009, 55-56)

3.3.3 Sum of the parts method

This method is based on the idea that you search every item of asset and liability and discover their true net asset value. When these true asset values have been calculated they are added together or asset minus liabilities. In listed and large companies this method is
based on the idea that the company is chopped down into smaller pieces and the business will be sold piece by piece. (Vernimmen 2014, 574 and Parviainen, 2017, 133-134)

Vernimmen, P (2014, 574) sees that book values of assets and liabilities are seldom reflecting their true value.

From time to time listed company’s market value could be way lower than the book value and therefore they might have a threat of takeover. This happens when an acquirer thinks that some of the intangible assets can be sold at higher value. Other parts may be founders’ competence levels and the values of contracts with clients. (Parviainen, 2017,133-134)

Vernimmen, P (2014, 576) tells about three methods to calculate value of an intangible asset like brand.

One method is more empirical method based on the thought asking how much expenses does it take to recreate the brand. Some use for example, four-year advertising costs as a value for a brand. (Vernimmen 2014)

The second method calculates the present value of income or royalty payments that are transferred due to use of brand. (Vernimmen 2014)

The third method is the trickiest. One can assume that without the brand the company could not make that much sales. So, there is the need of discounting the “excess profit” due to brand name after the costs connected to branding are taken away. This is certainly difficult as there is usually no comparable product to compare the method to. (Vernimmen 2014)

Vernimmen, P (2014, 577) sums up the method by stating that if a company has high net asset value this would imply that firm’s terminal value relatively compared to cash flows coming right away is very high. This leads to the fact that more net asset value means less cash flow, its value becomes more volatile. Because of this, sum-of-the-parts method should be applied for companies that have already the value set for their assets in secondary market. (Vernimmen et al 2014, 577)
Parviainen (2017, 134) disagrees and hence says that startups with intellectual property can be valued through this method. He tells as example intangible assets and also management team in the company among others. Below is description for each example.

Intangible assets are hard to value and these patents might be connected to a specific technology or part of a new business sector. Patent does not mean automatic protection for the innovative technology because startups’ patents are continuously under attack. Since startups usually do not have the resources to fight against, one way is to keep the new technology as long as you can away from your competitors. Technology is a large part of startup’s value and if it is not protected by any means it has a downgrading effect on startup’s value. ‘Parviainen (2017, 134)

A good board of directors, knowledgeable investors and good team among others can bring value to a startup. In valuation this part is hard because it all starts from how much added value the person can bring into the company, usually this is 1,5-3,0 times higher than “normal employee”. It is essential that in valuation it is considered firstly the added value to the company and the cost (usually salary) to the company. (Parviainen 2017, 134)

Proof of concept is used a lot in startup valuation since because there is not enough sales or turnover, the company must provide a proof of the concept working and there are customers wanting to pay for it. Here, important is to be critical on the information that you receive about the pilot of the product launch, reliability of information and its independency. Being honest is important as startups also have failed projects that the investor wants to be aware of. (Parviainen 2017, 134)

Contracts with clients and their value are evaluated also and especially if the client is international and the value of contract is high this will have a positive effect on company’s value. (Parviainen 2017, 134)

3.3.4 Berkus method

David Berkus, an angel investor found this method in 1990s with the goal of connecting startups development stages and potential in different parts of the business. This model is very useful for startups that have very little revenue. According to method, the company will
get maximum 2,5 million euros market value. Regarding the maximum value there may be differences between countries. (Parviainen, 2017, 140-141 and Lainema, 2011, 103)

Parviainen (2017, 141) states that Berkus model can be thought as of measurement of how big chances do the companies have to get over the Death-valley and reach the next growth stages. The model (Alford, 2017) can be described by a table below. Alford, H. (2017) states that add-pre-money-value should be updated for today’s standards since maximum sums are not relevant anymore.

<table>
<thead>
<tr>
<th>Value driver</th>
<th>Add to Pre-money value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound idea</td>
<td>0-500 000 euros</td>
</tr>
<tr>
<td>Prototype</td>
<td>0-500 000 euros</td>
</tr>
<tr>
<td>Management performs well</td>
<td>0-500 000 euros</td>
</tr>
<tr>
<td>Relationships that lower risks towards market and competition</td>
<td>0-500 000 euros</td>
</tr>
<tr>
<td>Product Rollout and Sales</td>
<td>0-500 000 euros</td>
</tr>
</tbody>
</table>

Table 10 Example of Berkus method, Source: modified from Alford, H. (2017)

This is a simple model and therefore more applicable to value seed or early growth companies. On the other hand, the section has provided also wide section of more financial-based valuation methods, for example DCF method can be more applicable for more mature companies. (Parviainen 2017, 141)

3.3.5 Risk factor method

Risk factor model’s initial idea is to assess target company’s risks. If the risk is negative, it will affect negatively to company value. If the risk is almost zero, it will give to the company positive value. Again, this is best applicable to seed and early growth startups. All risks are divided into 12 classes and you can classify each risk with following multiples: -1, 0, +1 and +2. Each risk can get maximum 250 000-euro value, so each factor can bring in the worst-case scenario – 250 000-euros and as its bet +500 000 euros. (Parvianen 2017, 139; Kowlessar, A., 2016)
Risk factors are:

1. Management
2. Growth stage
3. Technology
4. Competition
5. Easiness of getting finances
6. Production
7. Sales and Marketing
8. Internationality
9. Regulations and political risks
10. Legal cases
11. Reputation risk
12. Company's exit process

Parvianen (2017, 139-140) thinks that this model has the advantage again that it is quite simple and focuses on company’s “most important” items. However, this model can only give very blurry value of a company and if the startup has strengths or weaknesses that are particularly different from its peers, this method won’t work very well. Parvianen (2017)

3.3.6 Venture capital approach

Since traditional valuation methods are hard to apply to value startups, this method is focusing on the terminal/exit value of the investment. This time is usually in 3-7 years after initial investment. (Parviainen 2017, 138)

Lauriala (2004, 68-69) illustrates that the venture capital method has a lot of common factors with IRR and NPV. Most commonly as a basis for discussions between venture capital investors and founders are used NPV-based methods. These methods have the greatest benefit of discussing financing and exit strategies.
Within Venture capital approach these errors come at hand with this method. Next, we will illustrate the steps and method by Damodaran (2009, 14-16, modified):

<table>
<thead>
<tr>
<th>Step number</th>
<th>Method by Damodaran (2009, 14-16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP 1</td>
<td>We estimate earnings for the next 2-5 years or the amount of years that the venture capital investors are planning to exit.</td>
</tr>
<tr>
<td>STEP 2</td>
<td>Value at the time of exit is calculated by multiplying the earnings (by the time of exit) by Price to earnings ratio (multiple of earnings). In short, the equation is = Expected Earnings _year_n * Forecasted PE ratio. PE ratio is calculated usually by looking at publicly traded companies on the same sector as the startup.</td>
</tr>
<tr>
<td>STEP 3</td>
<td>We determine to discount back the value from step 2. Because startups have high risk of failure, this will be reflected to discount rate, which is certainly higher than with listed companies. Return required varies in each stage of Venture capital and they are decreasing the further one goes in the startups lifecycle: Start-up (50-70%), First stage (40-60%), Second stage (35-50%) and IPO stage (25-35%). But it is shown that actual returns are much lower, which indicates that real returns are very low and less satisfactory. Equity Value today = (Equity value at the end of forecast period) / (1 + Target rate of return or discount rate) ^n.</td>
</tr>
<tr>
<td>STEP 4</td>
<td>In order to determine the amount of stake that the VC investors will get for its investment into startup, one must add to pre-money valuation (calculated in step 3) the effect of VC investors investment. This will lead to post-money valuation. Post money valuation = Pre-money valuation from step 3 + New capital infusion. Next, we calculate the stake of VC investor would have at post-money valuation. Proportion of equity to new capital provider = (New capital provided) / (post money valuation).</td>
</tr>
</tbody>
</table>

Lauriala (2004, 72-77) also shows that after the basic valuation process it would be interesting to the investor to apply a sensitivity analysis where the target company’s value changes when the factors of valuation method are changed. For example, changing the terminal value, time to exit time and discount rate.
Damodaran (2009, 13-14) concludes this method with its Problems and valuation errors:

- There is too much focus on top line (turnover) and bottom line (earnings) without seeing what is happening between those factors that firstly separate earnings from revenues and cash flows.
- Focus on short-term forecasts.
- Analysts use often relative valuation by for example dividing exit multiple to company earnings or turnover. However, the multiple used is often derived from listed companies.
- Discount rate is often used additionally to primary concerns like political and other macroeconomic risks as a measurement of probability if the young company fails or not.
- There are different equity claims and hence liquidity degree for young companies.

3.3.7 First Chicago method

Schumann, C.P (2006, 2-4) introduces the First Chicago method as a model where it usually takes 3-5 years of time-spread and calculates the future value of Net Income at the year they occur for each scenario. (Schumann, 2006)

As second task one must calculate the terminal value using peer company and industry multiples. After these present values are calculated by dividing future values by the discount rate i.e. risk for the investment. VCs like to apply IRR because there is such a high risk of not being completely diversified with your investments and that is why WACC is not usable. (Venionaire Capital, 2015)

For this method, three scenarios are open to discuss: Success, Survival and Failure. Success is something derived from business plan, Survival has less growth (can be thought as a projection of an analyst after due diligence process) and Failure means that the company either stays is its position or in worst case scenario goes bankrupt. The whole method can be seen as betterment of DCF method: Net Income Value is finally calculated through calculating the PV of each scenario and multiply it by the weight of probability for each scenario. (Venionaire Capital, 2015 and Schumann, 2006)
An example illustration of First Chicago Method from Venionaire Capital (2015) is below:

![First Chicago Method](image)

*Figure 10 First Chicago Method, Source: modified from Venionaire (2015)*

### 3.3.8 Real options method

Van Putten, A.B & MacMillan (2004) suggest that why real options are more needed is the fact that they make it possible to utilize the risks and hence opportunities. DCF method certainly underestimate the growth opportunities that real options, on the other hand, embraces: Risks are captured but not the opportunities and therefore the discount rate is too high in DCF method. (Van Putten & MacMillan, 2004). Collan, M. (2018b) adds also that DCF method comes short to explain volatility in investments that increases the option value.

Schumann, C.P (2006) and Collan, M. (2011) see that DCF method has its potentials in easiness but of course its limitations like its disability to value intangible assets because they are more future-determined rather than having easily predicted cash flows. Option prices with methods of Black-Scholes or Binomial trees are more appropriate. These methods capture whether the project or investment have the option to be delayed, expanded or abandoned, DCF method does not offer these kinds of flexibility options. (Schumann, 2006; Collan, 2011)

Collan, M. (2018a) describes real options as different types of managerial flexibility among others in investment world. Real options are indeed a possibility but not an obligation to change. In sense if another project with real option has the flexibility to either hedge against negative events and utilize for positive ones, we can conclude that real options are more valuable than ordinary project without option. In summary real options are valuable when:
• We understand that they exist
• We are capable of identifying them in our current investments and new
• We actively manage real options
• We follow the value of real options and try to create more value for them with our own actions.

Collan, M. (2018a) views different option types. Those that are exercised usually during the time they are valid or mature and these are called American Options. European Options are only allowed to exercise at the end of maturity. This means that as real options are valuable and we do not have the secondary market for them, investor must think ahead how they will use the option and is it necessary.

Author defines that financial options and real options must be separated:

• Real options are a possibility to change something, but not an obligation.
• Financial options give the holder the right to buy/sell, but not the obligation.
• Financial options are financial securities that can be used for hedging. Real options are real assets.
• Financial options have pre-determined cost, in real option we do not know them.
• Financial options are defined according to contract, real options on the other hand have no contracts and hence a lot of uncertainty.
• Financial options have a set of maturity and real options have not precise maturity
• Financial options’ value can very seldom not be affected by option holder. But real option holder has the power of affecting the value by its own actions.

Collan, M. (2011) demonstrates that the logic behind option valuation is to:

1. Model the future value distribution from cash flows
2. Derive the expected value of future value distribution from phase 1 while mapping negative values from distribution to zero.
3. At last compute the present value of expected value

Why do we have to map negative values to zero? This is because in options the option holder has the right, however no obligation, to exercise it. Interestingly Venture capital comes into real options in the following way. Collan (2018a) suggests that VCs use the same
strategy as many companies do with R&D investments. This way is called stage investment. At each stage or rounds of investing VC wonders whether to continue or abandon the investment. VCs criteria to invest are both financial and operational and they look for successful technology, good team and sales figures. Through this way the probability to succeed is better. (Collan, M. 2018a)

Van Putten, A.B & MacMillan (2004) see two problems with real option valuation that suggest that real options should not be applied on their own. When we think of early stage investing, the value calculated with DCF is low, and with real options high. Most of the growth companies have the problem (in the eyes of investors) that they have such a vast area of uncertainty and therefore managers are forced to make complex decisions. Firstly, financial options are relying on historical measures of volatility but for real options there are no historical measures. Secondly, the more uncertainty about profits the more valuable the project is, so says option valuation logic nowadays. Uncertainty of profits come from two factors: Revenues and costs that are both fluctuating. This can lead to a problem that if VC for example values: a. higher a project that occurs predictable revenues but costs are not predictable and b. lower a project with same predictable revenues and predictable costs. They agree that the uncertainty of project should go down toe to higher uncertainty of costs related to investment. (Van Putten & MacMillan 2004)

3.3.9 Valuations of intangible assets

Since we have estimated by Damodaran (2001, 10) and Goldman (2008) that most of the startups are filled with technology and intangible assets it would be appropriate to introduce methods for valuing especially intangible assets. Kohtari et al. (2013) see that intangible assets are assets that are invisible in physical form. Usually intangible assets are patents, trademarks, good will etc. They have, however, economic value. Intangible assets are divided into two main groups: Legal and Competitive. Legal intangible rights are part of the intellectual property and hence matter of jurisdiction. Competitive intangibles, on the other hand, differ so that they are do not belong to the company in sense of jurisdiction but enable the company to have competitive advantage in terms of effectiveness and impact on customer orientation and market value among others. 40 years is the maximum life of intangible asset. The cost of intangible asset is connected to expense during the life of asset. IAS 38 is a standard reviewing the accounting ways of intangible assets. (Kohtari et al., 2013)
There has to be certain criteria under which one can tell that the asset belongs to intangible assets (Deloitte, 2014):

- Identifiability
- Control (power to obtain benefits from the assets)
- Future economic benefits (such as revenues or reduced future costs)

Goldman (2008) states that strategic investors acquire technology-based startups. These strategic investors are concentrated on buying the right technology companies and therefore are very interested into valuation of intangible assets. Income, cost and market approach are the methods to value intangible assets. Which factors impact on the value of intangible assets:

- Technology associated with business through product/service or process should be exclusive
- Ability to support the rights of owner
- Development stage
- Competition
- Lack of dependence on special owner/operator skills, location, or circumstances
- Effectiveness in increasing sales and decreasing expenses

Several authors are willing to open about different valuation methodologies of technology.

In cost valuation method the idea is to calculate the historic cost of recreation of the asset. (Kohtari et al. 2013)

Goldman (2008) believes that the cost method does not very well apply to startups because in case the company pumps a lot of cash into R&D costs but then it will either be successful or not. In the latter case the value is zero. Cost approach does not consider the growth which is the most important feature of a technology startup. (Goldman, 2008)

Kohtari et al. (2013) stresses that transaction method is ideal when assets like buildings are compared but then again there is also the difficulties that very rarely you find the exact match or comparison. Intangible assets are, however, even more difficult since finding the comparable will result empty hands. The problem is not particularly shortage of
comparability but the actual secret-keeping that the values of intangible assets in M&A deals are never revealed because they are very sensible. This limits the method hugely.

Goldman (2008) does not fully see that the market-based method is useless since in case revenues do not exist one can use royalty rates for same kind of technology in the market. But then again, he admits that there is the lack of information and comparability examples.

Income valuation method considers the earnings that it would gain in the future and discount them to get the asset’s net present value NPV. (Kohtari et al. 2013)

Goldman (2008) adds that with income-base model when analyzing growth companies also market and other macroeconomic data is under watch because they can have a massive impact on uncertainty of earnings. Customer research, how well the customers feel about the product or service, competitiveness in the market, resources, cyclicality of the business and many other factors. Regarding startups more specifically, author says that his way is to separate from the discount rate the rate of failure. Therefore, his formula for doing income-based method is:

\[
\text{Value of startup} = [\text{Discounted cash flow value of firm if it survives} \times \text{probability of surviving as a going concern}] + [\text{Liquidation value or distress sale value} \times \text{probability of failure}]
\]

Intangible businesses usually use income valuation (more specifically relief-from royalty methodology) because it reflects the economic reality in the best way and can be benchmarked. This leads to the fact that it shows the objectivity of valuating intangible assets the best way. (Kohtari et al., 2013)

Grajkowska, A (2011) agrees with Kohtari et al. (2013) that the income method reflects best intangible assets’ effects on company value.

Lauriala (2004, 191-192) sees that Venture capital investors usually look at the intangible assets and rights at the due diligence stage. In practice when talking about technology-based startups, their values are dependent on the intangible assets value that the founders and investors have brought. For this reason, it is evitable that the earnings potential of startups is discovered after the due diligence procedure. Protection of an intangible asset gives more value to the asset and of course whether it is useful for the future plans of the
company. Also, VC investors are concerned about different costs related to intangible assets and their protection. (Lauriala, 2004)

3.3.10 Summary of quantitative valuation

Van de Schootbrugge and Wong (2013) summarizes most of the methods like DCF, multiples, cost approach, real options and venture capital method suffer from weaknesses like determining the right discount rate and none of the methods give alone a value that is spot on. Multiples and cost approaches do not reflect the intrinsic value of the company but multiple for example concentrates on actual market prices. (Van de Schootbrugge and Wong 2013)

Vernimmen, P (2014, 567) concludes that the advantages of DCF include simplicity of the method and that it quantifies buyers’ and sellers’ assumptions. It also provides in comparison to multiples more conservative valuation. Additionally, it does not let you assume too high growth (should not be too much beyond market growth rate) rate or too high valuation in general but leads you to value of “company’s real economic performance”. (Vernimmen et al 2014, 567)

Disadvantages are in conclusion, however, many with DCF method: There is shortage of cash flow, history and growth rates and other financial related issues. Measuring cost of equity and debt and therefore WACC as discount rate is difficult to obtain. Growth rate and therefore calculating terminal value is difficult because of instability of startups and human capital dependency. (Parviainen 2017, 128-129; Damodaran, A 2009; Sander, P and Köomägi, M 2007; Schootenbrugge & Wong 2013)

Van Schootenbrugge & Wong (2013) tells additionally that DCF undervalues technology options and spin-offs to lower the risk during the projects and adjust the NPV of the projects and therefore there is flexibility issue.

Regarding multiples finding comparable is not the issue anymore and Damodaran (2009, 55-56) sees that nowadays other problems are more relevant. (Damodaran 2009, 55-56):

- Arms-length transaction
- Timing differences
- Scaling variable
• Non-standardized equity
• Non-US-firms

As we are speaking of such considerable number of methods it can be included that none of the single methods overcome other fully. Therefore, it would be critical to understand further with interviews how the professional investors make decisions based on different valuation methods especially in healthcare analytics business. It is vital to use as many valuation methods as possible because traditional methods and more qualitative-related Berkus and Risk factor methods hardly capture the difficulties risen from startup valuation.

Berkus and Risk factor methods can be viewed as more suitable to value very early stage companies and they are very simple as there is little numerical to analyze and therefore require more intuition than quantitative analyzing. On the other hand, the rest of the methods like DCF can be better applied to companies who have passed already development and growth phases. (Parviainen 2017, 141)

Next, I will introduce to what amount these methods are used.

Pintado et al. (2007) found that DCF method in valuation was used most of all companies, after that P/E ratio and ja peer prices in the same industry. All methods except book value and replacement value were used more in later stage investments. (Pintado et al. 2007)

Dittmann et al. (2004) claims based on their research that if VC investors use multiples or real options, they are also using DCF valuation in higher probability. DCF method users are also using other methods like real options, multiples and IRR to get broader view on the valuation of the company. (Dittmann et al., 2004)

Block (2007) surveyed American companies about the usage of real options as an alternative method for budgeting. This survey proved that the utilization of real options in corporate use is still significantly low. Only 14,3% answered that they use real options, out of which 45% use real option tools. (Block, 2007)

In Scandinavia use of real options is even less than in the USA according to Horn et al. (2015). DCF is most widely used counting almost three quarters of CFOs in Scandinavia. Real options (6% of answers) are wider used by companies that are active in energy and biotechnology fields, traditionally fields that have high capital and R&D costs. The difficulty
of real options implementation is thought to be the reason behind of small utilization of real option techniques. (Horn et al., 2015)

Sander and Köomägi (2007) support world-wide view (Horn et al., 2015 and Block, 2007) that Real option method is used more seldom in CEE region because of its application difficulties, in comparison to USA, only merely in later stage investments. (Sander and Köomägi, 2007)

In Finland, Lahti, T (2011) found out that quantitative methods for valuation are widely (87%) used by Finnish Business angels. There is a reason for it, what is the worth and size of share of the target company and approximate earnings projection and therefore 34% used price-to-earnings ratio and other estimation methods for future earnings got 62%, the most. DCF method was the second most used. Payback period reflecting the cash flows ability to pay back the investment back took almost half of the participants. Multiples related to book value like cost/book value and replacement asset value estimate come to last places, cost book value being slightly more popular. (Lahti, 2011)

When we see VC valuation methods, VCs are not using traditional NPV or DCF methods. VCs are using mostly multiples and IRR. When comparing to CFOs of companies, VCs hardly ever try to forecast cash flows. (Gompers et al., 2016)

In conclusion about the usage of different methods it is clear that real options is seldom used in valuing young startups. DCF and multiples were mentioned mostly, which indicates that traditional methods are used still a lot in VC and valuation world. In Finland Lahti, T (2011) showed that different methods for forecasting future cash flows are mostly used and multiples are used a bit less but no other methods were used by business angels.

4 Literature review

In the literature review, with a determination, I am going to concentrate more on the topic of healthcare technology and venture capital in this segment. First, I am writing about venture capital in general in the healthcare analytics sector in the world and what are its trends. Thereafter I am writing deeper about the valuation related items in healthcare technology. As this is a new business field this part is very short due to lack of research done especially on valuation related topics of healthcare analytics.
4.1 Venture capital in context of healthcare analytics startups

Parviainen (2017, 215-216) opens up about healthcare analytics sector as that genetics is the hardest thing to understand. It is like financing a scientific research project and this is not a sensible investment target at all.

In New York City Healthcare VC report (2018) it was announced that in New York area solidly 79 companies gained over 700 million US dollars funding in 2017. Mentionable is that top 10 of the best healthcare technology companies received 25% of the funding. In New York there are 300 VCs investing to healthcare. In the whole world in 2017 over 13,8 billion dollars were invested through 412 deals. Since 2010, 2017 year has been highest in capital invested and deal size wise. See picture below.

![Investor deals and Capital Investments](modified from New York City Healthcare VC report (2018))

Champenois et al. (2006) did empirical research on biotechnology startups and how they were funded between 1995-1999. These firms belong to high-risk class and operate in R&D fields in biotechnology. Early stage financing was received by 42% of high-risk companies. But much less funding was received early-stage companies with lower risk. This, however, does not mean that VCs are redundant in this field since in Germany only 2% of the companies in high-technology industries have VCs as investors. Corporate partners are
rarely investing into high-risk startups. In low-risk markets CVC is very often the case and reduce the finance gap for startups. (Champenois et al., 2006)

Potter & Wesslund (2016) says that CVCs were funding 13% of 7,5-billion-dollar worth venture capital deals in 2015. Direct investments have the highest earning potential but risks are highest also and therefore the focus of direct investments are more into early and mid-sized companies with readiness for strategic partnership. Healthcare was one fifth of the entire VC investment market. There are three types of CVCs in healthcare (Potter and Wesslund, 2016):

- Many organizations in healthcare sector have formed separate units led by experts in order to spot healthcare startups that can be integrated into the main organizations. In this case financial success becomes first, latter is strategic. The investments are to help the founders to cope within the tough competition and scale themselves.
- Also, there are organizations who use their internal innovation to create possible startups.
- Additionally, there are CVCs that have more strategic view on investments. Of course, financial return is important but more important is to find the next big thing for a break through. These CVCs work closely with parent companies and gain resources and knowhow as they need.

Potter & Wesslund (2016) listed CVCs’ motivation for CVC activities are following:

- Competitive advantage in matter of innovative technologies and further access to it
- Chance to go enter new markets through innovations
- Decrease risk level with co-operation between parent company and startup, this is one the greatest benefits of CVC activity

In order to succeed in healthcare market, corporations are required to be flexible and agile in change. Implementation of innovative ideas/technology is the key. CVC is only then successful if failures are accepted in the organization. (Potter and Wesslund, 2016)

Rosiello and Parris (2009) investigate the motives related to strategy from VC point of view in bio-healthcare industry. The results show that VCs are interested into market size, quality of work/science the target company does and at what stage the target company is. VCs
come to the startups with great expertise and bring financial support. Strategy is usually changed when VCs come along. There are usually syndicates in bio-healthcare VC business, which means that VCs from other regions communicate often and look for other opportunities also outside their home. In the clusters formed by VCs and entrepreneurs a great knowledge exchange about internationalization and R&D among others is vital. (Rosiello and Parris, 2009)

So, in healthcare technology industry CVCs and VCs are very common and particularly provide same kind of results within activities and motives what the literature gave earlier on VC investments in general. The expertise (in market, technology and internationalization) increase and risk sharing are only some of the motives of VC and CVC mentioned in the literature.

Wilkins et al. (1997) claim that today the knowledge assets represent most of the startups, also in healthcare and pharmaceuticals among others. Startup valuation goes through three stages: Resume, revenues and return. Within resume one looks at founder team capabilities/skills and experience at early stage. Later, sales and return are becoming more important. As being noticed by many other researches in the field, management competence is the key valuation aspect for VC investors. Author cites one VC investor who says that there is enough capital, but not enough competent people to use it. There are some incentives like stock options to ensure that the employees are pushing the company forward. (Wilkins, J. et al.,1997)

Keppler et al. (2015) go through investment criteria of venture capital for medical technology startups in Austria, Germany and Switzerland and they found that regulation is a key criterion for venture capital. CE approval and data access are at main importance. Clinical data is required to be sampled and tested to get CE marking. Investors wanting to invest to startup and expansion stage companies see clinical data at higher importance than those investors focusing on seed phase. In case the technology is fine but it is too early to invest, VCs might decline investing but stay in contact for future. Medical technology has the market size of over 100 million euros. Criteria for management skills i.e. experience from the field for example is highly depended on the stage of startup life cycle. Therefore, it is necessary to notify startup lifecycle. Also need of data and demand of medical technology are factors that affect to VC opinion towards medical technology (medtech) startups. Key success factors
for medtech startups were found additionally and they are represented in the table below. (Keppler et al, 2015)

<table>
<thead>
<tr>
<th>Criteria group</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product, Technology and Medical</td>
<td>Key opinion leader advise is also important since doctors and other medical professionals are asked for opinion on the product or service, this can be seen as proof of concept. (Keppler et al, 2015)</td>
</tr>
<tr>
<td>IPR</td>
<td>Over 60 of answers supported that patents are very vital in the success of medicine and especially at the exit part. (Keppler, S.B. et al, 2015)</td>
</tr>
<tr>
<td>Business model and strategy</td>
<td>Kaplan and Strömberg (2004) saw that business model is important in the eyes of VCs. Regulatory strategy and IPR strategy are key strategies at medical technology (Keppler et al, 2015).</td>
</tr>
<tr>
<td>Market and competition</td>
<td>Market growth is very important feature and also the size of the market show significance of importance. Market size the VCs invest in are usually over 100 million euros. A minority prefer to look at exit potential (based on multiples on revenue) over market size. These sales figures are relevant in the market. One third appreciated also competition related to market size and growth. Later stage investors are ready to accept more competition as long as it is protected by some kind of competitive advantage. (Keppler, S.B et al, 2015)</td>
</tr>
<tr>
<td>Management team</td>
<td>Management criteria are very important for VCs especially commercial skills, industry experience and regulatory experience as they are mostly pre-conditional for investment technical skills are necessary since at least one person in the company should know it. Financial skills can be a positive indication for VC investor. (Keppler, S.B et al, 2015)</td>
</tr>
<tr>
<td>Financial criteria</td>
<td>High earnings are very important for all VCs and over 80% of VCs decline from the deal in screening or evaluation stage if factors related to return are not connected with VCs. About 13% of VCs thought that return is important, but none saw it as the most important one. Endorsing new technology is the main thing, financial issues come thereafter. Gross margin requirement is high, nearly 40-80% and this is dues to the fact that R&amp;D in medical technology is a strong factor, almost 10% of sales on average. (Keppler, S.B et al, 2015)</td>
</tr>
</tbody>
</table>

Table 12 Key success factors for medtech startups, Source: modified from Keppler et al, 2015
Alemany and Villanueva (2014) explored if the criteria chosen by VCs have predicted through investment criteria company success, in this case sales. There is the entrepreneur / team, market and product criteria. Out of the company sample about 14% were associated with healthcare. In conclusion entrepreneurial and team characteristics are the only one to explain the performance of companies in this case sales because profit itself is not a good criterion for performance measurement. (Alemany & Villanueva, 2014)

In conclusion one can say that Wilkins et al. (1997) (more radical approach that team criteria determines the whole value) and Alemany and Villanueva (2014) support the view of importance of capabilities of entrepreneur and team. Alemany and Villanueva (2014) added that in later stages financial criteria are more and more important. Within healthcare technology (medical technology) Keppler, S.B et al, 2015 underlined that there are regulations and technology in various relations are very important and their understanding in entrepreneur and team level should be high. Also, Keppler, S.B et al, 2015 saw that financial criteria were very important (not most important however) since 80% declined to invest if the company does not show enough return potential.

4.2 Business valuation in context of healthcare analytics startups

Due to lack of academic literature on healthcare venture capital topic, we are ready to move forward to interviews. With different search items I could not find any literature specifically on the topic of healthcare analytics startups valuation which is my main research question and topic. I tried several keywords in different databases.

I searched EBSCO – business source complete, Emerald journals and Elsevier science direct and Google scholar. The keywords used were: Venture capital, VC, startup, start-up, healthcare, healthcare technology, healthcare analytics, big data, valuation, valuation method, valuation methods, investment criteria. With different ordering I found the necessary articles but as explained already, there was no literature available for specifically healthcare analytics startup business valuation.

We are basing our empirical research part both on short literature review and the background information about investment criteria and valuation methods.
5 Empirical research – Semi-structured interview

This section will tell more about the qualitative research that I am going to use in this thesis. We will go through why the exact method has been chosen and tell a bit about the interviewees. Finally, I will introduce the results of the interviews.

5.1 Research approach (methodology)

As I am trying to conclude what kind of research method I am going to use, it would be helpful to demonstrate what other researchers have previously done. Regarding investment criteria section, past studies have used surveys, questionnaires and other post hoc methods.

As in Chapter 3, we found that not every researcher came to the same conclusion with valuation methods, the same applies with investment criteria. Therefore, we must think of method that is best for our research.

Nunes et al (2014) brings in a table of research method that past researchers have done. We can assume based on Eloranta, O (2018) and Viljamaa, V (2017) master thesis that our sample size would probably be under 20 VCs I am going to send the interview request to. With regards to information Nunes et al (2014 modified) gathered from old researches, with sample size of 20 only possibilities are descriptive statistics and content analysis for example basic information about VCs like size of investment and experience.
Zacharakis, A. and Meyer, G.D. (1998) say also that many of the researchers on this topic have been using post hoc methods. Criticism to this, there is the danger or bias that VCs are not that critical nor introspective about their processes related to decision-making. (Zacharakis and Meyer 1998)

There is another method used which is called real-time method and Zacharakis, A and Meyer, G.D. (1998) and it is related to quantitative side and uses for example regression analysis. The research itself uses, in addition to regression analysis, policy capturing being familiar in psychology. Different methods provide different answers and therefore it is hard to conclude which method is the best one. Problematic about post hoc methods used
previously is that there was used maybe too large variety of criteria written down in questionnaire which may lead to problem of VCs underlining too much on factors they use and forget others. (Zacharakis and Meyer 1998)

Regarding different question types both open and closed questions have their advantages and disadvantages for sure. The main worry about open question is that it can be time consuming and sometimes also the understanding of answers can be tough to underestimate. For closed question the main worry is that one can understand the questions and answers in many ways. Indeed, regarding understanding the questions and answer possibilities can be tough in both ways. For example, one can use different criteria that one relates to product/service but another research relates to market criteria. Or that one may not understand multiple method but there is another name that he or she uses more regularly.

For me, to understand VCs criteria importance, in the questionnaire there must be also ranking possibility. Carlos Nunes et al. (2014) goes from also wanting to identify the VCs i.e. there are questions to which startup lifecycle phase they invest. Regarding the criteria, they referred to researchers like MacMillan et al. (1985) and Muzyka et al. (1996). I am going to divide the criteria into (modified from Carlos Nunes et al. (2014):

- Personality and skills of entrepreneur and management team
- Product-related criteria
- Market-related criteria
- Finance-related criteria
- Other criteria

Viljamaa, V. (2017) in his master's thesis used an open question interview and had also various interviewees from different areas. The research topic is very similar to mine but he focuses on valuation methods in startups in general and not focus on specific area of startups. The primary reason for interview was that the research questions were not that straight forward and next questions could be applied straight to the previous answer. The key advantage for interview over questionnaire is that the interviewer does not restrict the number of topics that come to the actual research paper but the interviewer can keep the discussion around the topic. (Viljamaa 2017)
Eloranta, O. (2018) used semi-structured interview hence qualitative method. Here, the questions and order of those are similar. Why only similar? This is because questions can be changed and edited during the interview so the interviewer must be focused. (Eloranta, 2018)

I am going to do a semi-structured interview as I have 8 people to be interviewed. With semi-structured interview I can capture new findings and especially when there is no specific research done on valuation methods on healthcare technology startups, semi-structured interviews are the best choice. Because I am not specifically knowledgeable about the valuation methods of healthcare startups from VC point of view, I also want to add an open questions and additional comment sections to the semi-structured interview so that VCs can share their knowledge if they wish. This will broaden the possibilities of getting additional information for example about new valuation methods. All in all, this is a great chance and on my opinion the best way to familiarize ourselves with this interesting topic. Professor Mikael Collan will confirm the interview questions that I have created.

The interviews were conducted in Finnish language. Translation of the interviews was conducted by the author himself and the questions asked are in the appendix 8.1.

5.2 Description of data gathered / used

I contacted about 20 venture capital or private equity firms regarding the research. Firstly, I called them and in all cases I sent my interview questions via email in advance so that the people could prepare themselves for the interviews. The interviews took from half an hour to one hour. I found the potential interviewees in Finnish Venture Capital Association website Pääomasijoittajat ry (2018c). I selected in the industry section “Health technology” and so a group of VCs turn up. But, since not all investors are I used also google search and Word of mouth hints which investors could help me in this project. I took part in Terkko Health Hub seminar on 30th of October 2018 about how different investors and funding are available here in Finland some designed specifically for Health Technology field. This was a great event with lots of attention created to understand communication between investor and startups.
As seen from the table below I managed to contact quite many people investing and advising startups and growth companies in various stages. This is helping me to explain whether there are actual differences between methods used in business valuation in context of health technology startups in comparison to other fields. The diverse backgrounds of investors represent the interesting point that there might be possible differences regarding investment criteria and hence in valuation methods during the life cycle of startups. I am happy myself that the interviews were rich regarding the information and insight about venture capital and different valuation methods and criteria. Interviewees were very welcoming and open about the industry and this can be viewed well in the quality of answers.

As the interviews were conducted in Finnish language some wordings and interpretations of interviewees’ thoughts are subject to be interpreted by the author, Niklas Wasama. Some interviews were conducted over the phone, few were at a meeting rooms in various locations in the capital city region of Finland. One interview was made by email response.

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
<th>Position in the company</th>
<th>Investment portfolio (in M€)</th>
<th>Experience in VC (years)</th>
<th>Experience in Healthtec VC (years)</th>
<th>Investment lifecycle position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annastiina Salminen</td>
<td>Maki Ventures</td>
<td>Investment Director</td>
<td>80</td>
<td>2</td>
<td>1</td>
<td>From Product Development to Growth</td>
</tr>
<tr>
<td>Pasi Sorvisto</td>
<td>Spark Finland</td>
<td>Director</td>
<td>Cannot identify</td>
<td>23</td>
<td>23</td>
<td>IDEA/Startup (pharma tech and health IT)</td>
</tr>
<tr>
<td>Mikko Leino</td>
<td>M&amp;M Growth Partners</td>
<td>Partner</td>
<td>Prefer not to disclose</td>
<td>20</td>
<td>20</td>
<td>Growth and maturity</td>
</tr>
<tr>
<td>Antti Miettinen</td>
<td>Guida Invest</td>
<td>Manager</td>
<td>1,5</td>
<td>6</td>
<td>1,5</td>
<td>Operational roll-out</td>
</tr>
<tr>
<td>Anonymous A</td>
<td>Anonymous B</td>
<td>Investment Director</td>
<td>155</td>
<td>4</td>
<td>0</td>
<td>Beyond maturity</td>
</tr>
<tr>
<td>Juha Mikkola</td>
<td>Anonymous C</td>
<td>Partner</td>
<td>40</td>
<td>25</td>
<td>12,5</td>
<td>Development to Growth</td>
</tr>
<tr>
<td>Tuomas Kosonen</td>
<td>Inventure Oy</td>
<td>Partner</td>
<td>230</td>
<td>13-14</td>
<td>4</td>
<td>Idea / Startup</td>
</tr>
<tr>
<td>Petri Laine</td>
<td>Innovestor</td>
<td>Managing Partner</td>
<td>100</td>
<td>15</td>
<td>13</td>
<td>Development</td>
</tr>
</tbody>
</table>

Table 14 Descriptive statistics of interviewees
All interviewees are considered so called generalist so they have multiple interests where they like to invest. Healthcare analytics is fairly new field so experience level of investors is quite high and here may come a bias effect that interviewees started to think that the length of experience means healthcare in general but as analytics has been in thoughts of businesses then actually it makes sense that one could have even 20 years of experience. None of the interviewee were a concentrated expert of venture capital in healthcare analytics field. But they have some experience on healthcare sector in general. Miettinen, A (phone interview 1.11.2018) is the only investor in this group that is investing from own assets i.e. the VC company does not have a fund.

In color codes there are the stages related to life-cycle of companies. Please see figure 8 for reference. Sorvisto, P. (Phone interview 13.11.2018) concentrates on medical technology and pharma IT that are a bit out of the healthcare analytics and technology but still give to the research additional view. Also, it is important to point out that Anonymous A (interview on 15.11.2018) viewed that they concentrate on investments outside of the range of VC and go beyond maturity. I also interviewed one business advisor but his contribution will not be seen because his experience on venture capital is too limited.

5.3 Results

Here comes the results of the interviews and the questions asked from interviewees. Descriptive data is also provided to capture who the interviewees are. The point is to understand what kind of quantitative methods like DCF, multiples, real options etc. and qualitative investment criteria investors are using especially in healthcare analytics and technology sector. Also, information about syndicates and future interesting areas of healthcare analytics is asked. This part has the purpose of opening up the answers for the research questions and reflect how they are correlated to the literature.

These results help to answer to my research questions about valuation of healthcare analytics startups. The literature did not provide much of help even though one article about medical healthcare provided interesting views on investment criteria.

Not only answering research questions is important but to connect quantitative valuation methods and qualitative methods together. Main areas of focus are naturally these two areas
of valuation methodology. The purpose is to explain why certain valuation methods or their parts do not seem or seem to be successful in valuation. Another thing is that since these investors are investing in different stages of company life-cycle then according to literature something could change in methodology.

5.3.1 Quantitative valuation methods

We are interested into the quantitative methods here. In the literature it was noted that DCF, multiples and other “traditional” valuation methods have their issues but still many VCs tend to use them according to the literature. Also, it was introduced Berkus and Risk-factor methods that provide wider perspective to valuation and maybe have, despite their cons, another approach especially for valuing more effectively start-ups. I noticed through the interviews that many of the methods were unknown for the investors and therefore I tried to explain the methods especially Berkus and Risk-factor methods were most asked. I noted that perhaps Berkus and Risk-factor method are not part of the quantitative method –class and it is difficult to determine what methods are “quantitative” because usually to many people the difference of quantitative and qualitative is small.

Salminen, A (E-mail 13.11.2018) declared that due to lack of historical data, early-stage companies are hard to be valued on operations or its operations predictability. Multiple method is mostly used because early-stage companies are valued based on market where companies at the same stage and geographical area are compared. In addition, Berkus method and (possible risk-factor) other methods are used where quantified factors like team profile, earlier experience, comparative advantage and company strategy are valued. DCF, Venture capital method and Real options are used never or seldom. (Salminen, A. E-mail 13.11.2018)

Sorvisto, P (Phone interview 13.11.2018) focus on medical technology and pharma IT where in both company needs to be established at early stage but it can take easily 12 months to 10 years to conduct clinical trials and other R&D-related works. The positive cashflow is hence far away. It is nearly impossible to discount cashflows for 15 years medicine technology R&D project. Venture capital method is only used.
Miettinen, A (1.11.2018 phone interview) claimed, like others, that DCF has its difficulties and predictions about future cash flows made by the companies are not very trustworthy. Multiple method is mostly used in terms of traditional approaches, aim is to find listed or non-listed companies. Then it was found out after explaining Berkus method and risk factor model that they represent in the best way the valuation. DCF model is in the background.

Kosonen, T (interview on 8.11.2018) say that DCF or other quantitative methods are used only a little because the companies we analyze are so early stages. Well, multiple methods are used and venture capital method to see how much money is needed to invest and how does the cap table is distributed after that.

Laine, P (phone interview 12.11.2018) use multiple method and venture capital method and they are compared if the same conclusion can be achieved. Different multiples are easiest to use and then analysis is made how much investment is needed after the first round – with the similar method like Kosonen, T (interview on 8.11.2018).

Mikkola, J (interview on 12.11.2018) saw that DCF is used even if the company is at 0 revenue so then best-case scenario is calculated. Venture capital method was used previously much more but its importance has decreased because Finland is such a small market. Multiple methods are also used with DCF. Interviewee was telling an interesting story that what he has seen is that exit prices of VC-backed firm, 80% of valuation are based on intuition (not only methods used) at price range of 10-20 million dollars. These are firms that are sold because for example the team are wanted to be hired by the acquirer.

Leino, M (phone interview on 9.11.2018) tries firstly to find a comparable listed company and the valuations. After that, venture capital method is used to determine the terminal value and calculate IRR for investment if it makes sense reach the terminal value. DCF is seldom used in the usual form but then actually use Monte Carlo or other simulation technique to test parameters how they affect to return.

Anonymous A (interview 15.11.2018) saw that cash flow method is used in their case as primarily focus is on companies with already cash flow of 2-20 million euros with growth potential. Here this DCF and other quantitative methods are much better applied here as the forecasting period and finance structure are better verified. Mostly Multiple methods and
LBO (Leverage Buy Out) -method are used, DCF a little less than these other two. DCF and LBO method especially take into account the finance structure change impact on analysis. Also, interviewee would like to lift up ARR (Annual Recurring Revenue) and MRR (Monthly Recurring Revenue).

<table>
<thead>
<tr>
<th>Name</th>
<th>Quantitative methods used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petri Laine</td>
<td>- Multiple method</td>
</tr>
<tr>
<td></td>
<td>- Venture capital method</td>
</tr>
<tr>
<td>Tuomas Kosonen (Inventure)</td>
<td>- Multiple method</td>
</tr>
<tr>
<td></td>
<td>- Venture capital method</td>
</tr>
<tr>
<td>Juha Mikkola</td>
<td>- Discounted Cash Flow Method</td>
</tr>
<tr>
<td></td>
<td>- Multiple method</td>
</tr>
<tr>
<td></td>
<td>- Venture Capital</td>
</tr>
<tr>
<td>Anonymous A (Korona)</td>
<td>- Multiple method</td>
</tr>
<tr>
<td></td>
<td>- Leverage Buy Out –method</td>
</tr>
<tr>
<td></td>
<td>- Discounted Cash Flow –method</td>
</tr>
<tr>
<td>Mikko Leino</td>
<td>- Multiple method</td>
</tr>
<tr>
<td></td>
<td>- Venture Capital method</td>
</tr>
<tr>
<td></td>
<td>- Discounted Cash flow method</td>
</tr>
<tr>
<td></td>
<td>- Monte Carlo and other simulation technique</td>
</tr>
<tr>
<td></td>
<td>- Berkus and Risk-factor or similar –method for investment criteria valuation</td>
</tr>
<tr>
<td>Pasi Sorvisto</td>
<td>- Venture capital method</td>
</tr>
<tr>
<td>Antti Miettinen</td>
<td>- Multiple method</td>
</tr>
<tr>
<td></td>
<td>- Berkus and Risk-factor or similar –method for investment criteria valuation</td>
</tr>
<tr>
<td>Annastiina Salminen</td>
<td>- Multiple method</td>
</tr>
<tr>
<td></td>
<td>- Berkus and Risk-factor or similar –method for investment criteria valuation</td>
</tr>
</tbody>
</table>

Table 15 Quantitative methods used – Interviewee based

Quantitative methods are used by all our investors. The most popular method was multiple method. Venture capital method was used also. Laine, P (phone interview 12.11.2018) and Kosonen, T (interview on 8.11.2018) viewed that these methods were used to together.

Discounted cash flow method was popular but its importance was only minor in many cases and lots of critics was said about this method. Salminen, A (E-mail 13.11.2018) declared that due to lack of historical data, early-stage companies are hard to be valued on operations or its operations predictability. Sorvisto, P (Phone interview 13.11.2018) who is more into medical technology and pharma IT says that DCF I very hard to use as cash flows can take
up to 10 years or longer to arrive so forecasting is nearly impossible. This supports the problems mentioned about DCF method in the literature. Mikkola, J (interview on 12.11.2018) saw that DCF is used even if the company is at 0 revenue so then best-case scenario is calculated.

Even Anonymous A (interview 15.11.2018) saw that DCF is still beaten by multiple and LBO methods. On the other hand, DCF and LBO method especially consider the finance structure change impact on analysis. (Anonymous A (interview 15.11.2018)

Berkus and Risk-factor-like methods were used although not perhaps with the same structure by 3 VCs.

In all interviews quantitative methods had the minor role when talking about early-stage and early growth startups and it came very clear to me (personal opinion) that in more late-stage investors focused more on quantitative approaches. Again, it is hard to determine any consensus on the methods because a lot of different methods are used in different order and some methods are used less and some more. Other methods mentioned in the literature for example real options, first Chicago method and specific valuation methods for intangible assets were not mentioned. We can say also that later-stage investors Leino, M (phone interview on 9.11.2018) and Anonymous A (interview 15.11.2018) are using more different quantitative methods like simulations and LBO in addition to multiples and DCF methods. This might come from the fact that these two investors invest into companies already having cash flows and other parameters that makes it possible to use these methods and support therefore the intuition and qualitative criteria that are going to be discussed next.

5.3.2 Top 3 most important investment criteria

What are your top 3 most important criteria?

The purpose was with modification from Franke et al. (2008) to search which criteria would be among most important criteria for Finnish VCs when investing into healthcare analytics and technology startups. In most cases top three criteria were asked but in one case the
answer was brought up already in another question with more than just one answer. In this research the question about the top 3 most important criteria is gathered in the table below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petri Laine</td>
<td>1. Real market (there is demand)</td>
</tr>
<tr>
<td></td>
<td>2. Technology works</td>
</tr>
<tr>
<td></td>
<td>3. The scale of clinical research</td>
</tr>
<tr>
<td>Tuomas Kosonen (Inventure)</td>
<td>1. Team</td>
</tr>
<tr>
<td></td>
<td>2. Market</td>
</tr>
<tr>
<td></td>
<td>3. Business model or technology (depending on the case)</td>
</tr>
<tr>
<td>Juha Mikkola (Capman)</td>
<td>1. Leadership</td>
</tr>
<tr>
<td></td>
<td>2. Honesty and reputation</td>
</tr>
<tr>
<td></td>
<td>3. Market growth/potential</td>
</tr>
<tr>
<td>Juho Mäkiaho (Korona)</td>
<td>1. Management team</td>
</tr>
<tr>
<td></td>
<td>2. The attractiveness of growth plan</td>
</tr>
<tr>
<td></td>
<td>3. Return on investment</td>
</tr>
<tr>
<td>Mikko Leino</td>
<td>1. Product – market fit</td>
</tr>
<tr>
<td></td>
<td>2. Team and how it fits to product – market fit</td>
</tr>
<tr>
<td></td>
<td>3. Entry valuation and IRR</td>
</tr>
<tr>
<td>Pasi Sorvisto (med tech and pharma IT)</td>
<td>1. Innovative service or product and its IP rights protection</td>
</tr>
<tr>
<td></td>
<td>2. Market possibilities and the available resources</td>
</tr>
<tr>
<td></td>
<td>3. Team intensity and learning ability</td>
</tr>
<tr>
<td>Antti Miettinen (usko, toivo ja rakkaus)</td>
<td>1. Love (enthusiasm of the entrepreneur and team)</td>
</tr>
<tr>
<td></td>
<td>2. Hope (Market potentiality and thinking outside the box)</td>
</tr>
<tr>
<td></td>
<td>3. Belief (team creditability and own belief into your thing)</td>
</tr>
<tr>
<td>Annastiina Salminen</td>
<td>No in specific order but criteria that are underlined in the investment decisions are: Team background, team dynamics, sales capability, chemistry between team members and investors and degree of readiness of technology</td>
</tr>
</tbody>
</table>

Table 16 Top 3 criteria – Interviewee based

As seen from the table above team and entrepreneurial characteristics were the most important just like in other researches before like Franke et al. (2008) summarized. Market is also very important character and especially its demand, potentiality and growth. explained how important is to find product-market fit like also that the team fits also into the product and market. Learning ability, chemistry, credibility and honesty were also mentioned in the interviews as important regarding investment criteria.

Product criteria were not that popular and only one interviewee mentioned the innovation and intellectual property rights. Also, the functionality of technology was mentioned. (Laine, P phone interview 12.11.2018; Sorvisto, P. phone interview 13.11.2018)
Regarding financial criteria only two investors raised their importance and this is notifiable that both are at the end (near maturity and above). (Anonymous A interview 15.11.2018; Leino, M phone interview 9.11.2018) Both investors underlined that they are responsible for the investors so this is important aspect as well. They use more quantitative methods as they analyze more mature and cash flow positive companies.

5.3.3 Entrepreneur and team criteria

Entrepreneur and management team criteria were among literature the most popular criteria and as we found out in the top 3 most important criteria the VCs also tend to appreciate the most team capabilities and their connected items.

<table>
<thead>
<tr>
<th>Name</th>
<th>Antti Miettinen</th>
<th>Kosonen Tuomas</th>
<th>Juha Mikkola</th>
<th>Petri Laine</th>
<th>Mikko Leino</th>
<th>Juho Mäkiaho</th>
<th>Pasi Sorvisto</th>
<th>Annastiina Salminen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust and honesty</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Credibility</td>
<td></td>
<td></td>
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<tr>
<td>Learning capability</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Customer / Service orientation</td>
<td>x</td>
<td></td>
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<td></td>
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<tr>
<td>Positivity</td>
<td>x</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Understanding of field and market</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Ambition and motivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance and Marketing skills</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Technical skills</td>
<td>x</td>
<td></td>
<td></td>
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<td></td>
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<td>x</td>
</tr>
<tr>
<td>Clinical research and regulation experience</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Leadership skills</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Future plans of the company</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Building customer relations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Chemistry</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Ambition</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Founder / manager relation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Out of the box thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Table 17 Entrepreneur and management team criteria – Interviewee based
Miettinen, A. (phone interview 01.11.2018) told that the most important features of entrepreneur and management team are: “If the entrepreneur is focused on the business and understands it, the product, needs of customers, market potential, customer orientation and does this positively, they are the most important things.” In short, the entrepreneur must be aware of the market trends and lead the company through the changes by being also customer focused. (Miettinen phone interview 01.11.2018)

Market and especially customer understanding was also important for Mikkola, J. (interview on 12.11.2018). Sorvisto, P. (phone interview on 13.11.2018, however, concentrated the knowledge more on the technical side so that this knowledge will able a break through, although market understanding is part of it.

Kosonen, T. (interview on 8.11.2018) underlines the practical experience of the management team, backgrounds are always checked for example previous partners for reference. It is not just investing into one person but a whole team and this means that people should have complementary skills in order to be stronger together. If the company is at early stage it is understandable that teams are not complete and so re-organizing must be done.

Leino, M. (phone interview 9.11.2018) saw that like Kosonen, T. (interview on 8.11.2018) that team must have complementary skills and avoid that only one in the team knows just one special thing. Additionally, dynamics was seen as very strong because during tough times you have no one else to rely on than the team. It is important also to know whether founders are also part of the management team. Dynamics come handy in terms that as health technology is very domain-focused field and you must have deep knowledge about the field.

Mikkola, J. (interview on 12.11.2018) told that all criteria presented were becoming more and more important at every stage. When going further the investment decision process, the deeper the looking at the company goes. In the first meetings number are not the topic but the actual people their leadership philosophy. Also, interviewee gave an interesting thought about how the reputation affects but the personal feeling matters the most, not the past. Still reputation counts as if there is no trust then nothing can replace it.
Laine, P. (phone interview 12.11.2018) told like Kosonen, T. (interview on 8.11.2018) and Mäkiaho, J. (interview 15.11.2018) and that experience from finance and marketing are appreciated but not must above basic level and knowledge can be brought from job market. Regarding health technology companies especially experience in regulatory processes and clinical researching are appreciated.

Sorvisto, P. (phone interview on 13.11.2018) underlined team’s ability to learn and take feedback and move forward and chemistry. He used words “intellectual honesty” in describing that everyone makes mistakes and if you have problems you need to report about it and not hide them. He also saw that in health care technical skills are very important, which supports also ideas from Leino, M. (phone interview 9.11.2018).

In conclusion, one can say that honesty and integrity were the most appreciated character of entrepreneur and team. This is not a news as VC is people business as I saw in the interview. The chemistry between entrepreneur and investors is very important and honesty and integrity affects both. Sorvisto, P (phone interview on 13.11.2018) said it nicely that intellectual honesty and admitting you are wrong and learn from experience are the key. After that comes surprisingly market understanding through importance of entrepreneur and team needing to very well understands market and the trends and items like customer, potential etc. affects it. (Miettinen, A phone interview 01.11.2018; Mikkola, J interview on 12.11.2018; Sorvisto, P phone interview on 13.11.2018).

Third most important was experience in various forms. Financial and Marketing skills were appreciated but not must and can be acquired from outside (Laine, P phone interview 12.11.2018; Kosonen, T interview; Anonymous A interview 15.11.2018). Leino, M (phone interview 9.11.2018) saw that like Kosonen, T (interview on 8.11.2018) that team must have complementary skills and avoid that only one in the team knows just one special thing. Salminen, A (E-mail 13.11.2018) and Laine, P (phone interview 12.11.2018) underlined that team with experience of healthcare technology related research and regulation will is beneficial.

It is also clear that teams do not have to be ready and VCs are open for changes and additions in teams to get more skillful team according to the interview with Kosonen, T (interview on 8.11.2018) proved it.
5.3.4 Market criteria

Market criteria was the second most important criteria when looked at the previous literature. Product and market usually goes hand in hand and among the three most important criteria it was underlined that market knowledge is very important for VCs.

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Anti Miettinen</th>
<th>Kosonen Tuomas</th>
<th>Juha Mikkola</th>
<th>Petri Laine</th>
<th>Mikko Leino</th>
<th>Juho Mäkiaho</th>
<th>Pasi Sorvisto</th>
<th>Annastiina Salminen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market size / sales</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Growth</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market potential</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relevant and addressable</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market share</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>me</td>
<td></td>
</tr>
<tr>
<td>Internatinality</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networking</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<td></td>
</tr>
</tbody>
</table>

Table 18 Market criteria – Interviewee based

Mikkola, J. (interview on 12.11.2018) explained that the strategy is to build leading companies in niche market so the market does not have to enormous, but company needs to be the best one in its niche. The other option is that the market is really fast growing and the company is working in the front line and we believe that this company will be acquired.

Miettinen, A. (phone interview 01.11.2018) saw that internationalization is important but usually due to shortage of capital exit (or staying minority shareholder at highest) usually happens occurs at the edge of internationalization.

For Laine, P. (phone interview 12.11.2018), on the other hand, internationalize potential is a pre-requisite for investment. Leino, M. (phone interview 9.11.2018) explained that firstly one must think of the home market and its achievable market share and what are the sales figures if successful. Then one can go to Sweden but Norway is already completely another story and to USA you should have a great plan to achieve it as it is the world’s most competitive market.

Sorvisto, P. (phone interview on 13.11.2018) discussed about the market understanding previously and he wanted to raise the point that there is no need to trust consultants’ reports
about markets and therefore investment team wants to encourage researchers, students and other employees in the startups to go to meetings and events to create network. Also, going abroad is important to see how the competitors and market works. Design thinking is important also as world is changing constantly and this should be brought into use in market understanding in order to create for example new business models.

Kosonen, T. (interview on 8.11.2018) supports Sorvisto, P. (phone interview on 13.11.2018) by saying: “They need to describe how to get there and so have market understanding, this is important. Let’s take an example like car industry it is worth trillion every year but for a new company building some gadgets market potential is not worth that much, therefore market understanding is vital. “

In conclusion, market potential and market growth were the most important criteria found. Mikkola, J (interview on 12.11.2018) even ranked market growth and potential to the top 3 of overall criteria. Kosonen, T (interview on 8.11.2018) explained that market needs to be addressable, large enough and enough growth potential but again crucial is that it is understood how well the market understanding is in the team. So, one can say that in the team market understanding was thought to be very important so hence this reflects that also market criteria are important.

Sorvisto, P (Phone interview 13.11.2018) and Salminen, A (E-mail 13.11.2018) see also that market cycles are long in healthcare technology.

5.3.5 Product / Service criteria

The product category concentrated in the literature review on the product or service being innovative and how they are being protected by intellectual property. Other regulatory areas came to acknowledgement later in the literature review when medicine technology was discussed. I expect that regulatory issues are also part of health technology. Even though only 3/8 of top 3 criteria were mentioned close to product criteria product, it is still important to dig into more detail how product category was seen by interviewees.
Miettinen, A. (phone interview 01.11.2018) opened that in any area also in health care different permissions must be in compliant with the law and regulations. Patents are however sometimes too heavy for companies at this lifecycle stage. The process of applying is heavy and to the protection you may easily spend a lot of money. Also, a misusage of patents is simple in many cases. There is a danger that time and resources goes into protecting the innovation rather than focusing on commercialization of the business. The product could be tested and take a risk that someone would try to intervene with similar product. This may not be a bad thing since it is possible that the value of the market grows and so does the market share of the company. Also, it would be better to let for example two companies seek in, market will grow and product gets validated. Patent is more justifiable in “…for example in healthcare technology and there is a genetic disease for example diabetes already the market exists, and through healthcare technology a new cure is invented, in this case when the market already exists so through innovation a new cure is invented so here patent is more justifiable. So, if there is new product that will serve completely new market that does not even exist, patenting does not sound sensible. “

Kosonen, T. (interview on 8.11.2018) also does not want to focus on just one area of business fields i.e. for example healthcare. He agrees with Miettinen, A (phone interview 01.11.2018) that patents may not be needed at the early stage but for larger companies like Nokia they serve good. Patents are to be understood in how company does business and how it is unique. They help but not solve troubles. He shows some skepticism about patents although his VC appreciates that someone innovates something new for the market and it has been validated. Skepticism lures in from the fact that the competition is so high and copy cats lie everywhere. He appreciates innovation more than patents. Here again, growing
market where there are few other players is a good sign for market growth. (Kosonen, T. (interview on 8.11.2018)

Mikkola, J. (interview on 12.11.2018), on the other hand raises that patents are not valuable if you are not able to utilize them. In the case the idea is strong patents are to be used. Healthcare companies are always international and the regulation in this area is very important, like told by Miettinen, A (phone interview 01.11.2018), and at the same time puts a challenge to organize because they are expensive and costly. CE- regulation compliance is very basic but FDA regulations in the United States are already very difficult to get. (Mikkola, J. interview on 12.11.2018)

For Leino, M. (phone interview 9.11.2018) patents are again a two-headed sword with pros and cons. In some cases, you may not even get to speak to investors if you do not already have a patent. In a digital health area for example the protection may come from just owning the solution that gives you a competitive advantage and you may not open this solution to crowd via applying to a patent. Leino, M (phone interview 9.11.2018) brings an interesting example about innovativeness. Like Kosonen, T. (interview on 8.11.2018), he was skeptical about the innovativeness. Leino, M. (phone interview 9.11.2018) told that sometimes treatment solutions in healthcare are created firstly for example around heart diseases but then (noticed by communication platforms) it could also work for diseases located in brain. For investors it does not make much difference for what is used for if the treatment idea is similar. (Leino, M. phone interview 9.11.2018)

Sorvisto, P. (phone interview on 13.11.2018) tells about, supporting (Leino, M. phone interview 9.11.2018), firstly of re-purposing of medicine means that for this medicine a new purpose of use will be invented and it could be for existing market a new medicine that has been also used to treat another disease. Other side of the story is that how these innovative technologies make new world possible and create new market. One example is to try cure one illness chemically with medicine but then it is figured out that a transplantation can be done.

Sorvisto, P. (phone interview on 13.11.2018) saw that patents are important in protecting the competitive advantage and generate positive cash flow out of it. Like Mikkola, J. (interview on 12.11.2018), Sorvisto, P. (phone interview on 13.11.2018) sees that if
patenting is only then necessary when the innovation can be utilized. Sorvisto, P. (phone interview on 13.11.2018) describes Laine, P.'s (phone interview 12.11.2018) story that scientists may lose their competitive advantage if they publish the innovation without the patent already applied and accepted. On the other hand, Laine, P. (phone interview 12.11.2018) sees that publishing also has the upside in getting views from key opinion leaders from science community. Sorvisto, P. (phone interview on 13.11.2018) sees that actually 50 000 euros invested into a good patent (in software industry getting patent is more difficult than in pure technology) but a sum of 50 000 euros patent cost is small what investors are willing to invest. Mikkola, J. (interview on 12.11.2018) supports the that one should invest money into good quality patent application, only then it has some worth.

In conclusion, product and service criteria focused mainly on patents and their importance for company valuation. Mikkola, J (interview on 12.11.2018) and Sorvisto, P (phone interview on 13.11.2018) saw that patenting was sensible if the utilization can be done right. Both said also that investing into protecting innovation should be done and with the right people, otherwise patent is worthless.

Leino, M (phone interview 9.11.2018) and Sorvisto, P (phone interview on 13.11.2018) talked about innovation being important but what is interesting is that the thoughts of product or service are related to market. It clearly does not matter how innovative the invention is but it matters how it reacts and relates to the market. (Leino, M phone interview 9.11.2018; Sorvisto, P phone interview on 13.11.2018) Miettinen, A (phone interview 01.11.2018), with support of Kosonen, T (interview on 8.11.2018) summarizes very well that the focus should be on the market (not trying to protect the product by all means) and test the product there and let the market itself validate the product or service. Additionally, when talking about product and market relation Leino, M (phone interview 9.11.2018) saw this relation very important but also that the right team would fit in also.

5.3.6 Financial criteria

Financial criteria were viewed in the literature generally the least important criteria as 2/8 of investors listed financial criteria in top 3. However, as found out in the literature investment does need to come with return and therefore we like to view financial criteria also. I am thinking that as we move forward in the startup lifecycle and as it starts to become easier to
forecast cashflows and measure financial criteria, these criteria are becoming more and more important.

<table>
<thead>
<tr>
<th>NAME</th>
<th>CRITERIA</th>
<th>Antti Miettinen</th>
<th>Kosonen Tuomas</th>
<th>Juha Mikkola</th>
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Table 20 Financial criteria – Interviewee based

Miettinen, A (phone interview 01.11.2018) does usually minority investments and thinks of exit possibilities through shareholder contract but does not like to put specific time frame on exit. Regarding rate of return, they do not see it as operation-forwarding factor although some return has to come of course. This comes also from the fact that this VC invests from founder’s assets, not through fund. However, cashflow-based ratios like EBITDA and to what the money invested go (administrative costs vs how much goes to growth) is taken into account.

Kosonen, T (interview on 8.11.2018) wants underline that because they are running a portfolio of companies the return of the whole portfolio is at focus. But, in every company 10x return is the opportunity we want to see but there are companies in the portfolio that do a bit worse and ones that do better, not just binary. Investment size is naturally important because fund has limited amount of capital. Usually it is ensured that enough resources are reserved for next rounds but it is important that the companies show that they use the money to create value.

Mikkola, J (interview on 12.11.2018) explained that healthcare projects take a lot of time and take a lot of resources to run for example in terms of regulations. Therefore, there are not that many investors in Europe specializing into healthcare. 3-10x is for Mikkola, J (interview
appropriate return. Investors have less impact on company’s fixed costs and market in many cases decide what the sales margin is.

Leino, M (phone interview 9.11.2018) underlines the return on investment and the relation between return and risk. It is especially difficult to justify high valuation and risk when return is low. Legal and financial due diligence are done to ensure the validity of valuation. Investment size is from 200 000 euros to 5 million euros.

In conclusion financial criteria was only in 2 out 8 eight top 3 lists of most important criteria. Return on investment was selected as the most important criteria. Anonymous A (interview 15.11.2018) saw that it is not sensible to invest if the expected return is not fulfilled. Also, Salminen, A (email on 13.11.2018) notified that return was very important. Leino, M (phone interview 9.11.2018) saw that it is not advisable for companies to go to presentation with too high valuation when return is low. Laine, P (phone interview 12.11.2018) and Mikkola, J (interview on 12.11.2018) agreed that appropriate level of return is 3-10x of investment. However, Miettinen, A (phone interview 1.11.2018) saw return as important but not as a factor that would steer operations.

Second important was different financial ratios from EBITDA to sales margins that the investors like to pay attention also. Especially Miettinen, A (phone interview 1.11.2018) mentioned the investment use rate for operative and growth factors.

Both Leino, M (phone interview 9.11.2018) and Anonymous A (interview on 15.11.2018) get also outsourced legal and financial due diligence to ensure the validity of valuation.
5.3.7 Other criteria

As I was talking before, the purpose of this research was also to find other VC criteria specifically for healthcare. Other criteria found in the literature review were about business plan, fit to investment strategy, sustainability and lots of others. Now, let’s dig deeper into what our investors have the say about other criteria.

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<th>NAME</th>
<th>Antti Miettinen</th>
<th>Kosonen Tuomas</th>
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<th>Petri Laine</th>
<th>Mikko Leino</th>
<th>Juho Mäkiaho</th>
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<td>Fit to investment strategy</td>
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<td>Number of patents</td>
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Table 21 Other criteria – Interviewee based

Salminen, A (E-mail 13.11.2018) rated business plan, fit to investment strategy and chemistry of entrepreneur and VC as very important.

Anonymous A (interview 15.11.2018) also thought that business plan and the team’s ability to execute it is very important. Additionally, investment strategy and its fit to portfolio is important because investors are trusting to the VC to invest into companies that fill in the requirements of portfolio.

Laine, P (phone interview 12.11.2018) saw that customer retention was important aspect whether the technology needs any updates and taking care of, this helps to analyze how
much more stable cash inflows are coming from the technology. Additionally, paying attention to possible data that can be utilized either now or for later stages for example in research is important. Regarding business models, the General view is that business models are easier to build up around therapy and treatment. In preventive the problem is that everyone sees that this is how it should be done and all the benefits goes to the whole value chain but it is hard to find who would pay for the benefits.

Mikkola, J (interview on 12.11.2018) saw that value chain in whole was interesting to analyze, this means all middle men and partners. This helps to understand the stake what the company can it acquire the in the whole chain. In addition, he saw that data utilization is also an important criterion.

Kosonen, T (interview on 8.11.2018) saw also data utilization, quality of data and number of patients related to revenue as important. Financial KPIs do not bring value on their own because as in purely health side SaaS project SaaS metrics are more used as they provide better scalability. Business plan is important but also checking background information through interviewing clients and other stakeholders is important to reflect what needs to be improved in the future.

Anonymous A (interview on 15.11.2018) also liked to raise reference calls as important part of checking the business plan. The best-case scenario is that everything goes as planned in the business plan.

In conclusion, investors saw business plan as the most important criteria but related references (calls and interviews with stakeholders) for the plan and team validation are also checked. (Anonymous A interview on 15.11.2018; Kosonen, T interview on 8.11.2018) Additionally, interesting point about healthcare was the utilization of data and its quality as criteria that was brought by Laine, P (phone interview 12.11.2018), Kosonen, T (interview on 8.11.2018) and Mikkola, J (interview on 12.11.2018).

5.3.8 Intuition and its importance

It was notified in the literature that intuition plays a big part in the literature and it is emphasized that the VC – startup relationship is mainly people business. Zacharakis and
Meyer (1998) described gut feeling and its importance in the world of great uncertainties. Zinecker and Wolf (2015) tells that the intuition of investor towards entrepreneur is very important in addition to other factors that investor can bring to the company.

All interviewees emphasized that intuition is important, there were however some differences in the answers. Personal match is seen important. Like Salminen, A (E-mail 13.11.2018) saw that intuition can also develop through experience you gather. VC business is very much deeply in touch with psychology when determine team’s strengths and weaknesses, and this is the hardest part.

Miettinen, A (phone interview 1.11.2018) underlined that intuition is important in determining the investment decision. Also, he found that although you may be confused by intuition you are still able to justify your decision based on facts or seeing things objectively. First impression usually appears to be the reality.

Kosonen, T (interview 8.11.2018) agrees that the first impression can fail and people are supposed to be given full chance. In technology field since the investment horizon is long, you should not underestimate intuition and importance of both sided chemistry because VC is co-operation. Sometimes, chemistry works but they have seen that they are not the right investor for the company and should be noticed.

Mikkola, J (interview 12.11.2018) told that intuition means a lot when you have to make decision that you cannot base on facts, it is just how it is and this is taught to young investors. He put it nicely: “Any firm coming to present their case to us, and we can shoot them down in any logical way (like that is not going to be successful at all). A good investor, however, has the ability to see imperfect case meaning that the company has all sorts of problems but if they are fixed this can be a success story. But the good investor cannot always base that decision on numbers or other criteria.”

Laine, P (phone interview 12.11.2018) was most critical than anybody else regarding that when you get gut feeling it is hard to change it with facts. If intuition says yes to investment turnaround with facts is a bit easier but no-feeling is nearly impossible to be turned into positive again.
Sorvisto, P (phone interview 13.11.2018) did not just see intuition as a definition towards chemistry between investors and entrepreneurs but also relating to other things like competition and market affecting the company. He said that that is why generalist investors are in trouble because markets in cancer medicine and gadget for filming are two totally different worlds.

Leino, M (phone interview 9.11.2018) explained that as chemistry is very important, like other interviewees also told, when working in team of investors it helps to look cases from different angle. If some cases shown by scoring matrix are unclear extended research is in order. (Leino, M 2018)

Anonymous A (interview 15.11.2018) saw that when doing qualitative valuation, in cooperation with quantitative, is based mostly on trust, background and assessed ability to execute the growth strategy.

In summary, we can say that all interviewees consider intuition as important. Some say that it first time intuition is so important that it cannot be changed but some say that in some cases intuition can be turned around with facts. Yes, facts, Anonymous A (15.11.2018) belongs to the investors who mostly operate out of the range of VC and it can be so that since there are more actual financial data and other facts (for example regarding market) intuition may play slightly smaller role and the justification for investment is easier to make. This is rationalized in the literature when thinking of the startup lifecycle and the “easiness” of valuation when the company grows and moves forward in the lifecycle.

For me personally intuition comes as chemistry and trust and as it was pointed out that integrity and honesty are important factors and VCs really appreciate this quality then there might be a crucial link between positive intuition and honesty.

5.3.9 Syndicates and their effect on investment decisions

7/8 investors claim that they have syndicated at least some of their investments. The literature brought by Etula (2015), Parviainen, A (2017), Gompers et al (2016) and Manigart, S et al (2006) list several advantages of syndications:

- Risk management through portfolio and expense risk
• Target wider selection of investments with more capital
• Chance to gain expertized VCs to join and cooperate with

Syndication was found very important especially in the light of bringing additional expertise to the investments. Anonymous A (interview 15.11.2018) was the only interviewee who replied not having any experience with syndicates but underlined the importance of expansion of expertise in the investor side of the table with the risk of having too many different motivations for investment. Mikkola, J (interview on 12.11.2018) shared that it best syndicates investors are open to each other and bring their expertise and networks to the company and fulfill that knowledge when working in the Board.

Sorvisto, P (phone interview 13.11.2018) was additionally mentioning that as big corporations have also venture capital investing activities (CVC) they usually play without considering what is best for entrepreneur and the team. Google for example is a splendid example of CVC that can serve as independent investor. In health care money is also important and therefore syndicates help the company’s financing needs. Also, he mentioned that the current investors reflect to the culture of the company. Hence potential investors will see what kind of culture is created in the company, what kind of people want to work there.

Mikkola, J (interview on 12.11.2018) explains that CVCs have additional issues with the fact that usually corporates send to startup a board member and he or she usually does not have any personal incentive for performance and hence does not put all effort into it. Also, there have been stories that in some CVCs have changed the representative even five times during investment period.

Miettinen, A (phone interview 1.11.2018) sees CVC investments as signal that the startup is potential investment target. Industrial players bring lots of knowledge in product and market area especially. (Miettinen 2018)

Kosonen, T (interview 8.11.2018) told about issues that when there are too many different investors and expectations then the time of CEO of startups goes into managing investors and not the business as it should be.
Another item connected to syndicates that will come when more and more investors arrive is anti-dilution. Leino, M (phone interview 9.11.2018) tells that to protect the fund’s investors there must be set anti-dilution protection. Sometimes, in case of too high valuation VCs could write a contract for advantage to take the investment back before anyone else. (Leino, M 2018)

Laine, P (phone interview 12.11.2018) underlined also that investors are protected by investor agreements and if minimum requirements cannot be mutually agreed between investor and target company the investment will not work out. Miettinen, A (phone interview 1.11.2018) told that to hedge against dilution and early investing risk free shares are given if specific value is achieved at certain investing time frame.

In summary, Syndication was found very important especially in the light of bringing additional expertise, networks and capabilities to the company. Corporate venture capital (CVCs) was thought to be two-way: First of all, as its best Miettinen, A (phone interview 1.11.2018) sees CVCs investments as signal that the startup is potential investment target. But some investors noticed that CVCs have little incentive to develop the company (Mikkola, J interview on 12.11.2018; Sorvisto, P phone interview 13.11.2018).

Another topic discussed was dilution effect when there are many investors with different expectations. Shareholder agreement were mentioned and sometimes funds have minimum requirements and if these do not fill up, investment does not work out.
I thought that it would be beneficial to acquire future thoughts about health technology market and which fields are interesting from VC point of view. This is important since we do not know much about how the technology is going to develop as today’s world is uncertain. Clearly, following things stepped out:

<table>
<thead>
<tr>
<th>NAME</th>
<th>Anti Miettinen</th>
<th>Christian Lardot</th>
<th>Kosonen Tuomas</th>
<th>Juha Mikkola</th>
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<tr>
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Table 22 Future healthcare fields – Interviewee based

Miettinen, A, (phone interview 1.11.2018) described that Artificial intelligence is going to be used even more in the future for example in storing people health information to cloud. Also, one can use crowdsourcing to spot patterns from huge source of data and make conclusions. Kosonen, T. (interview 8.11.2018) added that AI possibilities faster and more efficient diagnosis making. Also, he mentioned (supporting Miettinen, A., 2018) different apps for measuring for example stress and through that build up data to treat people right. Mental health problems are also very largely growing concern and its treatment is digitalizing fast. (Kosonen, T., interview 8.11.2018)

Mikkola, J. (12.11.2018) mentioned as application of e-health external treatments for sleep apnea patients. He also found that AI will serve its best purpose in finding solutions for diagnostics: “Healthcare analytics companies and the suppliers of services are going to be a great advantage in the future in efficiency of healthcare.”
Laine, P. (phone interview 12.11.2018) added that personal health monitoring through digitalization will be most important field under healthcare analytics. Additionally, he warned that although AI can be great help in diagnosis, it cannot still replace the doctor.

Sorvisto, P. (phone interview 13.11.2018) did not mention anything specific area because there is need for health every day and possibilities can be found anywhere whether they are medicines for difficult diseases or for diseases that have not yet been successfully cured. He adds that Finland is great at research in medical area but that we would need VCs that are specialized in health care.

Salminen, A (E-mail 13.11.2018) underlined that virtual reality is difficult to execute in clinical environment and its expanding in practical use has decreased as there is shortage of gadgets and expensive price. Advantages of personalized diagnostics however are waiting for crucial approval. Furthermore, digitalizing of imaging is growing fast but old ways of working and needed surface integration are slowing the development down.

AI –technology and machine learning were the most important fields of future health care technology. Also, e-health and robotics were seen as crucial part of future health care technology.

6 Summary and Conclusions

In conclusion section I am going to go through what the thesis has revealed on the topic and link literature with the empirical research conducted.

6.1 Conclusions and discussion

This master thesis had the goal to explore evaluation methods of specifically health care technology companies especially from venture capital investor point of view. The goal was targeted in two ways. Firstly, I conducted comprehensive background and literature review to reflect relevant evaluation models that venture capital investors are using: Investment criteria and “quantitative” valuation methods. Then, it was time to widen the background and literature review and conduct the actual empirical research part on how do Finnish VCs valuate healthcare technology startups. The research method was semi-structured interview because the research was very new in this business segment that actual interview would benefit the research in the future in the area of venture capital. Now in this section I would
like to present the research questions and how were they answered to and how they are connected to each other. The goals set gave me two research questions two study and here is the first question:

*What are the most important valuation methods for startups in the eyes of venture capital investors found in literature review?*

When we review the background information and short literature review we see to understand that there are two parts of the evaluation phase in investment decision-making. Firstly, I was explaining the emphasis of healthcare technology and why it is important. When reading Parviainen, A (2017) and Kallunki and Niemelä (2007, 23-32) then it became clear that some “quantitative” valuation methods also require using qualitative factors i.e. the investment criteria. Therefore, the valuation methods are not that easy. First of all, the difficulties of startup valuation were brought up and through literature different valuation methods were introduced and explain what are their pros and cons especially when thinking of startups. The literature also explained how previously “quantitative methods” were used and to what extent.

Then as explained that investment criteria are part of the valuation methods we found out that literature consists of five different criteria categorize: 1. Entrepreneur and team characteristics 2. Market characteristics 3. Product and Service characteristics 4. Financial characteristics 5. Other characteristics. Since the literature review did not give us very comprehensive check on actual healthcare technology startups valuation I needed (for the next question) to back on the general view of the valuation methods although the characteristics of regulative, intellectual property and high-technology related to healthcare technology were presented in the literature review.

In the literature evidence was shown that valuation methods could change throughout the startup lifecycle.

The second research questions:

*What are the most used valuation methods by Finnish venture capital investors when they value healthcare technology startups?*
The second question extends the existing background information and literature review to the actual research. There were five investment criteria categorized found out in the interviews that the Finnish VCs use: 1. Entrepreneur and team characteristics 2. Market characteristics 3. Product and Service characteristics 4. Financial characteristics 5. Other characteristics. As a reminder, a table of the top 3 most important investment criteria are once again presented below.

Clearly as in the literature, entrepreneur and management team criteria were among literature the most popular criteria and as we found out in the top 3 most important criteria. In conclusion, one can say that honesty and integrity were the most appreciated character of entrepreneur and team. This is not a news as VC is people business as I saw in the interview. The chemistry between entrepreneur and investors is very important and honesty and integrity affects both. Sorvisto, P (phone interview on 13.11.2018) said it nicely that intellectual honesty and admitting you are wrong and learn from experience are the key. After that comes surprisingly market understanding through importance of entrepreneur and team needing to very well understands market and the trends and items like customer, potential etc. affects it. Third most important was experience in various forms. Financial and Marketing skills were appreciated but not must and can be acquired from outside. Team must have complementary skills and avoid that only one in the team knows just one special thing. Finnish VCs underlined that team with experience of healthcare technology related research and regulation will be beneficial. It is also clear that teams do not have to be ready and VCs are open for changes and additions in teams to get more skillful team according to one interview proved it.

Hence, this supports the literature where Panda and Dash (2013), Nunes et al (2014), Petty, J.S and Gruber, M (2011) and Pintado, T.R et al (2007) where trust and honesty and understanding/skills of entrepreneur and team were underlined. Petty, J.S and Gruber, M (2011) also saw that management team should also be replaceable and answer to the market with skills and therefore it is understood why in the interviews it was underlined that complementary skills must be found and the team must work together very well and that VCs can bring additional skills from job market or other networks for example. Keppler, S.B et al (2015) made it very clear that regulation and IPR issues are very important features of healthcare. Therefore, it is vital also that VCs appreciate this kind of knowledge.
One can say that market was actually very important in terms of the other criteria. Regarding market criteria, market potential and market growth were the most important criteria found. Out of the top 3 of overall criteria market-related criteria were the second most important. Kosonen, T (interview on 8.11.2018) explained that market needs to be addressable, large enough and enough growth potential but again crucial is that it is understood how well the market understanding is in the team. So, one can say that in the team market understanding (already important in the entrepreneurial and team characteristics) was thought to be very important so hence this reflects that also market criteria are important. It is evitable that this supports the literature from Zacharakis and Meyer (1998) and De Haan, M and Vinig, T (2002) who underlined knowing the market, market size, potentiality, product-market relation in developing new markets. Pintado, T.R et al (2007) and Keppler, S.B et al (2015) saw the market size and growth also important.

Indeed product-market relation was also seen important. Only 3/8 of top 3 criteria were mentioned close to product criteria. Product and service criteria focused mainly on patents and their importance for company valuation. Some saw that patenting was sensible if the utilization can be done right and that investing into protecting innovation should be done and with the right people, otherwise patent is worthless. Sometimes researchers are eager to publish the results so early patenting can be beneficial but also gain proof-of-concept validation from science community. Miettinen, A (phone interview 01.11.2018), with support of Kosonen, T (interview on 8.11.2018) summarizes very well that the focus should be on the market (not trying to protect the product by all means) and test the product there and let the market itself validate the product or service. Additionally, to product and market relation, Leino, M (phone interview 9.11.2018) saw that the right team should fit in also. What is interesting is that the thoughts of product or service are related to market. It clearly does not matter how innovative the product is but it matters how it reacts and relates to the market. This fits very well with the thoughts of Nunes et al (2014) where product and market relation in terms of acceptance and internationalism and IPR rights were highly ranked criteria. Keppler, S.B et al (2015) saw from medical technology field that IPR issues are vital for the success, also support of science community in giving validation to technology. Vinig, T. and De Haan, M. (2002) saw that in the US patents are more important than in the Netherlands. This may be true also in case of Finland where patents are clearly two-sided discussion topic as others say it is necessary and others tend to think otherwise. Internationalization was also discussed and some VCs wanted to concentrate on Finnish market and others
said that the pre-requisite was that the product or service should contain international potentiality. For example, USA is the most competitive market and there already the regulations are very tough, Sweden could be next after home market.

Financial criteria were only in 2 out 8 eight top 3 lists of most important criteria. Return on investment was selected as the most important criteria. Agreed level of return was about 3-10x of investment. However, it was notified that return is important but not as a factor that would steer operations. Second important was different financial ratios from EBITDA to sales margins that the investors like to pay attention also, for example the investment use rate for operative and growth factors. More mature level VCs get also outsourced legal and financial due diligence to ensure the validity of valuation. From the literature review the results support Keppler, S.B et al (2015) which underlined that VCs in healthcare require high return and look for different margins like gross margin related to high R&D costs in the field. Also, Alemany and Villanueva (2014) viewed that in later stages financial criteria are more and more important, which supports my research results. Furthermore, Keppler, S.B et al, 2015 saw that financial criteria were very important (not most important however) since 80% declined to invest if the company does not show enough return potential, which supports views of one interviewee Anonymous A (interview 15.11.2018) who thought that it is not sensible to invest if the expected return is not fulfilled.

With the other criteria category interesting point about healthcare was the utilization of data and its quality as criteria that was brought.

Intuition played a significant role in the literature by MacMillan et al (1987) and Zacharakis and Meyer (1998) and Zinecker and Wolf (2015). They talked about the asymmetry of information between VCs and entrepreneur but a positive intuition could lead to even better chemistry between two parties. In the interviews intuition was considered likewise important. Some said that it first time intuition is so important that it cannot be changed but some say that in some cases intuition can be turned around with facts. Yes, facts, investors investing into more mature companies, it can be so that since there are more actual financial data and other facts (for example regarding market), then intuition may play slightly smaller role and the justification for investment is easier to make. This is rationalized in the literature when thinking of the startup lifecycle and the “easiness” of valuation when the company grows and moves forward in the lifecycle. For me personally intuition comes as chemistry and trust
and as it was pointed out in the interviews that integrity and honesty are key factors and VCs really appreciate this quality then there might be a crucial link between positive intuition and honesty.

Quantitative methods are used by all our investors. The most popular method was multiple method. Venture capital method was the second largest method. This result fits very well to the investment criteria since there it was underlined that markets and its understanding was crucial and since both of those most popular methods are more market—related the result of quantitative criteria supports also the results of investment criteria. DCF method was seen also as popular method but many VCs claimed the same issues like in the literature especially related to difficulties in estimating the cash flows. Few VCs claimed that they use also Berkus method and risk factor method –like methods in quantifying and valuing companies. One investor who was beyond mature phase VC investor was using LBO and as he was using more DCF –related methods than other interviewees since his companies already demonstrated positive cash flow and history. In the literature some researchers claimed that the traditional methods were also venture capital, multiple and DCF methods belonged to in the sense that neither of those fit in to valuate very well startups and technology/intangible assets. Horn et al (2015) and Sander, P and Kõomägi, M (2007) supported in the view that real options was not at all popular in Scandinavia or Europe. Lahti, T (2011) saw the popularity of quantitative methods as that estimation of future earnings was the most popular and DCF the second most popular and multiples were used by about one third or less. My study shows a different result that which might come from the fact that Lahti, T (2011) researched business angels, not actual VCs. Also, Lahti, T (2011) had 53 interviewees form different areas of the country. The questionnaire was much wider than mine and the interviews took 0.5-1.5 hours (I had 1 hour on average time) (Lahti, T 2011). Sander, P and Kõomägi, M (2007) saw that multiples are more used in the larger markets and sometimes the finding of comparable is hard. This however does not stop people going to internet and search for comparable in the wider market, which is evidenced why most interviewees used multiple methods.

All in all, this study was successful in finding the answers to research questions and regarding the investment criteria part the literature demonstrated very strong supporting but in the quantitative part slightly different results came. But one can still notify that there are differences in views of valuation methods of start-ups in healthcare analytics sector. One
can never really find 100% consensus in this matter because intuition and qualitative criteria still play a significant role in startup-valuation. Different quantitative methods were found and many investors seems to use so called traditional methods. In whole one can see that there are two parts in valuing startups: investment criteria and quantitative methods. In this thesis it is hard to determine the exact portion and ratios of investment criteria and quantitative methods used. But I noticed that later stage investors rely more on quantitative methods in comparison to investment criteria. Regarding monetary value of investment criteria this is showed as best in Berkus and risk factor methods.

6.2 Validity of the research and critique

Validity refers to trustworthiness of the research. The main issue in the validity of research was that most of the interviewees had generalist view on the topic of health care technology and therefore the answers should not be seen as full indication of how healthcare analytics startups are valued by Finnish VCs.

One issue is the whole interview situation and rational thinking. One interviewee answered to the interview via email based on 1-5 (1 being not important and 5 being very important) scale. Gladly open questions helped in interpreting the answers. When I was at the interviews mostly I heard that all criteria are here important this might also affect that one may not always use rational sensing in remembering or describing what is important and determining investments. Therefore, it was important that the topic of intuition was brought up to explain better the valuation process.

Also, when doing qualitative research, understanding of the terminology is perhaps not common to the interviewees. I had to in many cases explain what is meant for example with this valuation method. The conversations during the interviews were semi-structured which was very interesting but for example a more concentrated approach would have put more structure to the interviews. On the other hand, I think that with structured interviews the results would not have been as good because in semi-structured you could ask additional questions and widen your answers. Also, when thinking of pure surveys, they would not have worked because people would have answered more irrational and there would not have been place for open questions.
There were not a very large number of VCs participating, just 8 so this may not give a very comprehensive view on the topic. The sample was quite heterogeneous and only few investors were either seed stage or beyond mature, which offered a broader perspective on the topic unlike if I would have concentrated on just one life-cycle stage investors. However, one cannot make certain conclusion on the whole Finnish VCs based on such small number and not equally spread (in the company life-cycle) sample.

6.3 Further research opportunities

Further research opportunities can be found a lot in the area of venture capital investment criteria and the valuation methods. This research did not reflect on what are the BEST valuation methods in the context of healthcare technology startups. Different answers view different criteria and hence it will be interesting to view the success of venture capitalists based on the criteria they met. Also, there are areas of startups and technology that are to be more thoroughly researched how the valuations are changed there.

Venture capital goes worldwide as investors are looking for opportunities and companies are looking for founding. There are researches that look into country specific difference in valuation but perhaps it could be more focused why founding and the number of successful startups focus on different areas. A great example of successful startups is in the Silicon Valley in the United States of America.

As my research was concentrating on the whole valuation theme perhaps it would be wise in the future to concentrate in these kinds of researches on smaller parts of investment valuation. Also, syndicates were covered only to a small degree in this thesis so it would be beneficial to research on for example chemistry of VC syndicates and whether they can bring more value to the companies.
7 References


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have experience with such a strategy. *Healthcare Financial management, 70.5* (May 2016): pp.50+


8 Appendix

8.1 Interview questions

1. Haastateltava perustiedot. (Interviewee, General information):

Sukunimi (Family name) ____________________________
Etunimi (Surname) ____________________________
Yritys (Company) ____________________________
Asema (Position) ____________________________
Yhteystiedot (Contact info):
Sähköposti (e-mail): ____________________________
Puhelin (phone): ____________________________
Työkokemus vuosina (Job experience in years): ______ vv(yy)
Kokemus pääomasijoituksesta (Experience in venture capital): ______ vv(yy)
Kokemus pääomasijoittamisesta terveysteknologia-sektorilla (Experience in VC regarding healthcare analytics): ______ vv(yy)
Kuinka suuri yrityksen sijoitusportfolio (Size of investment portfolio): ___________M€

Vastaaja haluaa olla anonyymi (Kyllä / Ei) (Respondent wants to be anonymous (Yes / No)): ______

Vastaajan yritys haluaa olla anonyymi (Kyllä / Ei) (Company of the respondent wants to be anonymous (Yes / No)): ______

2. Tässä on kuvattu startup-yrityksen elinkaari. Missä kohti yrityksenne sijoittaa? Huom: Monta vaihtoehtoa mahdollista. Here is described the life-cycle of a startup company. Where would you see yourself regarding investments? There are many options.

3. Arvonmäärittys metodit. (Valuation methods)
   a. Käytättekö kvantitatiivisia arvonmäärittysmetodeja esimerkiksi diskontattu kassavirtalaskelma Kyllä / Ei . Do you use quantitative valuation methods for example discounted cash flow Yes/ No

   Perustelkaa/Justify:
b. What kind of methods do you use for valuation of healthcare analytics startups? Please mark 1 = do not use 2 = seldom 3 = sometimes 4 = very often

Diskontattu kassavirta (DCF): ______
Verrokki (Multiple): ______
Venture capital: ______
Reaali-optio (Real options): ______
Berkus: ______

Jos käytätte muita metodeja, olkaa hyvä ja kuvailkaa tähän.
If other methods use, please describe:
________________________
Perustelut metodien käytölle. (Justification for using methods):
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________


c. Do you use qualitative investment criteria (for example integrity of entrepreneur or market potential) regarding valuing healthcare analytics start-ups? Yes/ NO

Perustelkaa (Justify):
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

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d. Mitkä kriteerit ovat näissä luokissa tärkeitä teille terveysanalytiikka-startupien kanssa:

What criteria in these classes are important for you when valuing healthcare analytics startups:

<table>
<thead>
<tr>
<th>Kriteeriryhmä (Criteria group)</th>
<th>Alakriteeri (Sub-criteria)</th>
<th>Tärkeys (1-5) (1 -ei tärkeä ja 5- hyvin tärkeä tai sanallinen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yrittäjä / johtotiimi</td>
<td>Johtajuus (Leadership)</td>
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<td></td>
<td>Rehellisyys ja maine (Honesty and Reputation)</td>
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<tr>
<td></td>
<td>Tekniset taidot (Technical skills)</td>
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<tr>
<td></td>
<td>Talousosaaminen (Financial skills)</td>
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<tr>
<td></td>
<td>Markkinointi osaaminen (Marketing skills)</td>
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</tr>
<tr>
<td></td>
<td>Kokemus toimialalta (Experience from industry)</td>
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<tr>
<td>Markkina (Market)</td>
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<td></td>
<td>Markkinakasvu (Market growth)</td>
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<td>Markkinapotentiaali (Market potential)</td>
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<td></td>
<td>Kilpailu (Competition)</td>
<td></td>
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<tr>
<td></td>
<td>Markkinakoko / kysyntä (Market volume / size / demand / acceptance)</td>
<td></td>
</tr>
<tr>
<td>Tuote / palvelu (Product / service)</td>
<td>Patentti ja IPR-asiat (Patent and other IPR-issues)</td>
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<tr>
<td></td>
<td>Innovatiivisuus (Innovativeness)</td>
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<td>Potentialisuuus ulkomaille (Potential for foreign market)</td>
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<td></td>
<td>Tuote tai palvelu on korkeaa teknologiaa (High-tech)</td>
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<tr>
<td>Rahoitus / taloudellisuus (Financial factors)</td>
<td>Tuottovaatimus (Expected rate of return)</td>
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<td>Exit mahdollisuudet (Exit possibilities)</td>
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<td></td>
<td>Sijoituksen koko (Size of investment)</td>
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<tr>
<td></td>
<td>Liikevoittoprosentti (Operating margin)</td>
<td></td>
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<tr>
<td>Muita (Others)</td>
<td></td>
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<tr>
<td>Kriteeriryhmä</td>
<td>Alakriteeri</td>
<td>Tärkeys (1-5)</td>
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</tr>
<tr>
<td>Criteria group</td>
<td>Sub-criteria</td>
<td>(1 -ei tärkeä ja 5 - hyvin tärkeä tai sanallinen)</td>
</tr>
<tr>
<td>Liiketoimintasuunnitelma ja sen houkuttelevuus (Business plan and its reliability)</td>
<td></td>
<td>Importance (1-5) (1 - les important, 5 - most important)</td>
</tr>
<tr>
<td>Sopivuus pääomayhtiön sijoitusportfolioon (Fit to investment strategy)</td>
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<td></td>
</tr>
<tr>
<td>Pääomasijoittajan ja yritysjohtajan kemia (Chemistry between entrepreneur and VC)</td>
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</tr>
</tbody>
</table>

4. Miten kuvailisit intuitiota ja sen vaikuttavuutta sijoituspäätöksissä? How would you describe intuition and its impact on investment decisions?

Perustele (Justify): x
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

5. Miten näet syndikaatit eli yhteistyöt muiden pääomasijoittajien kanssa? How do you see syndicates i.e. co-operations with other venture capital investors? Could you tell any experience about these co-operations and how did they go?

Perustele (Justify): x
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
6. Millaiset alueet terveysanalytiikassa ovat tulevaisuudessa kiinnostavia pääomasioittajien näkökulmasta?
What kind of areas in healthcare analytics are interesting from the perspective of venture capital investors

Perustele (Justify):  x