

Improve the team quality of Dutch medtech startups in the eyes of venture capitalists

MSC BUSINESS ADMINISTRATION

ENTREPRENEURSHIP, INNOVATION AND STRATEGY

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1. Introduction

1.1 Situation and complication

Medical technology (Medtech) is an influential industry on a global scale. The total market value was around \$550 billion in 2022¹. Geographically, the two dominating markets in the medtech sector are the US and Europe², with market sizes of \$190 billion and \$155 billion, respectively³.

When looking at the future of an industry, we need to examine the development of its startup companies. It has been widely demonstrated that startups are important engines of innovation (Audretsch et al., 2023; Jesemann, 2020; Ziakis et al., 2022). Although the market values of the medtech sector in the US and Europe are comparable, the amount of investment from venture capitalists (VCs) differs significantly between these two regions: The amount in the US is more than four times higher than in Europe (Figure 1).

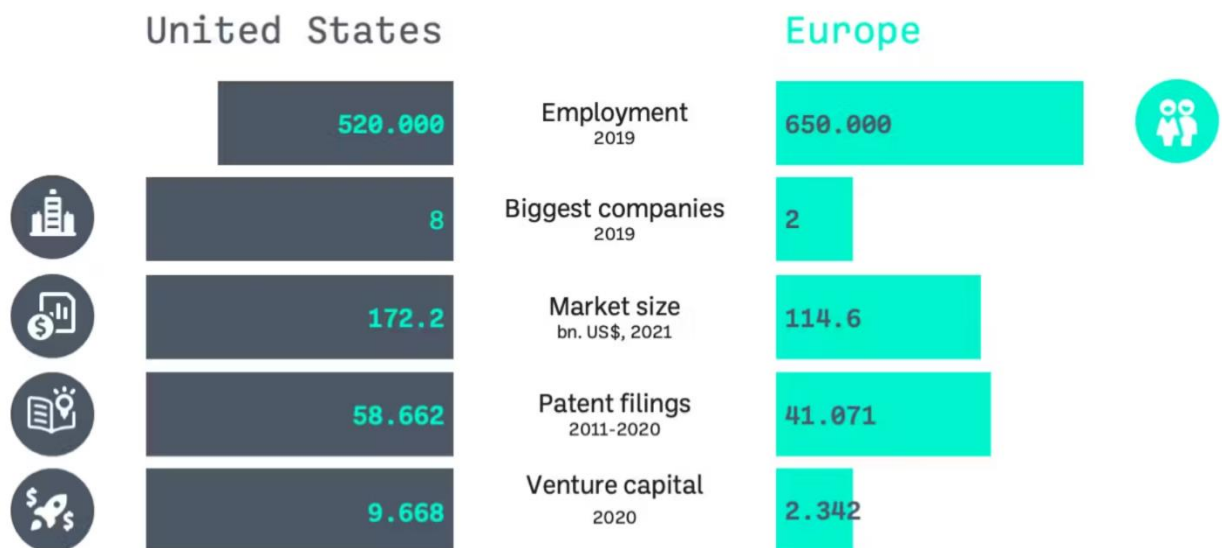


Figure 1 Data comparison in the medtech field between US and Europe²

Venture capital money, together with other types of funds that support the startups, plays an important role in innovation⁴ (Engel & Keilbach, 2007). As a result, the startups can deliver innovative products and technologies to the market in the near future. Therefore, we consider the low value of venture capital investment in Europe to be a dangerous signal.

We looked further in the literature to find out the potential reasons for the lack of venture capital investment in European startups:

Firstly, it is related to tradition, culture, and norms of the local market. In terms of tradition and history, (Oehler et al., 2007) points out that the lack of proper exit strategies for VC firms is a key reason: until

¹ Statista, [Link](#)

² Medtech Pulse, [Link](#)

³ Statista, [Link](#)

⁴ Harvard Business Review, [Link](#)

recently, Europe did not have a stock market as liquid and transitional as the NASDAQ in the US. In terms of culture, it is more typical in Europe that the venture-backed startups are sold to another company or VC fund, rather than pursuing the direction of Initial Public Offering (Oehler et al., 2007). It is also the norm in the US entrepreneurial market that they are much more prone to IPOs and other means of exits, compared to the European market (Black & Gilson, 1998; Cumming et al., 2010; Jeng & Wells, 2000).

Secondly, several studies suggested that the European VC firms are not as successful as the American counterparts in terms of making their return on investments from the startups they invested in (Engel D. , 2004; Hege et al., 2009; Schwienbacher, 2005). However, when we look at the American venture capitalists who invest in Europe, they do not generate more value than their European investor peers, which indicates that the American model cannot be copied directly and completely into Europe (Hege et al., 2009; Oehler et al., 2007). We need to further investigate which dimension within the “American model” Europe should learn from.

Although aspects such as history, culture, tradition, and norms provide a good context for understanding the fact that the US has a better developed VC-entrepreneurial ecosystem, it is more practical to dig further into the performance drivers if we want to offer pragmatic and executable suggestions for the European stakeholders. Although limited results are found regarding the responsible performance drivers that drag the European counterparties’ results behind, the direction is pointing towards the “venture capital contracting” (governance) side (Hege et al., 2009; Sapienza et al., 1996; Schwienbacher, 2008), which suggests that the US VCs are more experienced and sophisticated than the European ones (Hege et al., 2009).

Good venture governance, which is supported highly by team management and coaching, could contribute positively to the return on investment (Sapienza et al., 1996; Schwienbacher, 2008). Therefore, we could reasonably argue that it is beneficial for the end goal (achieving a thriving local venture ecosystem and increasing local innovation levels) if the entrepreneurs better prepare themselves in terms of the quality of their venture proposition and the team.

1.2 The research goal

This research aims at finding out the evaluation criteria of venture capitalists on the Dutch medtech startups. We hope the results of the study will contribute to 1) better evaluation outcomes for these startups; 2) To a further step, offering pragmatic action points to the Dutch medtech startups to survive longer and eventually become successful both technologically and commercially, so that the innovation levels of the medtech sector in the Netherlands can be continuously improved; 3) Finally, the Dutch medtech venture ecosystem will become more and more thriving.

However, to keep this research project focused, we will further define our research scope at this time as follows:

We would like to focus on the team aspect and getting to know what kind of team characteristics a startup team should possess to pass the evaluations of venture capitalists. Therefore, we will ask questions such as: How do venture capitalists evaluate medtech startups? What kind of criteria are important to them? Finally, we will zoom into the “team” aspect: we want to know the factors being evaluated in the scope of “team”, and specifically the team’s setup and the heterogeneity & homogeneity between the team members.

1.3 The research question(s)

The central research question is:

How can the Dutch seed round medtech startups better prepare themselves in terms of their team quality, so that they have better chances to pass the evaluations by Venture Capital investors?

To be able to answer the central research question, the following sub-research questions need to be answered:

- 1) How do venture capitalists define medtech startups?
- 2) How does the decision process of VCs look when they evaluate the seed round Dutch medtech startups?
- 3) What kind of general decision criteria do VCs apply when they evaluate the seed round Dutch medtech startups?
- 4) How important is the “team” aspect when VCs evaluate the seed round Dutch medtech startups?
- 5) Within the “team” aspect, how do the VCs evaluate the objective quality of the startup on the “integrated team” level? “

1.4 Academic relevance

Numerous studies have investigated the evaluation criteria of VC investors focusing on high tech startups (please view **Chapter 2&3**). However, not much research has specifically focused on medtech startups (see the summary in **Table 3**). Studies focusing on western European medtech startups are even more limited. Compared to general high-tech startups, the medtech startups are featured with the outstanding challenge of regulatory approval. Because of the regulatory requirements, the time a medtech startup has to endure before being able to start selling is usually 3 to 7 years¹⁹. The high level of uncertainty leads to longer time-to-market (Lettl et al., 2008) and declining trends of VC investment in the medtech sector²². This serves as an important distinguisher between medtech startups and other general types of high-tech startups. This research addresses the specific challenge faced by the medtech startups, and contributes insights regarding medtech startup evaluation criteria in the western European geographical scope. Additionally, no current research has provided a comprehensive introduction to the VC investors who invest in the Dutch medtech startups, such as how do they define medtech startups, their evaluation processes, general evaluation criteria, and how do they evaluate the team aspect specifically. This research is the first to provide such a summary in this field.

Therefore, this research fills this gap in academic research.

1.5 Practical relevance

As stated in the **Chapter 1.1**, to further enhance the general level of innovation and the venture ecosystem in Europe, it is important to make two things happen:

- 1) Increase the amount of money that investors put into startups.
- 2) Increase the chances of the startups providing returns for these investors so that they are willing to invest further.

This is why in **Chapter 2&3**, our literature review is not limited to the investors' point of view: "how investors evaluate the startups in terms of their investment readiness levels", but also includes the articles that address the objective metrics of the startups: "what characteristics of the startups will lead to positive metrics growth", such as sales growth, profitability, IPO, employment growth, and speed of product development. By doing this, we maximize the chance that the result is not biased based solely on the investors' opinions but can really contribute to the success of the startups.

In the short term, the practical contribution of this research project will be to help Dutch medtech startups pass the evaluation of the investors, thus increasing their chance of obtaining investment. In the long run, we hope the result of this research will contribute to better returns on investment for the investors and ultimately increase the venture investment in the medical device sector in the Netherlands.

1.6 Outline of the thesis

In chapter 1, we provide the general introduction to this research, including the existing situation and complications, the corresponding questions we raise that we want to solve with this research, and the relevancies of the questions, both academically and practically. In chapter 2 & 3, we build up the research literature framework, from the startup side and investor side, respectively. Chapter 4 introduces the methodology of this research project connecting with its research framework, includes: selection and sampling methods, all the variables, their types of measurements, and the corresponding references, as well as the data collection and processing methods. Chapter 5 provides in-depth answers and insights corresponding to each research question (RQ 1-5) and propositions 1-5 in RQ 5. Chapter 6 summarized the core findings in the research compared to existing studies, and provides limitation points and future research possibilities.

2. Theoretical framework: The startup side

The **Chapters 2 and 3** cover the literature research and theoretical framework. The structure of literature research follows the core of the main and sub research questions. This structure is visualized in the **Figure 2 below**. In chapter 2, we introduce the definitions of startups and medtech, respectively. Chapter 3 offers a view from the investor's point of view, and introduces their evaluation processes, investment stages and evaluation criteria.

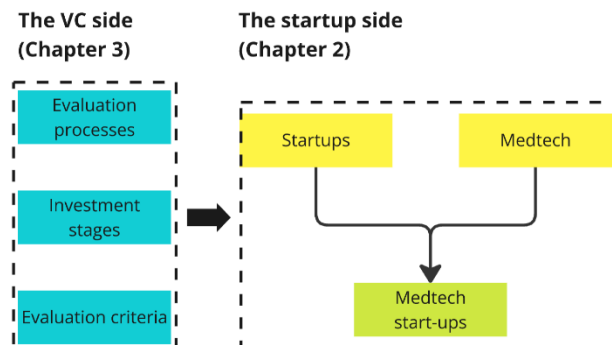


Figure 2 The structure of literature review, following the logic of research questions

2.1 The definition of medtech startups

2.1.1 The definition of startups

Startup companies usually have a few features: they are new to the market, and the size of their revenue (if any) is small. Additionally, they usually have high levels of technological innovation (Kariv, 2013) and a high potential to grow rapidly (Judith & Karlovitz, 2020). The risk levels of startups are typically high, as it is usually the founders financing the startups by themselves or develop the business through external investments⁵.

1) The newness of the company

It is commonly agreed that to qualify as a startup, a company should not have been in the market for too long. However, there isn't a standard limitation in terms of the exact number of years.

In North America, we have seen US researchers set the threshold for startups at those younger than 8 years old (McDougall et al., 1992). On the other hand, the Canadian government supports the view that a startup usually enters a more stable stage after 5 years of existence⁶.

In Europe, the European Startup Network⁷ requires a startup to be younger than 5 years. This standard is also shared by Italian law (Decreto Crescita 2.0: The Startup Act): The company needs to be "less than 5 years from their registration in the special section of the Business Register"⁸. The European Startup Monitor⁹ includes companies that have existed for less than 10 years as its targetgroup. According to the Erasmus Centre for Entrepreneurship¹⁰, companies that have been established within 10 years can be referred to as startups and scale-ups.

2) The financial threshold

The financial performance of startups varies significantly due to the differences in geographic locations, industries, sectors and stages. Therefore, the current literature in this area is also limited. We have found some identification criteria from both governmental authorities and practical fields.

From the point of view of the authorities, the Italian government set the threshold for qualifying as startups at less than 5 million Euro turnover, and at the same time, no dividend shall be paid or planned to be paid in the foreseeable future⁸. According to the definitions in France and the European Commission, the limitations for turnover are 50 million and 10 million euros respectively (Bouhal et al., 2022).

On the other hand, some investors identify the revenues of startups by different stages. For example, Atlanta Ventures defines seed stage startups as those generating less than \$1 million in revenue, while startups in early stage and growth stages should have revenues between \$1 million and \$5 million and above \$5 million, respectively¹¹. The financial software company Paddle, which specializes in the startup

⁵ Investopedia, [Link](#)

⁶ Innovation, Science and Economic Development Canada, [Link](#)

⁷ European Startup Network, [Link](#)

⁸ Scaleup Italy, [Link](#)

⁹ European Startup Monitor 2019/2020, [Link](#)

¹⁰ Erasmus Centre for Entrepreneurship, [Link](#)

¹¹ David Cummings on Startups, [Link](#)

market¹², believes the seed stage startups should have an annual recurring revenue of less than \$3 million.

Regarding the level of investment received, (Flamholtz & Randle , 2006) argue that receiving €1 million in investment should be the line to separate startups from scale-ups; while scale-ups are within the investment scope of €1 - 10 million. InvestTech Advanced Solutions¹³ considers companies that have raised no more than €5 million in funding, and are still before Series A, to be startups.

3) The threshold of core (founding) team sizes

Although a startup can have a team size as big as it wants, there is usually a limitation on the size of the core founding team.

According to European Startup Monitor 2019/2020⁹, the sizes of the founding teams are generally between 1 to 4 team members. The distribution of numbers of founders in European startups can be found in the **figure 3**. This range is echoed by the studies and statistics in individual European countries as well. For example, the Deutscher Startup Monitor 2023¹⁴ reported that the average size of the startup team in Germany in 2022 is 2.5 persons. In Greece, the startup team sizes range also mostly between 2 to 4 persons (Ziakis, Vlachopoulou, & Petridis, 2022). In another study from (Clarysse & Moray, 2004), which also focuses on the European scope, the ideal team size team is defined as 3 – 4 team members. They believe that if the size of the team reaches seven, it will become highly difficult to manage.

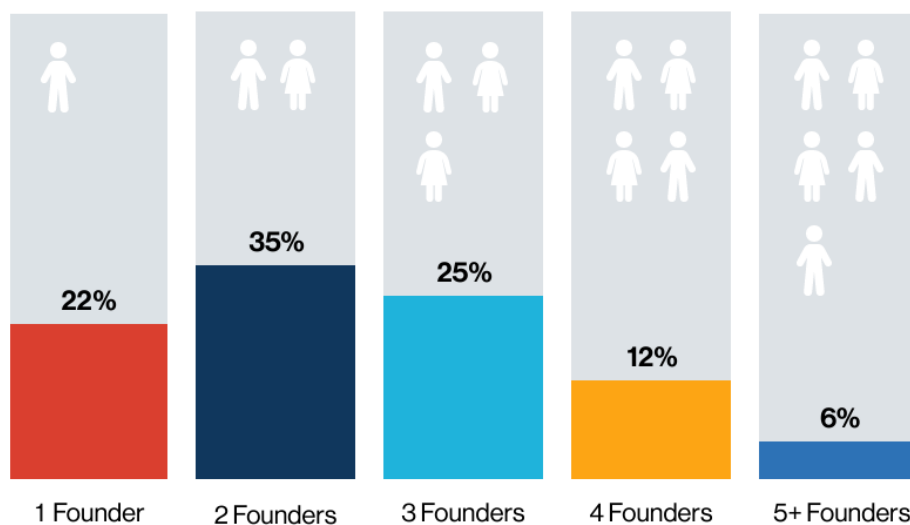


Figure 3 Sizes of Startups founding teams⁹

4) High levels of innovation

As stated in the previous chapter, startup are important engines for innovation. Various European countries' governments have emphasized the indispensable necessity of "innovativeness" in their

¹² Paddle, [Link](#)

¹³ InvestTech Advanced Solutions. [Link](#)

¹⁴ Deutscher Startup Monitor 2023, [Link](#)

definitions for startup companies^{8,15,16,17}. From the startups' perspective, a higher level of innovation is usually associated with better company growth (Fiorentino et al., 2021). With the educational levels of the founders being a strong indicator of the levels of innovation (Hunady et al. 2018; Østergaard et al., 2011), usually having a PhD in the founding team in a technology-oriented startup is more likely to attract venture capital money (Ferràs-Hernández et al., 2021). According to research conducted by Foothill Ventures, the strongest correlation between company success (represented by becoming a unicorn) and having PhD(s) in the founding team exists in the healthcare sector¹⁸. However, newness is not the same as novelty. (Amason et al., 2006) explains that the new ventures are usually positioned within the spectrum between "imitation" and "initiation", in terms of their novelty levels. This is regardless of the ages of the new ventures.

Startups are also characterized by high potential and high risks at the same time. According to the European Association of Business Angels, 90% of startups end up failing¹⁹. Among these startups, about 30% cannot survive until the end of their second year (van Weele et. al, 2018). A critical phase that almost every startup needs to face and overcome is "the valley of death", which describes the phase when the founder has already put in significant amount of resources, but the startup has not yet generated enough revenue for the company to break-even (Ritter & Pedersen, 2022). The number of years the startups must endure under this challenging situation is especially high in the medtech and healthcare sectors. This is due to the complex processes involving industry-specific regulatory requirements usually known as CE or FDA approval. Typically, it takes 3-7 years for a medtech startup to bring their product to the market, sometimes even longer²⁰. The regulatory approval process is also not favorable to startup companies. The FDA average review time for startup companies takes 330 days, which is much longer than the average 177 days for established companies²¹. The high level of uncertainty leads to longer time-to-market (Lettl et al., 2008) and declining trends of VC investment in the medtech sector²².

2.1.2 The definition of medtech

Medtech is short for "Medical technology". Based on the definition from The European Medical Technology Industry²³ (2018), the medtech is defined as "any technology used to save lives or transform the health of individuals suffering from a wide range of conditions." For the purpose of fitting investors into their corresponding investment scope in the medtech sector, we want to understand the following questions:

- What kind of technologies are defined by the investors as "medtech", in based on their individual investment scopes and opinions?
- How mature should the technology be, to be defined as the "investable technology levels"?

¹⁵ Spanish Ministerio de Economía, Comercio Y Empresa, [Link](#)

¹⁶ UK Home Office, [Link](#)

¹⁷ Netherlands Chamber of Commerce, [Link](#)

¹⁸ Foothill Ventures, [Link](#)

¹⁹ European Business Angels Network, [Link](#)

²⁰ Focused Ultrasound Foundation, [Link](#)

²¹ The Economics of Growth, [Link](#)

²² Deloitte, [Link](#)

²³ The European Medical Technology Industry, 2018, [Link](#)

1) Categories of medtech

According to WHO²⁴, “A medtech device can be any instrument, apparatus, implement, machine, appliance, implant, reagent for in vitro use, software, material or other similar or related article, intended by the manufacturer to be used, alone or in combination for a medical purpose. MedTech Europe²⁵ categorizes medical technologies into three categories:

- **Medical devices (MDs):** are products, services or solutions that prevent, diagnose, monitor, treat and care for human beings by physical means.
- **In vitro diagnostics (IVDs):** are non-invasive tests used on biological samples (for example, blood, urine, or tissues) to determine the status of one’s health.
- **Digital health and care:** refers to tools and services that use information and communication technologies (ICTs) to improve prevention, diagnosis, treatment, monitoring and management of health and lifestyle.

However, based on the study from (Keppler et al., 2015), “active implantable devices”²⁶ are also separately categorized.

In summary, because both “IVD” and digital services are not “tangible or independent products” like medical devices and their business models and production manners are very different from medical devices²⁷, we will need to further verify the scope of definition with our interviewees.

Additionally, in execution, we foresee that we will not include startups in the field of “low-value disposables” (such as gloves, syringe, face masks) in our project scope. Our focus will be the innovative startups who develop reusables or high value disposables, preferably with patents in place.

2) Stages of technology

- Regulatory approval

As stated previously, obtaining the regulatory approval (CE-MDR/ FDA) is a significant milestone for medtech startups^{28,29,30} (ten Bok , 2018). After this, the companies become legitimate in terms of commercializing their approved products.

Therefore, the objectives, focuses and required team characteristics can be quite different between the two phases. In this research project, we will only focus on the context of the period before regulatory approval. In **Appendix 3**, we include the differences in focus between these two phases.

- Technology Readiness Levels (TRLs)

²⁴ WHO, [Link](#)

²⁵ MedTech Europe, [Link](#)

²⁶ EU-LEX, [Link](#)

²⁷ For example, an IVD company can sign a 3-years tester contract with a hospital and thus subsidize the hospital for the device use, and a digital solution is usually largely software-based and using a subscription business model, but the typical business model for devices is to sell or lease.

²⁸ Medium, [Link](#)

²⁹ EU MDR, [Link](#)

³⁰ FDA, [Link](#)

Since it usually takes much longer before medtech startups can start commercialization compared to other industries, it is worth investigating how these startups can advance their value in the eyes of investors before gaining regulatory approval. Funding opportunities in the US and Europe both use TRLs to evaluate the development phases of innovations^{31,32}. Scientific research also shows that investors use TRLs as an instrument to evaluate startups (Bel et al., 2021, Bititci & Mayfield, 2017). According to NASA³³, Technology Readiness Levels (TRL) refer to “a type of measurement system used to assess the maturity level of a particular technology.”

The TRLs comprise 9 levels, which are typically grouped into 3 or 4 stages based on different sources^{32,34}:

- Usually the levels 1 to 3 are called the “exploration, discovery or research” phase.
- While the levels 4 to 6 are considered the “development” phase.
- For levels 7 to 9, some sources group them together and call them the “deployment” phase³⁴ while other sources see only the last level (level 9) as the deployment level, while the levels 7 & 8 are still grouped as the the “demonstration” phase³².

The detailed explanations of each level in the TRL schema are visualized in **Figure 4** below:

RESEARCH	9	ACTUAL SYSTEM PROVEN IN OPERATIONAL ENVIRONMENT
	8	SYSTEM COMPLETE AND QUALIFIED
	7	SYSTEM PROTOTYPE DEMONSTRATION IN OPERATIONAL ENVIRONMENT
DEVELOPMENT	6	TECHNOLOGY DEMONSTRATED IN RELEVANT ENVIRONMENT
	5	TECHNOLOGY VALIDATED IN RELEVANT ENVIRONMENT
	4	TECHNOLOGY VALIDATED IN LAB
RESEARCH	3	EXPERIMENTAL PROOF OF CONCEPT
	2	TECHNOLOGY CONCEPT FORMULATED
	1	BASIC PRINCIPLES OBSERVED

Figure 4 : The 9 levels in the TRL schema³⁴

Some research has shown that for general high-tech innovations, the Valley of Death (VOD) appears at the middle stage (Level 2 to 6) (Belz et al., 2021), while the United States General Accounting Office³⁵ (GAO) issued a report stating that for biomedical technologies, usually the risk levels will not decrease significantly until the very late phases of TRL levels.

³¹ Innovation Newsnetwork, [Link](#)

³² Rijksdienst voor Ondernemend Nederland, [Link](#)

³³ NASA, [Link](#)

³⁴ TWI Global, [Link](#)

³⁵ United States General Accounting Office, [Link](#)

Therefore, it will be interesting to find out how would the investors evaluating Dutch medtech startups perceive and utilize this TRL schema or if they use another comparable schema.

3. Theoretical framework: The Venture Capitalists side

3.1 Types of investors and their corresponding investment stages

The **Figure 5** below summarizes the general startup stages and their corresponding investment types. The first round of funding is called seed round or pre-seed round. Their sources of funding are usually from friends, family, founders themselves, grants and angel investors^{36,37,38,39}. The pre-seed round is typically non-dilutable, while it is likely for the seed round to be dilutable.

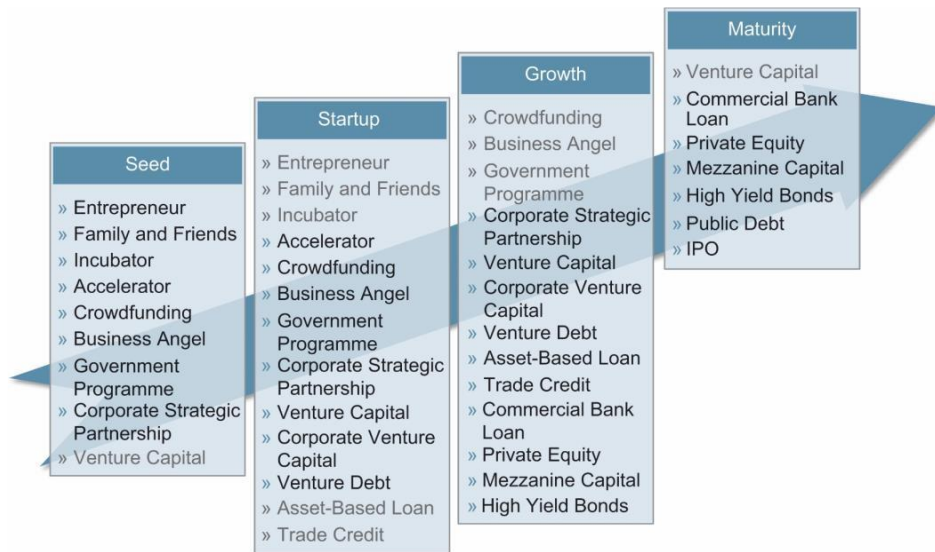


Figure 5 General startup stages and their corresponding investment types (Alemany & Andreoli, 2018)

³⁶ Visible.vc, [Link](#)

³⁷ Brex, [Link](#)

³⁸ Investopedia, [Link](#)

³⁹ Scalex Invest, [Link](#)

Following the seed round will be the Series A round, and after that are Series B,C rounds, and so on³⁸. The main party involved in Series A round is venture capitalists, while angels and private equities also join sometimes^{40,41}.

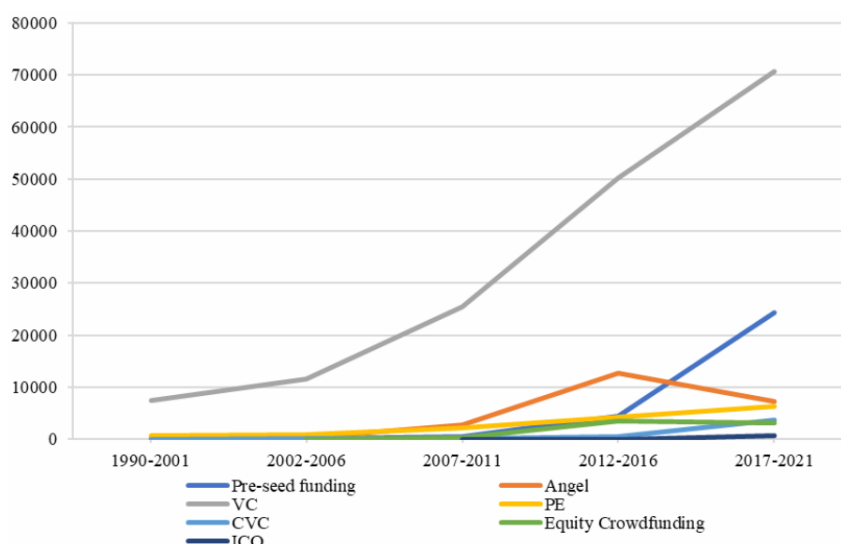


Figure 6 Numbers of deals by different types of investment over years (Júnior et al., 2022)

According to a bibliometric research conducted by (Júnior et al., 2022), the venture capitals, pre-seed fundings, angel investors and private equities cover the highest numbers of deal in the recent years (Figure 6).

To further understand the scopes and thresholds of investments from each type of investors, the following **Table 1** is generated based on multiple literature and empirical sources:

Round	Investors	Invested amount	Runway duration	Dilutable for founders
Pre-seed	Angels, grants, friends and families, founders ³⁹	\$50,000 - \$250,000 ⁴²	3-9 months ⁴²	Typically no
Seed		\$250,000 - \$2 million ^{39,38}	12-18 months ⁴²	Typically yes
Series A	Mainly venture capitalists, sometimes angels and private equities ^{38,39,40}	\$2-15 million ³⁸	Median 17 months, average 20.3 months ⁴³	Yes

Table 1 Main facts and numbers of investments rounds: Pre-seed, Seed and Series A

When we zoom into the medtech sector, the main investors types are: VC, public grants and loans, angels, and family offices⁴⁴. However, the VCs are typically reluctant to involve in the pre-seed and seed rounds. Therefore, a gap is generated between the (pre-) seed and Series A/B phases⁴⁵.

⁴⁰ Investopedia, [Link](#)

⁴¹ Corporate Finance Institute, [Link](#)

⁴² Peak Capital, [Link](#)

⁴³ Brex, [Link](#)

⁴⁴ MedTech Europe, [Link](#)

⁴⁵ Medium, [Link](#)

In US, the size of pre-seed round in the medtech sector averages as \$250,000, and the seeds round and Series A round as \$1.3 million and \$4.8 millions, respectively. The average runway duration of seed round in medtech sector is much shorter than that of other industries, namely only 6 months. The round size up to Series A in medtech sector in Europe averages at €680,000, and 80% of the deal sizes are smaller than €5 million¹³.

The investment stages are corresponding to the development stages of medtech startups. For early-stage startups, series A is a critical milestone⁴⁶: The Series A investors look beyond the proof of concepts⁴⁷, and the corresponding funding will “enables startups to move from the idea stage to the prototype and then on to a product”, and finally enter the market⁴⁶. In the medtech setup, we could translate the Series A funding to the technology stage of regulatory approval.

3.2 Evaluation process

Based on literature studies from (Gompers et al., 2020; Tyebjee & Bruno, 1984), the evaluation processes of venture capitalists can be summarized as follow in general:

1) Deal origination/ pre-investment screening

In this stage, the investors look for potentially investable projects. The most important channels come from professional referrals and entrepreneurs’ self-recommendation.

2) Deal screening and evaluation

In this stage, the investors use various evaluation methods and metrics to judge the deals. It is important to note that VCs can have different standards and criteria, depends on their industries, demographic situations, stages and seizes of the project (Monika & Sharma, 2015). Because usually the desk-screening process is a very quick review process (Zacharakis & Shepherd, 2007), we expect the team evaluation will happen more in the (face-to-face) screening and further evaluation process.

3) Due diligence

In this stage, more detailed and in-depth investigation will be performance to further validate the business case and potential return.

After these three stages, deals will be structured and proposed to the entrepreneurs. The visualized evaluation process is shown in **Figure 7**.

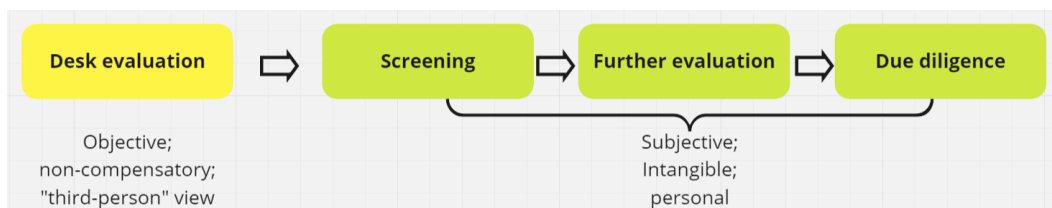


Figure 7 Evaluation process of VCs, based on research from (Gompers et al., 2020; Maxwell & Jeffrey, 2011; Ngassam , 2020; Tyebjee & Bruno, 1984)

⁴⁶ Mind Machine, [Link](#)

⁴⁷ Deloitte, [Link](#)

In this research, we are going to ask the subjects to further validate and elaborate on this process model, and tailor it to the specific medtech startup context.

3.3 Evaluation criteria

3.3.1 General evaluation criteria

What kind of characters should a startup possess, so that it can be deemed as “investable” in the eyes of the investors? Based on the existing research, some researchers highlighted three categories (Brush et al., 2012; Douglas & Shepherd, 2002): **technology**-related factors, **market**-related factors and **management**-related factors. Additionally, **financial** projections (Boocock & Woods, 1997) and the **previous funding received** can be also a trait of successful startup (Groenewegen & de Langen, 2012; Lee et al., 2019). However, even if a company has good readiness levels in the previously mentioned areas, they would still probably be rejected by the investors due to some other reasons, such as: 1) they are not able to generate a high-quality business plan document; 2) The limitations from the investors’ sides, in terms of for example investors’ selections of stages, industries and investment amount (Boocock & Woods, 1997; Hall & Hofer, 1993).

In this research, we do not take the factors of “business plan quality” and “investors’ own limitations” into the research scope. Because the focus of this research project is to identify the characters of investment readiness of the start-companies, the focus of our investigation is the “real quality” of the startup companies. We see the capability of “delivering a high-quality business plan” is more like a “rendering” skill and is trainable. Every company, after receiving proper training from their business coaches, will eventually be able to reflect their true competencies in the business plan documents in a professional and efficient manner. Another pre-condition of this research is that the startups are evaluated for their readiness levels only by the investors within the scopes of suitable industries, stages and funding levels.

In this chapter, we will investigate what kind of criteria are being evaluated by the investors. However, although the final goal of this research project is to help the startups passing the evaluations from investors, our literature research is not limited to the single success criteria of “passing evaluations”. Instead, we also include company success metrics, such as “sales growth”, “team growth”, “team viability” and “speed of product development”. This is because we want to keep our skepticism: What the investors evaluate as “good” does not necessarily equal to company’s real metrics growth.

we do not want to miss out important dimensions because of potentially incomplete existing literatures: we could imagine if we present some specific positive signals to the investors for evaluation, they could agree that these signals contribute positively to their evaluation outcome, even though the criteria might not yet have been studied by the existing literature. Additionally, we would not want our result to be biased, which means that there could be certain criteria only thought to be important by investors, but actually do not contribute to the objective metrics growth. As stated in Chapter 1, we want to build a “positive spiral circle”: giving advices to the startups regarding passing the evaluations → startups generate profitable metrics → successful exits → more investment into medtech field.

This chapter focuses on the literature research regarding investors’ (VCs’ and angel investors’) investment criteria, in terms of the “**market**”, “**technology**”, and “**finance**” factors (including both “financial projection” and “previous funding records”) categories. In the next chapter, we will run a

dedicated literature research in the **team/management** category, which will be the core focus of this research. In the past literature research regarding the selection criteria of venture capitalist, there are two main voices: one argues that the **team and management** factors are the leading criteria (examples of researches are conducted by (Dubini, 1989; Gompers et al., 2020; Macmillan et al., 1985; Sudek, 2006), and the other views the **market and technology** factors rank at the top positions, and “**team**” factor follows (Khanin et al., 2008). In either case, we can conclude that the “**team/management**” category is an indispensable and critical factor considered by investors. Therefore, in this research, we choose to zoom further into this category, and will build our research framework on it.

The following **Table 2** summarizes the literatures have been reviewed regarding the market, technology and finance aspects of startups investment evaluation.

Author info	Characters			Outcome	Category	Judged by	Evaluation phase
	Positive correlated	Negatively correlated	Not correlated				
(Aggarwal et al., 2015)	Number of patents	-	-	Investment readiness	Technology	VCs	Non-specified
	Market size	-	-	Investment readiness	Market	VCs	Non-specified
(Boocock & Woods, 1997)	-	Negative market characteristics ⁴⁸	-	Investment readiness	Market	VCs	Desk evaluation
	-	Lack of USP	-		Market	VCs	Desk evaluation
	-	Poor start up finance	-		Financial	VCs	Desk evaluation
(Brush et al., 2012)	Presence of existing customers,	-	-	Investment readiness	Market	Angel investors	Desk evaluation
	Stage of product development ⁴⁹ , Obtain of intellectual property	-	-	Investment readiness	Technology	Angel investors	Desk evaluation
(Croce et al., 2016)	-	No innovativeness	-		Technology	Angel investors	Desk evaluation
(Hussain & Scott, 2015)	Presence of existing customers	-	-	Investment readiness	Market	Angel investors	Desk evaluation

⁴⁸ Such as: “market too narrow and specialised to have significant growth prospects”, “mature and contracting market”, “market saturated”, “insufficient growth potential”

⁴⁹ 1.concept, 2.prototype, 3.product in development , 4.product ready, or 5.revenue generated

	Obtain of intellectual property	-	-	Investment readiness	Technology	Angel investors	Desk evaluation
(Macmillan et al., 1985)	Obtain of intellectual property	-	-	Investment readiness	Technology	VCs	Non-specified
	Potential of market growth rate	-	-	Investment readiness	Market	VCs	Non-specified
	High expected return rate	-	If the investor was involved in the first round, if they are expected to make subsequent investment	Investment readiness	Financial	VCs	Non-specified
(Maxwell & Jeffrey, 2011)	Product adoption from customers	-	-	Investment readiness	Market	Angel investors	Desk evaluation
(Maxwell & Jeffrey, 2011)	Product stage, Protectability	-	-	Investment readiness	Technology	Angel investors	Desk evaluation
	Customer engagement, Route to market, Market potential, Financial model	-	-	Investment readiness	Market	Angel investors	Desk evaluation

Table 2 Literature review in the market , technology and finance aspects

3.3.2 Team-related criteria in medtech startups

In this chapter 3.3.2, we looked into literatures focusing on the team characteristics of medical startups. In the next chapter 3.3.3, we investigate the ones focusing on team aspect in innovative high-tech startups in general.

The **Table 3** below summarizes the research addressing the team evaluation criteria for medical startups. Not only the number of research is very limited, furthermore, there are certain limitations about each of them, thus they do not paint a complete picture of a successful team's composition in terms of investment readiness:

(Keppler et al., 2015)'s research mostly highlights the products, technology marketing and regulatory aspects; while the work from (Mas & Hsueh, 2017) and (Houterman et al., 2013) only outlined the characters of the CEO. Additionally, although the focus of (Houterman et al., 2013)'s work is indeed in the Dutch medical and biotech fields, they did not make a distinction between the two different markets. The scope of (Ismail & Medhat , 2019)'s work is primarily in the Egyptian market, which, concluded by the researchers themselves, is characterized as lack of funding. As a result, the research insights might not properly represent the European market. (Chatterji, 2008) specifically pays attention to how can the

knowledge learned from the prior incumbent firms be used by the founders in their new startups. At last, the insights from (Huang et al., 2020) could only be directly associated with the Taiwanese spinal field, at this moment.

Author info	Team/management-related readiness items
(Keppler et al., 2015)	Regulatory experience of the team
(Mas & Hsueh, 2017)	Expertise of technical, (pre)clinical development, fundraising of CEO
(Lee et al., 2019)	Startup experience, market analysis skills, technical skills
(Ismail & Medhat , 2019)	Previous relevant industry experience, size of the entrepreneur's social network
(Chatterji, 2008)	Previous market- and regulatory-related knowledge
(Houterman et al., 2013)	The scientist founder should not be the CEO
(Huang et al., 2020)	Nature and professional competencies of the management team is important

Table 3: Literatures that addressed investment readiness in the medtech field

Therefore, we further investigated the literature focusing on team and management factors in a broader scope, in terms of innovative high-tech startups in general.

3.3.3 Management/team-related literature research in general high-tech startups

The important elements of a startup getting evaluated by venture capitalists are summarized in the chapter 3.3.1. In the same chapter, the decision of further diving into only the “team” aspect is also made. Therefore, in the following chapter 3.3.3, the literature review will only focus on contents within the “team” aspect.

3.3.3.1 Initial categorization of literatures within the “team” aspect

In the existing literatures, different aspects of a startup team are studies, in terms of the correlations between qualities of the aspects and the outcomes of the evaluations from the investors. To make the literature study more effective and clearer, the following initial categorizations are made based on two themes:

- **Who** are evaluated?
 - “Individual team members” vs “team as a whole”?
- **What** are evaluated?
 - “Tangible records/ experience” or “subjective personality”?

Based on the division within these two themes, the literature research is categorized into **Table 4 -7**.

3.3.3.2 Explanations and literatures summarized of the “individual-objective” category

This category asks for the individual contributions of the core team members. On one hand, the investors evaluate the professional expertise regarding the financial, technical, and marketing aspects of the

corresponding team members; on the other hand, the historical records are also examined, in terms of the past leadership experience, as well as the network they have built up by their prior experience.

The literatures cover attributes in this category is summarized in the **Table 4** below:

Literature source	Level	Dimension	Focused aspect	Theme explained	Correlation with evaluation outcome
(Brinckmann & Gemuenden, 2011)	Lv.1	Finance	Financial expertise	External financing capabilities	Positive
(Brinckmann & Gemuenden, 2011)	Lv.1	Finance	Financial expertise	Finance controlling	Positive
(Brinckmann & Gemuenden, 2011)	Lv.1	Finance	Financial expertise	Financing through operation	Positive
(Clarysse & Moray, 2004)	Lv.1	Market and technology	Commercial and technical expertise	Team consists of both higher quality of original researchers and members with commercial expertise.	Positive
(Vissa & Chacar, 2009)	Lv.1	Professional track record	Inter-industry networking	Distinct count of core connections of the TMT	Positive
(Stam & Elfring, 2008)	Lv.1	Professional track record	Intra-industry networking	A firm's quick and independent access to another particular firm's network within the same industry	Positive
(Maxwell & Jeffrey, 2011)	Lv.1	Professional track record	Industry and management experience	Relevant industry and management experience	Positive
(Macmillan et al., 1985)	Lv.1	Professional track record	Industry experience	Familiar with the market targeted by venture	Positive
(Mittens et al., 2012)	Lv.1	Professional track record	Industry experience	Relevant industrial operating experience	Positive
(Franke et al., 2008)	Lv.1	Professional track record	Industry experience	Some TMTs have relevant industry experience & leadership experience	Positive
(Stam & Elfring, 2008)	Lv.1	Professional track record	Intra-industry networking	Extent to which a firm maintains ties beyond the focal industry network to organizations from other fields.	Positive
(Macmillan et al., 1985)	Lv.1	Professional track record	Management experience	Demonstrated leadership ability in past	Positive

(Boocock & Woods, 1997)	Lv.1	Professional track record	Management experience	Have management experience before	Positive
(Franke et al., 2008)	Lv.1	Professional track record	Management experience	Some TMTs have relevant industry experience & leadership experience	Positive
(Mittiness et al., 2012)	Lv.1	Professional track record	Start-up founding	Industrial start-up experience	Negative
(Beckman et al., 2007)	Lv.1	Professional track record	Start-up founding	Previous start-ups experience	Negative
(Aggarwal et al., 2015)	Lv.1	Technology	Technical expertise	The technical capability of the venture's technical head	Positive

Table 4: Literature research covering the bottom-left “individual-objective” quadrant

3.3.3.3 Explanations and literatures summarized of the “individual-subjective” category

In this category, criteria are featured as “individual-subjective”. This “leadership charisma” could originate from the team members’ prior experience, but they are evaluated based on the subjective feeling of the investors. Usually through face-to-face meetings, the investors will tell if the team leader have the following characters: have 1) a distinctive leadership, 2) empathy, 3)endurance, 4) an ability of expressing themselves, 5) an open attitude, and 6) an ability to assess and take risks.

The literatures cover attributes in this category is summarized in the **Table 5** below:

Literature source	Level	Dimension	Focused aspect	Theme explained	Correlation with evaluation outcome
(Knockaert et al., 2011)	Lv.1	Individual leadership and charisma	Distinct leadership character	Be agreeable	Irrelevant
(Bernardo & Welch, 1997)	Lv.1	Individual leadership and charisma	Distinct leadership character	Independent, innovators, change agents, or even dissidents. This dimension describes Right proportion of over confidence entrepreneurs in the team, compared with rational team members.	Positive
(Bernardo & Welch, 1997)	Lv.1	Individual leadership and charisma	Distinct leadership character	Serving as a recognized/distinct leader	Positive
(Foo et al., 2006)	Lv.1	Individual leadership and charisma	Distinct leadership character	Serving as a recognized/distinct leader	Positive

(Baron & Markman, 2003)	Lv.1	Individual leadership and charisma	Empathy	Accuracy in perceiving others	Positive
(Macmillan et al., 1985)	Lv.1	Individual leadership and charisma	Endurance	Capable of sustained intense effort	Positive
(Knockaert et al., 2011)	Lv.1	Individual leadership and charisma	Endurance	Conscientiousness (motivation to achieve)	Positive
(Knockaert et al., 2011)	Lv.1	Individual leadership and charisma	Endurance	Emotional stability	Positive
(Baron & Markman, 2003)	Lv.1	Individual leadership and charisma	Endurance	the ability to adapt to a wide range of social situations	Positive
(Knockaert et al., 2011)	Lv.1	Individual leadership and charisma	Expressiveness	Being extrovert	Positive
(Baron & Markman, 2003)	Lv.1	Individual leadership and charisma	Expressiveness	The ability to express emotions and feelings in an appropriate manner	Positive
(Knockaert et al., 2011)	Lv.1	Individual leadership and charisma	Open attitude	Open to experience	Positive
(Warnick et al., 2018)	Lv.1	Individual leadership and charisma	Open attitude	Open to feedback	Positive
(Macmillan et al., 1985)	Lv.1	Individual leadership and charisma	Risk management	Able to evaluate and react to risk well	Positive
(Groenewegen & de Langen, 2012)	Lv.1	Individual leadership and charisma	Risk management	Being able to take risks	Positive
(Knockaert et al., 2011)	Lv.1	Individual leadership and charisma	Risk management	Being able to take risks	Irrelevant

Table 5: Literature research covering the bottom-right “individual-subjective” quadrant

3.3.3.4 Explanations and literatures summarized of the “team-objective” category

In this category, criteria are featured as “team-objective”. It contains two main categories of information: the teams attributes and setup, and the heterogeneity & homogeneity of the team. In terms of team attributes and setup, the team’s functional structure (if the structure setup is complete and balanced, and if it aligns with the company’s core strategy) and team size will be assessed. While in the “heterogeneity & homogeneity” category, the investors will look at how similar and different the team members are, in terms of their ages, educational background, professional experience and network circle.

The literatures cover attributes in this category is summarized in the **Table 6** below:

Literature source	Level	Dimension	Focused aspect	Theme explained	Correlation with evaluation outcome
(McGee et al., 1995)	Lv.2	Basic attributes and setup	Functional experience aligning with cooperative strategy	The chosen cooperative strategy aligning with the company management's expertise (marketing, manufacturing and technology)	Positive
(Macmillan et al., 1985)	Lv.2	Basic attributes and setup	Balanced functions	Achieve functionally balanced within the team	Positive
(Beckman & Burton, 2008)	Lv.2	Basic attributes and setup	Complete functions	The FT with a more complete functional structure	Positive
(Aggarwal et al., 2015)	Lv.2	Basic attributes and setup	Team size	Big team size	Positive
(Brush et al., 2012)	Lv.2	Basic attributes and setup	Team size	Big team size	Negative
(Eisenhardt & Schoonhoven, 1990)	Lv.2	Basic attributes and setup	Team size	Big team size	Positive
(Franke et al., 2008)	Lv.2	Heterogeneity & homogeneity	Personal affiliation	Mutual acquaintance among TMTs	Positive
(Kor, 2003)	Lv.2	Heterogeneity & homogeneity	Professional affiliation	The number of years of shared experience for the four managers with the longest tenure in the top management team	Irrelevant
(Amason et al., 2006)	Lv.2	Heterogeneity & homogeneity	Age	Heterogeneity in age	Negative
(Chowdhury, 2005)	Lv.2	Heterogeneity & homogeneity	Age	Heterogeneity in age	Irrelevant

(Amason et al., 2006)	Lv.2	Heterogeneity & homogeneity	Educational background	Heterogeneity in educational background	Negative
(Foo et al., 2006)	Lv.2	Heterogeneity & homogeneity	Educational background	Heterogeneity in educational background	Positive
(Franke et al., 2008)	Lv.2	Heterogeneity & homogeneity	Educational background	Heterogeneity in educational background	Positive
(Chowdhury, 2005)	Lv.2	Heterogeneity & homogeneity	Gender	Heterogeneity in gender	Irrelevant
(Chowdhury, 2005)	Lv.2	Heterogeneity & homogeneity	Past experience	Heterogeneity in past functional background	Irrelevant
(Beckman et al., 2007)	Lv.2	Heterogeneity & homogeneity	Past experience	Team members that have worked for many different employers	Positive
(Beckman & Burton, 2008)	Lv.2	Heterogeneity & homogeneity	Past experience	Team previous experience being diverse and broad	Positive
(Beckman et al., 2007)	Lv.2	Heterogeneity & homogeneity	Past experience	Team previous experience being diverse and broad	Positive
(Eisenhardt & Schoonhoven, 1990)	Lv.2	Heterogeneity & homogeneity	Past experience	Heterogeneity in past industry experience	Positive
(Amason et al., 2006)	Lv.2	Heterogeneity & homogeneity	Past functional background	Heterogeneity in past functional background	Negative
(Vissa & Chacar, 2009)	Lv.2	Heterogeneity & homogeneity	Past functional background	Heterogeneity in past functional background	Positive

Table 6: Literature research covering the top-left “team-objective” quadrant

3.3.3.5 Explanations and literatures summarized of the “team-objective” category

In this category, criteria are featured as “team-subjective”. Usually through face-to-face meetings, the investors will tell if the team as a whole have cohesion on both emotional and professional levels, and how do they manage conflicts and hierarchy. Additionally, as the research shows, the team members’ remaining or departure will play a role on the team’s future performance, but at the moment of evaluation the team of course stay intact, it is a part of “cohesion judgement” to predict the future stability of the team.

The literatures cover attributes in this category is summarized in the **Table 7** below:

Literature source	Level	Dimension	Focused aspect	Theme explained	Correlation with evaluation outcome
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(Beckman et al., 2007)	Lv.2	Synergy and cohesion	FT changes	Founder remains in the management team	Negative
(Kor, 2003)	Lv.2	Synergy and cohesion	FT changes	Founder remains in the management team	Positive
(Beckman et al., 2007)	Lv.2	Synergy and cohesion	TMT changes	TMT remains in the management team	Positive
(Souitaris & Maestro, 2009)	Lv.2	Synergy and cohesion	Multi-tasking	Mutual preference of team members engaging into multiple tasks at the same time	Positive
(Ensley & Pearce, 2001)	Lv.2	Synergy and cohesion	Emotional cohesion	The degree that team members like each other	Positive
(Croce et al., 2016)	Lv.2	Synergy and cohesion	Emotional cohesion	Trust between team members	Positive
(Foo et al., 2006)	Lv.2	Synergy and cohesion	General cohesion	Members of the team are quick to defend each other from criticism by outsiders,' The success of other members of the team help me achieve my own objectives,' and 'Everyone's input is incorporated into most important company decisions.'	Positive
(Vissa & Chacar, 2009)	Lv.2	Synergy and cohesion	General cohesion	The extent of mutual agreement within the team	Positive
(Croce et al., 2016)	Lv.2	Synergy and cohesion	Professional cohesion	The core team shows commitment to the tasks	Positive
(Foo et al., 2006)	Lv.2	Synergy and cohesion	Professional cohesion	The team can make open communication with each other	Positive
(Ensley & Pearce, 2001)	Lv.2	Synergy and cohesion	Cognitive conflicts	Team level conflicts which are tasks-oriented	Positive
(Higashide & Birley, 2002)	Lv.2	Synergy and cohesion	Cognitive conflicts	Team level conflicts which are tasks-oriented	Positive
(Ensley et al., 2006)	Lv.2	Synergy and cohesion	Team hierarchy	Flat hierarchy style	Positive

Table 7: Literature research covering the top-right “team-subjective” quadrant

Additionally, there are literatures that address the potential bias of the VCs when they evaluate the startups, because of the similarities between the VCs and the startup core team members.

The **Table 8** below summarizes these literatures:

Literature source	Level	Dimension	Focused aspect	Theme explained	Correlation with evaluation outcome
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(Warnick et al., 2018)	Bias	Outlier, Similarity between investor and entrepreneur	Aligned focus and passion	Investors with more investing experience place greater emphasis on entrepreneurs' product passion; while Investors with more entrepreneurial experience place greater emphasis on entrepreneurs' entrepreneurial passion	Positive
(Franke et al., 2006)	Bias	Outlier, Similarity between investor and entrepreneur	Aligned past experience	VCS' and TMTs' similar background in working experience (Start-ups or large firms) and education (Engineering or management)	Positive

Table 8: Literature research covering the potential bias factors

The **Figure 8** below is created to summarize the 4 categories mentioned above. For this research, we will put our focus on the left two quadrants, as they serve as the foundations of the right two quadrants. We expect that, as the results of this research, we will figure out the importance levels of the left two quadrants regarding the decision-making and selection criteria of the venture capitalists. Based on the results of the study, future research can be conducted with a focus on the right two quadrants.

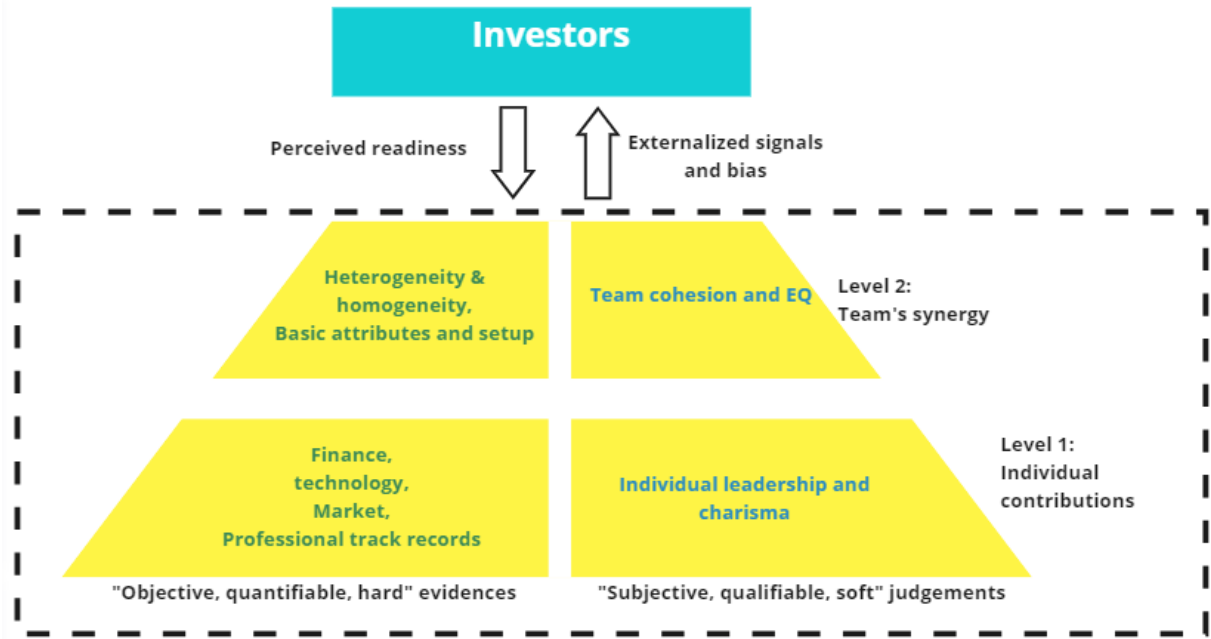


Figure 8 Summarized framework of literature research in “management/team” aspect

3.3.4 Elaboration of elements in the left two quadrant

As shown in the research questions, this research will mainly focus on “objective measurements” in the teams’ quality, on a team’s integrated level. We choose this focus is because of the following reasons:

- We believe that the “objective” measurements serve as the foundation for the “subjective” ones. Because of the current limited number of studies in “VC evaluation criteria in the (European) medtech startups”, we decide to make the focus of this research the “objective measurements”. Future studies could make use of findings from this research as a basis and reference point, and develop further insights on the “subjective level”.
- Researching teams’ “integrated and interactive” characters also requires investigating individual team members’ quality and experience. For example, to find out “if a team has balanced functional structure” requires finding out the functions of each individual members in a team. Therefore, the research scope will cover both of the two left quadrants in Figure 7.

The **Table 9** below elaborates the elements being covered in the left two quadrants:

Dimensions	Focused aspect	Sources	Data collection method	Variable assessment/ measurement	Proposition from literature	VC control variables
Basic attributes and setup	Balanced functions	(Macmillan et al., 1985)	Interviews+ surveys	In a questionnaire, asking how important is the team if: initiated by more than one individual, the individuals constituting a functionally balanced management team.	Proposals get positive evaluations from VCs	All members of the National Venture Capital Association and VCs listed in Venture Magazine’s 1983 Directory were included
	Complete functions	(Beckman & Burton, 2008)	Interviews+ archive database	Whether the firm has defined executive-level positions in each of the following six functional areas: sales and marketing, general administration (including human resources), science/R&D/engineering, operations, business development/ strategic planning, and finance/ accounting	Achieve quicker speed to IPO	-

	Functional experience aligning with cooperative strategy	(McGee et al., 1995)	Archive database	Three functional areas of the management team: marketing, R&D, and manufacturing. Three basic types of competitive strategy were recognized: marketing differentiation, technical differentiation, and cost leadership	Achieve better sales growth	-
	Team size	(Aggarwal et al., 2015)	Surveys	In a questionnaire, asking what the team size is	The venture with bigger team gets better evaluation from VCs	1. invested industries, 2. total years of experience 3. Country origin
		(Brush et al., 2012)	Archive database	Retrieving the number of team members from the proposal archives.	The size of the top management team has a significant and positive effect at the desk-rejection stage, but a significant and negative effect at the small group presentation stage.	Selected one specific large angel group
		(Eisenhardt & Schoonhoven, 1990)	Interviews+ archive database	Team data and sales data were collected in structured interviews and retrieved from annual reports	A bigger team size is positively associated with sales growth	-
		(Chowdhury, 2005)	Interviews	The data of team size is from result of interviews. The "effectiveness" measurement is from an instrument developed by (Cardyand Dobbins, 1994; Stewartand Barrick, 2000).	A bigger team size is negatively associated with effective level	-
Heterogeneity & homogeneity	Gender	(Brush et al., 2012)	Archive database	Retrieving the team gender composition from the proposal archives.	All-male team has similar chances as diverse team to pass evaluations by angel investors	Selected one specific large angel group

	Age	(Amason et al., 2006)	Archive database + from phone call verification	The data of age, sales and profit growths are all retrieved from the IPO files and annual reports	Age heterogeneity between TMTs is negatively correlated to the company performance (sales and profits) growth	-
	Educational background	(Amason et al., 2006)	Archive database + from phone call verification	The data of educational background, sales and profit growths are all retrieved from the IPO files and annual reports. Individuals were categorized into five education specializations: arts, sciences, engineering, business and economics, and law.	Educational heterogeneity between TMTs is negatively correlated to the company performance (sales and profits) growth	-
		(Foo et al., 2006)	Interviews+ surveys	10 areas of educational background, including computer science, engineering, science, and business administration.	educational diversity is positively related to perceived team viability and member satisfaction.	-
		(Franke et al., 2008)	Interviews	Splitting the educational background into 2 categories: engineering and management.	A heterogeneous team comprising technical and management skills is much desired in the initial stage of evaluation	Firm level: Firm age (years), Firm size (no. of professionals), Volume of funds (EUR), Investment stage (seeds, startup,...), Industry focus, Office locations Individual level: Age, educational level(apprenticeship; university degree; MBA, doctorate), educational type (business/ economics; engineering; science; law), Tenure with firm (years), Number of business plans

						evaluated, Prior professional experience, Leadership experience
Past experience	(Beckman et al., 2007)	Interviews +surveys +archive database	Prior functional diversity: sales and marketing, administrative support functions, manufacturing, science or engineering, finance.	Founding teams with high functional diversity have higher rates of receiving venture capital.		
	(Beckman & Burton, 2008)	Interviews+ archive database	Whether the firm's TMT has prior experience in the following six functional areas: sales and marketing, general administration (including human resources), science/R&D/engineering, operations, business development/strategic planning, and finance/accounting	Achieve quicker speed to IPO		Count the sum of the unique functional positions

		(Amason et al., 2006)	Archive database + from phone call verification	The functional background was categorized as marketing, finance, technical (engineering, R&D, etc.), operations/manufacturing, information systems, and general administration.	Functional heterogeneity between TMTs is negatively correlated to the company performance (sales and profits) growth	-
		(Vissa & Chacar, 2009)	Surveys	Used Blau's index but did not specify which functions were included in the paper.	Team with higher functional background diversity will lead to higher revenue growth.	-
Personal affiliation		(Franke et al., 2008)	Interviews	Manner of acquaintance among team members: private, professional, brief. Years of acquaintance.	If the acquaintance among team members is featured as a longer time and in a professional manner, the team will be evaluated more highly by the VCs.	Firm level: Firm age (years), Firm size (no. of professionals), Volume of funds (EUR), Investment stage (seeds, startup,...), Industry focus, Office locations Individual level: Age, educational level(apprenticeship; university degree; MBA, doctorate), educational type (business/ economics; engineering; science; law), Tenure with firm (years), Number of business plans evaluated, Prior professional experience, Leadership experience

		(Eisenhardt & Schoonhoven, 1990)	Interviews+ archive database	The number of founding executives who had worked with another founding executive for at least six months prior to founding the company. This number is divided by total number of executives.	Past joint working experience is positively associated with sales growth.	-
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Table 9: The method, measurements, proportions and control viables of the top-left “team-objective” quadrant

3.3.4.1 Basic attributes and setup

1. Functional setup

In terms of teams' functional setup, (Macmillan et al., 1985) gave the bottom line, by indicating that the startup should never only consist of one team member. They also suggested a balanced team would receive positive evaluation from the VCs. However, they did not specify what kind of team composition exactly is defined as "balanced". (Beckman & Burton, 2008) and (McGee et al., 1995) proposed detailed categories about what kind of functions should be included into a startup team. They have agreed with each other on two indispensable functional areas: 1) Science/ R&D/ engineering, and 2) sales/marketing (commercial). Additionally, (Beckman & Burton, 2008) and (Brinckmann & Gemuenden, 2011) both brought up the extra functional areas: financing. In the medical specific field, (Keppler et al., 2015) and (Chatterji, 2008) strengthened the importance of the regulatory expertise in a team; while (Mas & Hsueh, 2017) believes it is important to have clinical (medical) capacity within the functional setup.

However, the optimal formula of functional setup in each startup is not identical. (McGee et al., 1995) raised the important point that the functions in a team need to align with the company's core strategy. For example, if the company's key differentiator is in the R&D, then it is essential that the team has a strong "technical" figure. Similarly, if the core strategy lies in marketing differentiator or cost leadership, then the profiles of business or manufacturing leaders should excel, respectively.

Proposition 1:

Five essential functions need to be included in a medtech startup's core team: 1) Science/ R&D/ engineering (technical), 2) sales/marketing (commercial/ marketing), 3) clinical development and education (medical), 4) regulatory, 5) financing.

Proposition 2:

The team functional composition should not be evaluated in an isolated way. An external link should be made between this composition and the core strategy of the startup. The quality of this link should be evaluated by the investors.

2. Team size

The opinions about the team sizes in startup teams are controversial. There are researchers who advocate the benefits of a bigger team, as they will not only receive positive evaluations from VCs (Aggarwal et al., 2015), but can also benefit the sales metrics growth (Eisenhardt & Schoonhoven, 1990). However, (Chowdhury, 2005) argues that a smaller team is more advantageous in terms of enhancing the working effectiveness. (Brush et al., 2012) argues that the team sizes will be viewed differently in different stages of the evaluation processes. In more details, a bigger team increases the chance for the startup to pass the desk evaluation phase, but might get them rejected in the face-to-face stage.

If we look at the research and empirical studies that focus on the European scope, we found that a startup team in Europe should not exceed 4 persons. The European Startup Monitor 2019/2020⁹, a study focusing on the Greek startups (Ziakis et al., 2022), and another study focusing on the European level in general (Clarysse & Moray, 2004) give the ideal number of team members as "1 to 4", "2 to 4" and "3 to

4”, respectively. This also aligns with the data from the Deutscher Startup Monitor 2023¹⁴, who reported that the average size of the startup team in Germany in 2022 is 2.5 persons.

Given the fact that our geographic scope is the Netherlands, which belongs to the region of west Europe, we do not propose a team size that goes beyond the European common norms.

Proposition 3:

The team size should be acceptable if it is between 2 to 4 people. Teams having 3-4 members have the highest chance of passing the evaluation from investors.

3.3.4.2 Heterogeneity & homogeneity

1. Diversity in demography (age and gender)

(Brush et al., 2012) has researched how angel investors would react to a startup team with gender diversity compared to the ones with gender singularity. They concluded that all-male teams has similar chances to pass evaluations in front of angel investors compared to teams with both genders.

(Amason et al., 2006) looked into how the age diversity in a startup team will impact the performance of the company. They found out that the bigger age diversity the team has, the less well they will perform on the commercial metrics growth (sales and profits).

Proposition 4:

The gender diversity is not an important factor to be considered when composing a medtech startup team. The age diversity (measured in absolute years) plays a negative role in VC evaluation, therefore the age difference level within a team should be limited.

2. Diversity in past experience (educational background and professional experience)

It is hard to conclude by a single term if a team with diverse educational background is a good thing or not, as researchers taken different views. (Amason et al., 2006) argued that diverse educational backgrounds between the core team members will have a negative impact on the commercial metrics growth (sales and profits); while (Foo et al., 2006) supported an educationally diverse team, because it will be beneficial for the perceived team viability and member satisfaction. The work from (Franke et al., 2008) has directly linked the team’s educational diversity with the evaluation from VC investors: based on their interviews with the investors, they found out that a team with educational diversity will receive higher chance in passing the early-stage evaluation.

Regarding diversity in past working experience, (Amason et al., 2006) and (Vissa & Chacar, 2009) drew completely opposite conclusions: (Vissa & Chacar, 2009) argued that a team with diverse past working experience drives up the company’s commercial metrics growth, while (Amason et al., 2006) believed this would bring negative impact. (Beckman & Burton, 2008) measures the relation between a diversely experienced team with their speed to IPO, and the correlation, is positive. (Beckman et al., 2007) takes the angle of VC investors, and proposed that founding teams with high functional diversity have higher rates of receiving venture capital.

Based on the previous propositions (proposition 1 and 4), we see the ideal startup team should not exceed 4 team members, and should cover at least 3 different functions. Current functions should come from prior professional experience, and prior professional experience should (at least to certain degree)

be relevant with prior educational experience. Therefore, it is reasonable to propose a team with relatively diverse past professional working experience.

Proposition 5:

It is more easily for a startup to receive positive evaluations from VCs if they have diversity in terms of both educational and working/functional background.

3. Personal affiliation

Both (Franke et al., 2008) and (Eisenhardt & Schoonhoven, 1990) have investigated the impact of personal affiliation on the startups' development. While (Franke et al., 2008) took an angle of VCs, and (Eisenhardt & Schoonhoven, 1990) looked into the commercial metrics growth (sales), their conclusion are both positive towards that the startup team being built up by members who have sound prior professional level affiliation.

Proposition 6:

It is preferred by the investors if the acquaintance among team members is featured as long-term (measured in absolute years) and in a professional manner.

4. Method

4.1 Research design

We reckon the research target selection and goal of research highly comparable to the research conducted by (Keppler et al., 2015): Both research projects focus on the startups in the medtech sectors in western Europe, and select the targets of researches as venture capitalist. Although (Keppler et al., 2015) focuses on VC's general selection criteria in three western European countries, while our current research zooms into the "team's aspect" of Dutch medtech ventures, we could learn a lot from their research methods and measurements.

As described by (Keppler et al., 2015): "Since criteria specific for medtech ventures are a new field of research with exploratory character, the collection of qualitative data with certain standardization in data collection for subsequent statistical analysis seemed to be the most adequate research method."

Therefore, we also adopted **semi-structured interviews** as our research methodology. As we result, we aim at gaining both the rich insights, as well as the quantifiable measurements.

As there are 5 sub-questions, each sub-questions and their corresponding literature research chapters are designed as:

- Sub question 1 → Chapter 2.1, 2.2
- Sub question 2 → Chapter 3.2
- Sub question 3 → Chapter 3.3.1
- Sub question 4 → Chapter 3.3.1, 3.3.2, 3.3.3
- Sub question 5 → Chapter 3.3.2, 3.3.3, 3.3.4

4.2 Selection

As stated in the research question, the primary focuses of the interviewees are the venture capitalists. We chose to interview 8 venture capitalists. All of them and their firms have experience in the medtech investment sector, meaning that they have analyzed or invested in Dutch Medtech startups, and see medtech as (one of) their investment focus(es).

Additionally, learning from (Keppler et al., 2015)'s research, we also interviewed 2 experts who have the "bird-eye view", in this case: one business coach from a university incubator and the other one has had decades of experience in the medtech entrepreneurial world (on both entrepreneurial side and in terms of coaching and acceleration programs). Therefore, we can learn about their holistic views on the Dutch medtech startup sector in general.

4.3 Sample

LinkedIn Sales Navigator⁵⁰ was used as the primary tool for interviewees selection and acquisition. Our strategy was to get as many interviews from the qualified interviewees as possible. For the size of sampling, we decided that the "probability sampling" method was not a proper choice, because everything when changing the key words for searching, the search result will differ to certain degree. Additionally, not all people appear in the search results fit in the interviewee criteria, manual check-up and identification is usually needed. As a result, it is difficult to calculate accurately how many VCs exactly fit in the interviewee pool. Therefore, "probability sampling" method is not possible for our project. Instead, we choose to adopt the "**non-probability sampling**" (meaning our sample size is not chosen randomly and in proportion to the whole population, based on the probability theory) (Saunders et al., 2007): We tried to reach out as many as possible qualified venture capitalists and try to get them agree to conduct this interview. As a result, we got to interview 8 venture capitalists with the qualified backgrounds, and two experts with a "bird-eye view".

The purpose of the study is to extract the in-depth insights of a common group: the venture capitalists with a focus on the medtech field. Therefore, we chose the "**homogeneous**" sampling strategy. This is because this sampling method "focuses on one particular subgroup in which all the sample members are similar. (Saunders et al., 2007)" This enables us to study the group in great depth. Considering the field being niche and subjects usually being very busy, we used the combination of "**purposive and convenience**" sample strategy. Purposive sampling falls under the category of "non-probability sampling", which instructs us to select the samples due to their specific characters (explained in chapter 4.2). While convenience sampling suits the typical "very busy" image of the VC investors. As a lot of them are usually not very available for activities not directly related to "deals" (confirmed by the large number of rejections we later received regarding the interview requests), we interviewed everyone who agreed to talk to us.

The descriptive summary of the sample (10 interviewee participants) can be found in the chapter 5.1.

4.4 Measurement

In each sub-research question, we formulate the measurements as follow:

⁵⁰ LinkedIn Sales Navigator, [Link](#)

4.4.1 Control variables

Based on literature research summarized in **Table 9**, we set the following control variables for VC investors:

- **Invested industries** (Aggarwal et al., 2015; Franke et al., 2008)
- **Total years of experience** (Aggarwal et al., 2015)
- **Firm size (no. of professionals)** (Franke et al., 2008)
- **Volume of funds (EUR)** (Franke et al., 2008)
- **Investment stage in terms of rounds (pre-seeds, seeds, series A,...)** (Franke et al., 2008)
- **Geographic scopes of investment** (Aggarwal et al., 2015; Franke et al., 2008)

Measurement summary:

The control questions above are all regarded as straightforward Q&A questions. We simply write down the answers the interviewees provide.

4.4.2 Definition of medtech startup by investors

Measurement	Sub-measurement	Type of question	Measurement explanation	Reference
Newness	Years of establishment	Quantitative, fill in number	Upper threshold of years of establishment	(McDougall et al., 1992), footnotes: 6, 7, 8, 9, 10
Financial thresholds	Revenue generated	Quantitative, fill in number	Upper threshold of revenue generated	(Bouhal et al., 2022), footnotes: 8, 11, 12
	Investment received	Quantitative, fill in number	Upper threshold of investment received	(Flamholtz & Randle, 2006), footnote: 13
Innovativeness	Significance for investment decision	Open	If a startup being innovative is important for investor's decision-making	(Fiorentino et al., 2021), footnotes: 8, 15, 16, 17
	Signals of being innovative	Quantitative, select in scale	Correlation between having PhDs and being innovative: 1) Strong indicator, the more the better 2) strong indicator, but number doesn't matter, 3) weak indicator, 4) not relevant.	(Ferràs-Hernández et al., 2021; Hunady et al., 2018; Østergaard et al., 2011)
		Quantitative, select in scale	Correlation between having patents and being innovative: 1) Strong indicator, the more the better 2) strong indicator, but number doesn't matter, 3) weak indicator, 4) not relevant.	(Aggarwal et al., 2015; Baum & Silverman, 2004; Brush et al., 2012; Hussain & Scott, 2015; Macmillan et al. 1985)
		Open	Other important criteria of judging innovativeness	
Medtech	Definition of medtech	Quantitative, multiple choices	Choose from medical devices, IVD, digital products, active implantable devices	footnotes: 24, 26
Development levels	Regulatory and TRLs	Open	Thresholds for qualifying as startups regarding regulatory levels	(Belz et al., 2021; Bititci & Mayfield, 2017), footnotes: 28, 29, 30, 31, 32
		Quantitative, fill in number	Thresholds for qualifying as startups regarding TRL levels	

Table 10: Key measurements in the “definition of medtech startup by investors” sub-question

4.4.2.1 Newness, revenue threshold and threshold for investment received

In the literature study, the definitions of “newness”, “revenue threshold” and “threshold for investment received” are mostly given by the European/ national level government and industry associations. Therefore, the relevant questions in the interviews are asked directly in a “quantitative and questionnaire” manner.

4.4.2.2 Innovativeness

- **Importance of being innovative**

(Fiorentino et al., 2021) and footnotes: 8, 15, 16, 17 have stated that “being innovative” is an important character of startups. Therefore, the first question in this sector is about to verify this importance with our interviewees, in the context of Dutch medtech startups.

Measurement summary:

We ask this in the form of an open question.

- **Signals of being innovative**

In this part, we investigated what are the criteria used for judging the levels of innovativeness. In general, two criteria were mentioned by researchers: educational level/ existence of PhD team members (Ferràs-Hernández et al., 2021; Hunady et al., 2018; Østergaard et al., 2011) existence of patents (Aggarwal et al., 2015; Baum & Silverman, 2004; Brush et al., 2012; Hussain & Scott, 2015; Macmillan, 1985).

In most studies above, the data was collected either qualitatively or quantitatively from the startup side. However, because our research targets are the VC investors, we want to know the generalized opinions from the investors’ side.

Measurement summary:

Therefore, we designed our measurement to be: “Quantitative, select in scale”, and ask for the opinions of the interviewees directly.

4.4.2.3 Scope of medtech

Based on the literature study, the general definition is clear under this topic. Therefore, the investors simply need to choose based on their own criteria for the definition of “investable medtech”.

Measurement summary:

This measurement is “Quantitative, multiple choices”. We let the interviewees to choose what applies to their working practices.

4.4.2.4 Development levels

Similar as section 4.4.2.3, the development levels have been well defined, in terms of regulatory and TRL stages. The investors need to select the inclusion scope and define the “qualified startups” for their own firms.

However, we made a differentiation in terms of measurements for regulatory levels and TRL levels: For TRL levels, as there are 9 levels in total, it is much easier to give a number as the “qualifying line”. Therefore, we make it a “Quantitative, fill in number” question; However, for “regulatory levels”, there are only 2 levels: before and after, and most startups are in the “before” level. Therefore, we keep this as an open question, to make it possible for investors give further explanations and justify their decision.

Measurement summary:

For TRL levels, it is a “Quantitative, fill in number” question; while for regulatory levels, it is an open question.

4.4.3 General decision process in seed round investment

In this section, our goal is to gain further understanding about the decision-making process of VCs in the seed round evaluation. We firstly map out the general steps being taken, then zoom into the desk evaluation phase, and ask for further explanations.

Measurement	Sub-measurement	Type of question	Measurement explanation	Reference
General steps	Steps in seed round evaluation	Semi-structured open question	Validate and further implement the steps: scouting → desk evaluation → f2f screening → due diligence	(Gompers et al., 2020; Tyebjee & Bruno, 1984)

Table 11 Key measurements in the “decision process” sub-question

(Gompers et al., 2020) and (Tyebjee & Bruno, 1984) have conducted comparable studies for VCs in US. They both firstly summarized the general evaluation steps based on literature studies, then verified and further developed based on surveys. We take the methods and measurements as references, and adapt to our semi-structured interview method:

Measurement summary:

We ask a “semi-structured open question”: We ask the interviewees to verify and further elaborate based on the general process, which is summarized from literature review.

4.4.4 General decision criteria in the seed round investment

In this section, we would like to know what are the key criteria being evaluated for the seed round investment; In other words: what factors do the VC investors deem as important? To determine what pre-selected options do we provide to interviewees in the interview guide, we investigated into the existing literature research:

Measurement	Sub-measurement	Type of question	Measurement explanation	Reference
General criteria	Aspects being evaluated	Semi-structured open question	Validate and elaborate on the elements: team, technology, market, regulatory path, finance.	(Boocock & Woods, 1997; Brush et al, 2012; Douglas & Shepherd, 2002; Keppler et al, 2015; Lee et al., 2019)
	Rank the aspects	Quantitative, split between 100%	Based on the importance of each aspects mentioned above, split the factors between 100% in total.	

Table 12 Key measurements in the “general criteria” sub-question

- (Keppler et al., 2015) lays out 7 categories of criteria: “ 1) Product, Technology, Medical Need; 2) Regulatory Criteria; 3) Intellectual Property (IP); 4) Business Model and Strategy; 5) Market and Competition; 6) Management; 7) Financials”.
- (Brush et al., 2012) highlighted “organizational readiness (team)” and “readiness of technology”.
- (Douglas & Shepherd, 2002) decomposed the “investor readiness” into three facets: 1) technology readiness; 2) market readiness and 3) management readiness (team).

- (Boocock & Woods, 1997) summarized “team”, “market”, and “business strategy” as the main considerations in their study.
- (Lee et al., 2019) included 3 elements in their study: technical skills, market ability, and funding history/ ability.

For this study, we summarize the literature studies above, and come to the list below to be evaluated by our interviewees:

- Team;
- Technology (IP, technical skills. Technology levels);
- Market (medical needs, market potential, competition, business model and strategies);
- Regulatory path
- Finance (funding ability, business projection)

Measurement summary:

In this section, we firstly ask a semi-structured open question, so that the interviewees could select the key evaluation aspects and make further implementation. Then, we ask them to “slice the pie” between these elements, based on their relative importance, within a total scope of 100%.

4.4.5 Role of team aspects in seed round decision-making

This question serves as a linking-pin between “general evaluation criteria” and “team-specific criteria”.

Measurement summary:

We design an open question here, to allow the interviewees to explain freely about their opinions on the “team” aspect.

Measurement	Sub-measurement	Type of question	Measurement explanation	Reference
“Team” criteria	Elaboration on importance level	Open question	Explain why and how important/ not important is the “team” aspect in evaluation. Is this a “veto” criteria or compensable? Ask for detailed explanations	-

Table 13 Role of “teams” in evaluation

4.4.6 The top-left “team-objective” quadrant evaluation

4.4.6.1 Basic attributes and setup

Measurement	Sub-measurement	Type of question	Measurement explanation	Reference
Team functions and roles	Function pool	Semi-structured open question	Validate and elaborate on the possible roles for a medtech startup’s core team: Commercial + Technical + Financial + Medical + Regulatory	(Brinckmann & Gemuenden, 2011; Keppler et al., 2015; Mas & Hsueh, 2017)
	Importance of functions	Quantitative, binary	Which of the roles are essential and if missing then serve as “veto” criteria	
		Quantitative, split between 100%	Based on the selected roles above, split the total 100% based on the importance.	

	Functional strategic alignment	Open question	If the interviewee evaluate the strategic alignment between the team setup and startup's core strategy? If so, how do they evaluate?	(McGee et al., 1995)
Team size	Acceptable size	Quantitative, fill in number	The thresholds of a team size considered as acceptable in desk evaluation	(Aggarwal et al., 2015; Clarysse & Moray, 2004; Eisenhardt et al., 1990; Ziakis et al., 2022;; Brush et al., 2012) footnotes: 9, 14
	Ideal size		The most idea team size considered by VC	

Table 14 Basic attributes and setups of team in evaluation criteria

This section includes two main topics: 1) what functions and roles should be included in a medtech startup's core team? 2) What should be an ideal team size?

1. Team functions and roles:

First, we aim at finding out what is the scope of the pool for potential functions/ roles in a startup's core team. To determine what pre-selected options do we provide to interviewees in the interview guide, we investigated into the existing literature research:

- (Brinckmann & Gemuenden, 2011) highlighted on the financial competence;
- (Keppler et al., 2015) proposed the importance of having team members specialized in the following aspects: regulatory, clinical development & education (as quoted "ability to communicate to doctors and KOLs"), technical development and commercial/ business development.
- (Mas & Hsueh, 2017) suggests the core team should be composed by people with expertise in areas such as: clinical development, technical knowledge, and fund-raising.

For this study, we summarized the literature studies above, and come to the list below to be evaluated by our interviewees:

- Financial team member,
- Technical team member,
- Commercial/ marketing team member
- Regulatory team member,
- Team member of clinical development and education.

Secondly, we investigate the necessity of the potential roles. We split it into two sub-questions: 1) which roles are essential? 2) evaluate their relative importance in a scale of 100%.

Thirdly, echoing chapter 4.4.4, where we examined the strategic alignment between the startup's resources and the company's core strategy, here we also examine the strategic alignment between the core team's setup and the startup's core strategy. The main measurements, according to (McGee et al., 1995), include:

- If a company's core strategy is market differentiator, then a strong marketing team member should exist;
- If a company's core strategy is technical differentiator, then a strong technical team member should exist;
- If a company's core strategy is cost leadership, then a strong operation/manufacturing team member should exist;

Measurement summary:

In this section, we first ask a semi-structured open question, so that the interviewees could select the potential functions to be included in the pool. Then, we ask them to identify the essential functions (Quantitative, binary), and "slice the pie" based on the importance between these roles, within a total scope of 100% (Quantitative, split between 100%). Finally, we ask an open question regarding the "strategic alignment topic". This is because at this moment, we are still not sure if this is included as a criteria by the interviewees, we would like to ask for their opinions.

2. Team size:

As introduced in chapter 3.3.4.1 (2), most academic research and empirical sources have quantified the ideal/ acceptable team sizes in numbers. Therefore, we also ask the interviewees to identify the quantitative answers directly.

Measurement summary:

We ask the interviewees to identify the acceptable and ideal team sizes in number.

4.4.6.2 Heterogeneity & homogeneity

Measurement	Sub-measurement	Type of question	Measurement explanation	Reference
Demographics	Gender diversity	Quantitative, select in scales	Select in regarding gender diversity topics: must have, prefer to have, prefer not to have, must not have.	(Brush et al., 2012)
	Age diversity	Quantitative, fill in number	The ideal age range of a startup team	(Franke et al., 2008)
		Quantitative, select in scales	Select in regarding age diversity topics: must have, prefer to have, prefer not to have, must not have.	(Amason et al., 2006)
		Quantitative, fill in number	What is the minimal age difference do you start to consider as "age diversity"	
Past experience	Fields of educational	Semi-structured open question	Validate and elaborate on the pool of possible educational background: engineering + business/ management + medical.	(Amason et al., 2006; Foo et al., 2006; Franke et al., 2008)
		Quantitative, binary	Which of the educational backgrounds are essential and if missing then serve as "veto" criteria	

		Quantitative, split between 100%	Based on the selected roles above, split the total 100% based on the importance.	
	Fields of working experience	Semi-structured open question	As for validation and implementation of the roles: sales and marketing, manufacturing, science/R&D/engineering , finance, medical, general management, and others	(Amason et al., 2006; Beckman et al., 2007; Beckman & Burton, 2008),
		Quantitative, binary	Which of the past experience backgrounds are essential and if missing then serve as “veto” criteria	
		Quantitative, split between 100%	Based on the selected experience categories above, split the total 100% based on the importance.	
Prior acquaintance	Professional level acquaintance	Quantitative, select in scales	How important is it for the founders to have previous professional level acquaintance: must have, prefer to have, prefer not to have, must not have.	(Franke et al., 2008; Eisenhardt & Schoonhoven, 1990)
		Quantitative, fill in number	The minimal years of professional level acquaintance can be started to count as effective	

Table 15 Heterogeneity & homogeneity of team in evaluation criteria

1. Demographics:

Measurement summary:

Both genders and ages are straight-forward measurements.

2. Past experience:

Firstly, we investigate the educational background.

In terms of educational fields background, we would like to know what kind of combinations in terms of educational categories if possessed by the team members would be deemed as ideal by the investors. To determine the “pool for selections”, we investigated into the existing literature research:

- (Amason et al., 2006) proposed five educational specializations: arts, science, engineering, business and economics, and law;
- (Foo et al., 2006) included 10 categories of education in their study, but only four were highlighted in the paper: computer science, engineering, science, business administration;
- (Franke et al., 2008) separated the educational background into two broad categories: management and science.

However, because in this research we specifically look at the medical sector, we include the “medical” educational background also into our potential pool.

Secondly, we investigate the past working experience.

In terms of past work experience, we are curious about what kind of team profile in terms of working fields combination would help the startup to pass the evaluation of VCs. To determine the “pool for selections”, we investigated into the existing literature research:

- (Beckman et al., 2007) proposed five functional areas: 1) sales and marketing, 2) administrative support functions, 3) manufacturing, 4) science or engineering, and 5) finance.
- (Beckman & Burton, 2008)’s research reflected similar categories, but with some modifications, and thus summarized the categories into six: 1) sales and marketing, 2) general administration (including human resources), 3) science/R&D/ engineering, 4) business development/ strategic planning, 5) finance/ accounting and 6) operation.
- (Amason et al., 2006) also specified six functional areas: 1) marketing, 2) finance, 3) technical (engineering, R&D, etc.), 4) operations/manufacturing, 5) information systems, and 6) general administration.

To summarize, the pre-selected pool for functional experience are: 1) sales/ marketing/ business development, 2) administrative support functions, 3) manufacturing/ operation, 4) science, R&D, or engineering, 5) finance.

Measurement summary:

For both educational and functional experience, we firstly use a semi-structured open question to ask the interviewee to verify and elaborate on the pre-selected pools, then we ask quantitative questions so the interviewees could weigh the importance of each category.

3. Professional acquaintance:

Regarding professional level acquaintance, (Franke et al., 2008) categorized this measurement into three levels: professional, private and brief. (Eisenhardt & Schoonhoven, 1990) set the threshold of time of affiliation between founding team members as 6 months.

Measurement summary:

For this measurement, we firstly use a “Quantitative, select in scales” question to measure the importance of professional level acquaintance. Then, we ask the interviewees to quantify the minimally qualifying time of the acquaintance.

4.5 Data collection

Our starting point was secondary data collection from literature research, which helped to build the initial research framework. The data came from multiple sources, such as industrial reports, literature studies and documents from national/regional authorities.

In the next step, we collect data via semi-structured interviews to answer our research questions. As stated in earlier chapters, by doing so, we are able to both generate rich insights and formulate structured and standardized criteria.

4.6 Data analysis

The original data was captured in audios, meaning all interviews were recorded. After obtaining these audio files, a transcript software TurboScribe⁵¹ is used to help generating the automatic transcription texts. Because the research project is composed by five sub research questions, the answers we collected from the interviewees are targeted for each research question. Therefore, the data is analyzed following a deductive analysis approach (Bingham & Witkowsky, 2022).

We used different types of questions for different research questions. Please refer to chapter 4.4.2 for detailed list of question types. In general, the question types include: “Fully open questions”, “semi-structured open questions (verification and elaboration based on previous findings)”, “Quantitative, select in scale/ multiple choices” and “Quantitative, fill in number”.

- For fully open and semi-structured open questions, the original text containing relevant answers were quoted, analyzed and grouped to generate insights and answers. The process is done by excel.
- For quantitative questions, the answers and numbers were double checked comparing to the audios and text, then registered in excel for further analysis. The basic functions such as sorting, filtering, counting and taking average are used, in order to find important insights and draw conclusions.

5. Findings

This chapter provides the definition of medtech startups in the eyes of VC investors, illustrates the evaluation process, highlights venture selection criteria, and shines lights on the detailed criteria within the team aspect. Sub-chapter 5.1 summarize the control variables of the participating interviewees, and sub-chapter 5.2-5.6 answers the corresponding research questions 1 to 5, respectively.

5.1 Summary of control variables

To facilitate the analysis, we labeled them as Participants 1-10 (P1 to P10). P1& P2 are field experts, and P3 to P10 are the 8 venture capitalists. Their general profiles are presented in **Table 16** below. **Appendix 4** presents the detailed statistics of the control variables via graphs.

Interviewee No.	Interviewee type	Focused industries (vc)	Focused industries (personal)	Years establish VC firm	Experience level (personal)	No. Investors	Fund value (mil €)	Investment stages	Investment locations
1	Field expert	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
2	Field expert	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
3	VC	Hightech general	Hightech general		4 Manager	12	50	Pre-seed, seed, Series A	Certain regions in NL
4	VC	Hightech general	Hightech general		8 Student	6	0.3	Pre-seed, seed	Certain regions in NL
5	VC	Hightech general	Medtech	42	Manager	40	605	Pre-seed, seed, Series A	Certain regions in NL
6	VC	Hightech general	Hightech general	49	Manager	26	500	All	Certain regions in NL
7	VC	Medtech	Medtech		7 Associate	4	26	Pre-seed, seed	Netherlands
8	VC	Medtech	Medtech		18 Partner	11	75	Pre-seed, seed, Series A	Western Europe
9	VC	Hightech general	Hightech general		3 Manager	7	59	Pre-seed, seed, Series A	Certain Dutch alumni universities
10	VC	Deeptech	Deeptech		2 Associate	6	75	Seed, series A	EU

Table 16 General profiles of the interviewees

⁵¹ TurboScribe, [Link](#)

Within the eight interviewees from the VC sector, two (P7& P8) are from VC firms dedicated in the medtech sector, five (P3, P4, P5, P6, P9) are from firms focusing on general high-tech investment but include medtech as one of their focuses. Another interviewee (P10)'s firm specializes in a specific type of deeptech, of which medtech is one of their application areas. Although the firm focusing on general high-tech portfolio, the P5 is an expert in medtech startup, and thus focuses on the medtech portfolio. The fund value and years of establishment both show the levels of experience and position in the industry. We found out although older firms (P5 & P6) have highest levels of fund values, the youngest firms (P10, P9 & P3) do not necessarily have lowest fund value. Regarding investment stages, almost all firms specialize in early-stage investment, only P6's firm does investment in all stages. In terms of geographical scope of investment, 4 out of the 8 (P3 -P6) interviewees' firms take the startups registration location as a pre-condition: The startups have to be registered at certain locations within the Netherlands. The firms of P8 & P10 takes startups from certain parts of Europe into consideration, while the scope of P7's firm is the whole Netherlands. The firm of P9 only invests in startups if the founders are alumnus from certain Dutch universities, regardless the startup's current locations.

5.2 Research question 1: Identifying medtech startups

5.2.1 Originally proposed criteria were mostly not supported

Understanding how the participating interviewees define the medtech startups serve as the baseline of our whole research. In literature research (Chapter 2.1.1), we summarized 5 dimensions in order to define a medtech startup: newness, innovativeness, financial threshold, development level, and scope of medtech. However, we found out three out of the five elements were not supported by most the interviewees as a criterion to identify medtech startups, namely newness (8 interviewees objected), development level (10 interviewees objected), and financial threshold (8 interviewees objected against revenue level, 5 interviewees objected against investment received). The key reason for these objections is because the interviewees define a medtech startup mainly by checking **if the market needs is addressed and if the scalability is created**. Comparing to these key strategic questions, the rigid number scales that filter the years of establishment, financial thresholds and development levels are rather superficial than fundamental.

Regarding the newness (years of establishment), the two interviewees who rooted for this criterion are P3 and P7, who gave the year limitation of 5 and 7 years, respectively. However, when we looked for the reasons of their statements, both of them said the number of years was just a policy/ hard criterion of the investment selection. All of the other interviewees replace this criterion with ability of growth (scalable business model and profitability). ***“(All of these) do not matter. as long as the company still does not have valid business model, it is a startup”. -- P5***

Regarding the development levels, all of the interviewees defined the TRL level 9 and regulatory approval as a prerequisite of graduating from a startup. In medtech sector, a scalable business model requires regulatory approval, without needing to say. ***“If you want to be able to sell it for anything else than research use, you will need to have the approval to sell.”—P1***

Regarding revenue level, most people found it is a difficult criterion to use because different medtech products generate dramatically different revenue levels. This is also validated by the two interviewees (P1, P7) who gave a numeric number to define the revenue threshold. The numbers they gave are €3-5 million, and €0.2-0.3 million, respectively. Considering two interviewees have significantly different

backgrounds and focuses of (P1 is a general expert specializes in all healthcare startup fields, while P7 is a VC investor only focuses on digital health sector), the contexts that supported their arguments, such as product unit price, units of sales, market potential and landscapes are also different. This results in ununified answers towards this threshold. **“From the step of startup to scale-up, it requires that you have a repeatable and scalable business model. You cannot say a company is scale-up only by its revenue number.”—P2.** Similar reasoning is given to the criterion of investment received. Although 5 interviewees voted in concrete values, the given values range from 2 million to 5 million, from Series A to Series D.

the most returning answer we receive that defines startup threshold is that “the startup is growing in a scalable (60%) and healthy (positive cash-flow, 20%) way”. A company could be many years old, but if they have not figured out their scalable business model, and been able to create more revenue than cost, then they will continue stuck in the startup phase. **It’s a startup as long as the business model isn’t validated. So it can, for example, be 10 years of age. But if there’s no valid business model, meaning creating structural less revenue than costs, then it’s still a startup. In our definition.-- P5**

5.2.2 Innovativeness

Innovativeness is supported by all interviewees (10/10) to as an important feature to define startup. However, the two proposed criteria: 1) existence and number of PhD founders; 2) existence and number of patents, were only partially supported by the interviewees. All interviewees (10/10) rooted for the importance of patent existence, but none of them (0/10) reckoned the number of patents is important. The numbers of interviewees supported and objected the importance of PhD founders are comparable (6 vs 4), and none of them voted for the importance of number of PhD founders.

Regarding patents, the interviewees all agree the quality of patents is much more important than the quantity. While good patents are defined as those which could defend the company’s “Sustainable competitive advantages”. Furthermore, three interviewees (P3, P9, P10) linked the criticality of patents with the patent portfolio strategy. In this case, although the portfolio strategy could link to the number of patents, however, the investors would not see it as a problem if the technology can be well protected by low number of patents. **If they (the startups) can protect their entire technology with, for example, two patents, it’s not like that we will say ‘oh, only two patents! and it’s not innovative enough.’—P10.**

Regarding PhD founders, 40% interviewees (P1, P3, P5, P6) did not think it is a strong signal of innovativeness, while the others did think so. The key arguments against the importance of PhD founders include: “PhDs do not necessarily mean knowing market needs” and “the key point of good innovations is about addressing the unmet market needs”. **“I know quite some startups from TU Delft. They are master students and found something which you could argue, okay, maybe technologically or scientifically not that innovative, but they’ve found a new use of existing technology.” – P1.**

Interviewees who agreed that having PhDs is an important indicator for innovativeness is because they think PhD represents professional expertise. The reasoning is highly similar compared to the chapter 5.6.5—The educational background of the core funding team. **Seeing PhDs is good because then, you know, for us, there is medical knowledge in the team. -- P7**

To a further step, the consensus of the new definition of “innovativeness” has been reached by most (70%, P1, P5 – P10) interviewees: It has to be “market-pulled”, meaning solution should be “addressing the unmet needs, problem-solving, showing competitive and uncopiable advantages”. In essence, the

innovativeness is viewed as an “enabler”, that enables the startup to connect to the real market needs, and achieve the final goal of scalability. ***“If you address an unmet patients' need, we reckon that innovative. If you just want to create a new therapy, we found that less interesting.”-- P8***

5.2.3 Medtech definition: B2B and tangible products

When being asked “what does medtech mean for you when defining a medtech startup”, the majority (6/10 interviewees) defined that the products have to be “B2B and tangible”, meaning no digital solutions or consumer products should be included in the definition. For the other 4 interviewees who answered differently: interviewee no. 7 specializes in digital health solutions, therefore it is logical that they only see digital healthcare solutions being included in the definition scope. P2, P3 and P4 do not put any restriction on the product type, as long as the technology serves the purpose of healthcare.

In general, the definition of medtech is more depended on the decisions of investors’ business scopes. There was no clear reasoning and associations between chosen product types and positive/ negative judgements of the venture’s potential. However, according to the sample interviewees, we can come to the argument that a startup with a tangible device targeting at the B2B healthcare market will be considered by most VCs with medtech business as a “product type fit”. Yet medtech startups developing other product types will be taken into considerations by much smaller numbers of VCs, hence they have to select their targeting VCs much more carefully.

5.2.4 Summarized answers to research question 1

The purpose of research question 1 is to bring a definition for medtech startups, based on the answers from experts in the venture capital field in the Netherlands. Please review **Appendix 5** for the statistics and illustrations of the answers to each interview question under RQ 1.

We categorized this definition into two scopes:

- What is startup?
- What is medtech?

Within the scope of “startup definition”, we identified the 4 dimensions: newness, financial threshold, development threshold, and innovativeness. Within the scope of “medtech definition”, we asked for the interviewees’ opinions based on a list generated from literature research.

To summarize the results from chapter 5.2.1 to 5.2.5, we define the features of medtech startups in the following **Table 17**.

Scopes	Items		Results
Startup definition	Newness		Before figuring out valid business model
	Financial threshold	Revenue per year	Before reaching positive cash flow
		Investment received	Not a strong signal
	Development level	TRL	Not a strong signal
		Regulatory	Not a strong signal
	Innovativeness	Importance and meaning	Must be market-pull, fill unmet needs

		Patent(s)	Highly strong indicator, number does not matter
		PhD founder(s)	Strong indicator, number does not matter
Medtech definition			B2B and non-digital

Table 17 Summarized answer for definition of medtech startups

To describe the definition, we put it in the following wording:

Medtech startups are the companies who:

- Have not yet figured out their valid business model.
- Have not yet reached break-even.
- Must focus their innovation on addressing the unmet needs from market and users.
- Must have one or more patent(s), whose purposes align with the company’s core business strategy.
- The customer group must be business (hospitals and other healthcare providers), instead of end consumers.
- The product(s) of the company must be tangible, instead of digital.

5.3 Research question 2: The evaluation process

5.3.1 Result of analysis

Table 18 below presents the summarized evaluation process described by the 10 interviewees.

Interviewee No.	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9
1	Getting in touch	Initial screening	F2f meeting	Further investigation	Term sheet	Due diligence			
2	Getting in touch	Initial screening	F2f meeting	Further investigation	Term sheet	Due diligence			
3	Getting in touch	Initial screening	F2f meeting	Further investigation & questions	F2f meeting	Term sheet	Due diligence		
4	Getting in touch	Initial screening	F2f meeting	Pitch for board/partners	Further investigation & questions	Vote	Submit to IC/Supervisory board	Term sheet	
5	Getting in touch	Initial screening	F2f meeting	Further investigation & questions	Term sheet	Due diligence			
6	Getting in touch	Initial screening	desk research	F2f meeting	Further investigation & questions	Term sheet	Due diligence		

7	Getting in touch	Initial screening	F2f meeting	Further investigation & questions	Pitch for board/partners	Metrics evaluation	Term sheet	Due diligence	Submit to IC/Supervisory board
8	Getting in touch	Initial screening	F2f meeting	Further investigation & questions	Term sheet	Due diligence			
9	Getting in touch	Initial screening	F2f meeting	Form investment consortium	Term sheet	Due diligence	Submit to IC/Supervisory board	Confirmatory DD	
10	Getting in touch	Initial screening	F2f meeting	Further investigation & questions	Term sheet	Due diligence	Submit to IC/Supervisory board		

Table 18 Summarized table for evaluation process

Although some parts of the answers are different between the interviewees, we see the venture capitalist and field experts share comparable results in general:

- (1) All interviewees describe the process start with getting in touch with the startups, although some are more actively scouting for startups, while others mostly get the pitch decks sent to them.
- (2) After getting in touch, the venture capital firms will quickly conduct initial screening and evaluation. Noticeably, 7 out of the 10 interviewees have described this first screening will go very quickly, and most of the time the startups will get a meeting with the investors. The main function of this initial screening is to sift out the startups that do not fit in the investment portfolio of the VC firms, instead of judging the quality of pitch decks.
- (3) The third step is usually the first face-to-face meeting. It is also the first time that the VCs evaluate the teams.
- (4) After the first face-to-face meeting, the VCs start their background investigation, by further desk research and calling for references. Then it will take some iterative rounds of further meetings, questioning, investigating, and validating.
- (5) The fifth step is offering a term sheet to the startup.
- (6) After figuring out the term conditions, the due diligence will be conducted.
- (7) Finally, the investment proposal will be submitted to (typically) the investment committee for ultimate approval.

Compared to the original steps summarized by literature research in chapter 3.2, our findings based on the answers from the 10 interviewees have both confirmed them steps, but also brought rich elaborations. One of the main points that we summarized from the interviewees but not was not mentioned was the iteration of the process from after initial screening to before term sheet. After the first face-to-face meeting, the VC firms will contact field experts for validation, come back to startups with new questions, validate again, and iterate in this way for a few time. ***“So especially in MedTech, they (the VC investors) will be looking at certain key opinion leaders in the field to identify, let's say,***

who is an authority on this subject before actually bringing an offer to the table in a term sheet.” –P2.

For this research, we can associate this point with one of the key findings we drew from chapter 5.2: The “unaddressed market needs” is one of the most reoccurring concepts during the interviewees, when the interviewees are summarizing the important characters of medtech startups. The VC investors have to be sure that the market needs claimed by the startups are indeed true and significant.

5.3.2 Summarized answer to research question 2

To summarize the analysis, the **Figure 9** below shows the answer to the research question 2.

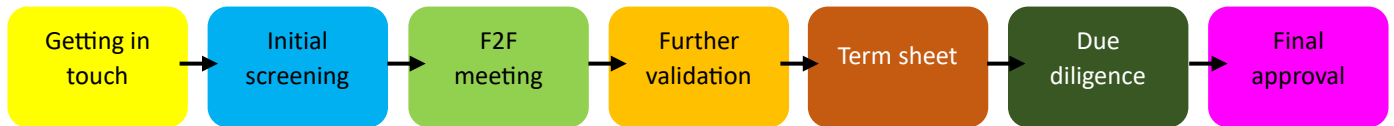


Figure 9 General evaluation process for medtech startups by venture capitalists

5.4 Research question 3: The evaluation criteria

5.4.1 Result of analysis

The research question 3 asks about the general evaluation criteria and the components being involved, in the formats of both semi-structured open questions and quantified numbers. The **Table 19** presents the selected criteria and corresponding weights given by each interviewee.

Interviewee No.	Team	Technology	Market	Regulatory	Finance
1	33%	33%	33%		
2	30%	20%	25%	20%	5%
3	40%	25%	35%		
4	20%	35%	30%	5%	10%
5	20%	20%	60%		
6	20%	20%	20%	20%	20%
7	40%	10%	20%		30%
8	10%	40%	20%	20%	10%
9	35%	10%	35%	10%	10%
10	20%	40%	20%	20%	
Total average	27%	25%	30%	10%	9%

Table 19 Selected evaluation criteria and corresponding weights

The top three criteria being selected are: market (30%), team (27%), and technology (25%). However, notably, 5 (50%) interviewees (P2, P4, P6, P8 and P9) have explicitly expressed that all of the five evaluation components are indispensable, meaning that performing poorly on any of the aspects will lead to a red flag in evaluation. ***I think if for example the financial readiness would fail, then you have an issue. If another one (aspect) would fail, you have an issue. So, they all must be important. That's always what I say, if you build a bridge to another side of the river, you must make sure that you can reach the other side of the river. Half a bridge is no bridge. --P6***

In general, the interviewees believe the regulatory and financial capabilities are less important. Mostly because of the reasons: it could make sense to outsource them in an early stage startup. ***For finance and regulatory, you can always outsource them and use consultant in seed-round. –P4***

5.4.2 Market, team and technology: who is the initiator of a medtech startup?

As a qualitative research, we value not only the ranking and numbers given by the interviewees, but even more the logics and reasons behind them. As half of the interviewees strengthened that all the 5 elements are indispensable, we curiosity started to expand from not only the “ranking of importance”, but also to “which quality should a startup generate first”. As the resources of startups are usually highly limited, such insights will be highly valuable when a startup is about to take-off.

We heard three voices:

- The team (P6, P7, P8, P9, P10)
- The unmet market needs (P1, P5)
- The innovative technology (P2, P3, P4)

The interviewees who rooted for teams believed that teams are the ones who make things happen. They are the ones who solve problems in all other aspects and make progress for the startup along the way. ***We can discuss the products right now, we can also discuss the market right now, and we can discuss everything. But we also know that everything will change in some way. So we are trying to predict the future, but we're not really sure. And there's one thing we know for sure is that this team needs to build a big company. So if the team is unable to deal with challenges, then we know for sure that it won't be a success. –P9***

P1 and P5 argued that the unmet needs of the market are the beginning of everything. ***We first look at the market opportunities. Then the technology: does it fit the best possible solution to the problem better than any other technology? Does it strengthen sustainable competitiveness? And the team: can the team build a solution based on this technology to get a new value reflection point? –P5.***

Additionally, P1 added that the team is actually replaceable, if the investors believe the team is not the right fit. However, at the same time, P1 added that a “star-team” (a team composed by experienced serial founders) is an exception, because such a team is always able to identify the true user’s needs.

The other three interviewees believed the technology comes first before market needs, as they believe an innovation should be technology-pulled (see chapter 5.2.2). However, it does not mean that they would think technology is the most important aspect for a medtech startup to succeed. ***For a MedTech startup, I think what makes or breaks it is the product itself. However, even you have some groundbreaking idea or technology, you might later still find out that there's not a really big market for it. So then the founders also have to have the mentality of pivot. –P3***

5.4.3 Summarized answer to research question 3

The market, team and technology are the most important evaluation criteria. However, the startups should also prepare themselves in terms of adequate levels of regulatory readiness and financial projection, to pass the evaluation from the venture capitalists.

5.5 Research question 4: The role of team aspect

5.5.1 Coding

For this research question, we asked the open question: “Explain why and how important is the ‘team’ aspect in evaluation.” The **Table 20** below presents coding summary for this research question. Please review the **Appendix 6** for the linkage between original quotations and 1st level quotes.

Interviewee no.	1st level quotes	2nd level quotes	3rd level quotes
1	"Star-team" exception	"Star-team" exception	"Star-team" exception
7			
1	Coachability	Flexibility	Entrepreneurial spirit (subjective factor)
5			
8			
4	Pivotability		
9			
1	Investors can replace team		
3	Goal-driven	Being determined	
6			
4	perseverance		
6			
7			
9			
1	Secondary important	Secondary important	Importance level
5			
7	Highly important	Highly important	
8			
3	Indispensable factor	Indispensable	
4			
5			
6			
9			
10			
2	Most important factor	Problem-solving ability	Demonstrated capability (objective factor)
6	Make things happen		
9	Solve challenge		
10			
2	Senior experience	Past record	
8			
6	Team-milestone alignment		
3	Team cohesion	Team cohesion	Team cohesion

4			
7			

Table 20 coding summary: importance of team aspect

We obtained 5 3rd level quote by the end. Two (“Highly important/indispensable factor” and “star-team exception”) described the importance levels of “team factor”, and three (“Entrepreneurial spirit (subjective quality)”, “Demonstrated capability (objective factor)” and “team cohesion”) described what kind of team factor are seen as the most important by the investors.

5.5.2 Key findings

5.5.2.1 Team: A highly valued factor by medtech venture capitalists

Vast majority (8/10) of the interviewees confirmed the significant position of “team” regarding VCs’ evaluation towards medtech startups. Only P1 and P5 believes that “team” is secondary compared to market opportunity/ unmet market needs.

However, if we investigate further, we found out that their statements are built upon some prerequisite:

- The “team” factor ranks after “unmet” market potential, because the VCs will replace the (core) team members when needed. However, this requires the team’s strong ability of “being flexible and coachable” (explained in the next section in this chapter).
- According to interviewee P1, the statement “team is secondary” does not hold when the team is a “all-star team” (experienced serial entrepreneurs). In this case, the team could always find the unmet needs and create solutions. This point is also echoed by the P7. ***“If they (the startup) have like an amazing team that already did like multiple exits, then that's very interesting. Then the team was so good that the other things become a little bit less important.” --P7***

Therefore, we are convinced that “team” is a highly important factor when VC investors evaluating medtech startups.

5.5.2.2 How to build a medtech startup team that will be perceived positively by VC investors?

To summarize the answers from the 10 interviewees, the VC investors would like to see three characters from the medtech startup core teams:

- Entrepreneurial spirit,
- Demonstrated capability,
- Team cohesion.

a. Entrepreneurial spirit

Everybody agrees that building a medtech startup is no easy task. The VC investors hope to see the team members to be both flexible and determined.

- In terms of “flexibility”, interviewees P1, P5 and P8 highlighted the keyword “coachability”, while P4 and P9 strengthened “pivotability”. They made it very clear that, under difficult circumstances, the teams need to be willing to absorb external advice and signals and adjust their original plans and strategies. Additionally, when P1 stated that “the team might not be the most important factor, as the investors could replace the team”, it actually also requires the

flexibility from the team. ***“Why is team important? Well, because we can discuss everything (product, market,...) right now. But everything will change in some way in the future. There’s one thing we know for sure is that this team needs to build a big company. They need to adapt to all these uncertainties in the future.”--P9***

In terms of “being determined”, interviewees also shared their opinions: startup can be a challenging journey. The team has to be always motivated, striving for the goal, and have a strong mindset. Otherwise, the investors think the startup is not viable. ***“I see it quite often that we have a startup and then something doesn't go well, then they just get a bit depressed and it doesn't work out and they don't work as hard anymore.”--P 4***

Notably, “being determined” requires both forward looking (goal-driven) and getting through the current moment (perseverance). The entrepreneurs should have an unshakable future that they bear in mind, so that they can hold mentally strong and get through the current barriers.

b. Objective capability

Entrepreneurial team members should have past records to make sure they understand the challenge and bring in the right expertise and network. At the same time they should also have the ability to get hands on and solve the current challenges.

Experience

P2 and P8 require seniority and certain experience levels in a startup team. They believe that, besides the “willingness (mind power)”, the startup team members should also have the ability to solve the problems and make things happen. This is especially the case in the medtech sector, as talking to medical professionals require specific knowledge and experience. ***“You need very senior people in this industry to really get your innovation to be sold to hospitals and all these other people.” --P2***

P6 aligned the experience level with the milestone that the team is going to achieve: they believe that each phase of the startup has different focus and require different types of talents with specific strengths. Only people with the right experience and capability could help the team to move to the next phase. ***“After a certain development period, you need more business type of people, commercial people. Each phase, you need the right team.” --P6***

Problem-solving ability

To solve problems occurred in the entrepreneurial journey, mindpower is of course important (explained above). However, it gets the team nowhere if the actual problem-solving ability is not in place. The team needs to know all the aspects of building a company, and be able to execute it. They are the ones who make things happen. ***“The team has to run like hell for a small amount of money. And they have to be at the steering wheel. They have to do the job.” --P6***

c. Team cohesion

Aligning with our literature research in the right-top (subjective and qualifiable) quadrant, “team cohesion” is highlighted by three interviewees (P3, P4, P7).

A team with good cohesion can complement each other’s drawbacks, communicate with each other well, and solve the conflicts and move forward. If investors sense the team members are not able to

work with each other smoothly, a red flag could be raised. As we stated in the previous chapter, generally investors do not like single founders. This means that the investors expect a team is formed with diversity: each team member has their own specialty and takes on different roles. Therefore, personal capability can only deliver value in a startup team, if the team is working in a cohesive way.

“There has to be good team cohesion, so everyone can work together and that they're able to also solve conflicts.”-- P4

5.6 Research question 5: The “team-objective” (top-left) quadrant

5.6.1 Proposition 1: Functional setup

Original proposition 1:

There are five essential functions that need to be included in a startup’s core team: 1) Science/ R&D/ engineering, 2) sales/marketing (commercial), 3) medical, 4) regulatory, 5) financing.

5.6.1.1 Data presentation

In the interviews, we asked the interviewees to: a) select the indispensable roles within the list: Commercial, Technical, Financial, Medical, Regulatory, and others; b) quantify the importances of each role in the functional setup. **Table 21** presents the selections of indispensable functions.

Interviewee No.	Science/ R&D/ engineering	Commercial	Medical	Regulatory	Financial	General/ entrepreneurial
1	y	y	y			
2	y	y				
3	y	y	y			
4	y		y			
5		y				y
6	y			y		y
7	y	y				y
8	y		y	y		y
9	y	y			y	
10	y		y			

Table 21 Selections of indispensable functions

We have seen that there are 3 function roles nominated by more than 50% interviewees. They are: Science/ R&D/ engineering (90%), commercial (60%), and medical (50%). Additionally, 4 interviewees have brought up a new function: general/ entrepreneurial. They describe it as the person as someone who could “set up the company and get things started”, and have the “true entrepreneurial spirit”. ***“Sometimes it's just a PhD and a professor (on the startup team). We are looking for a founding team that does the right things at the right stage of life and can raise sufficient money from the market.”—P5.*** Most interviewees see regulatory and financial are the capacities that could be hired from external sources (echoing chapter 5.4.1).

Furthermore, we found out that usually the “general/ entrepreneurial” is not a separate role. Instead, it is someone specializes in the engineering, commercial or medical that also have an entrepreneurial spirit

and can take on a general management responsibility. This is because the startup team must be as compact as possible. Everyone in the team needs to serve a concrete function and make things happen. ***The technical or medical expert has to be the entrepreneur, so to speak.*** –P10

The **Table 22** shows the result of weighted importance of each function.

Interviewee No.	Science/ R&D/ engineering	Commercial	Medical	Regulatory	Financial	General/ entrepreneurial
1	33%	33%	33%			
2	40%	30%	20%	10%		
3	33%	33%	33%			
4	25%	20%	25%	10%	10%	10%
5		40%				60%
6	33%			33%		33%
7	33%	33%				33%
8	40%		10%	20%		30%
9	33%	33%			33%	
10	40%	20%	40%			
Average	31%	24%	16%	7%	4%	17%

Table 22 Selections of indispensable functions

In general, the ranking of functional importance aligns with the voting on indispensability. The top two important functions are “science/ R&D/ engineering” and “commercial”, respectively. The importance of “general/ entrepreneurial” role is almost the same as “medical”. We are interested in digging out a bit more insights regarding these two factors.

Surprisingly, we found out that within the three interviewees who specialize in medtech investment (P5, P7, P8), two out of three did not mention “medical” as an important functional setup at all. The third interviewee (P8) only give 10% importance on this item. On the other hand, when rating “general/ entrepreneurial”, all of these three specialized medtech investors gave high value, namely 60%, 33% and 30%, respectively.” We summarize that the specialized medtech investors believe the technology know-how, identifying the unmet market needs for this technology, and ability of setting up the venture are the fundamental factors in team composition. ***“A team that is as small as possible but with knowledge about the technology, knowledge about the market of the first application and has a strong sense of leadership. So it's more of a general type with a strong focus on the technology and on the application.”***—P5. ***“We usually like to have a hustler, which is commercial; a hacker, which is technical; and also the hipster, which is more strategic visionary. If you have a medical background, that's always good. But it's not a necessity.”*** – P7

However, for the general hightech investors who include medtech as part of their investment scopes, they believe that it is important if a medtech startup have a medical expert.

5.6.1.2 Conclusion and revision of proposition 1

We select 3 functions as the most important in a medtech core team: science/ R&D/ engineering, commercial, medical and general/ entrepreneurial. Additionally, at least one of the three roles need to also take on the “general/ entrepreneurial” responsibility. If the medtech startup goes for the general high-tech investment fund, they should pay attention to highlight their medical expertise and the expert

in the team. However, if the startup is presenting themselves in front of a specialized medtech fund, they should focus on showing their understanding about the technology, as well as the ability of commercializing this technology.

Refined proposition 1

There are three essential functions need to be included in a medtech startup team: 1) Science/ R&D/ engineering, 2) sales/marketing (commercial), 3) medical. “General/ entrepreneurial” role is also highly important in a medtech startup, but it should not be a separate role. Instead, it should be included into the responsibility of one of the three functions named above.

5.6.2 Proposition 2: Strategic alignment

Original proposition 2:

The team functional composition should not be evaluated in an isolated way. An external link should be made between this composition and the core strategy of the startup. The quality of this link should be evaluated by the investors.

5.6.2.1 Data presentation

To validate proposition 2, we asked the open question to the interviewees: “Besides evaluating the functional setup in a general way regardless context, do you also value the alignment between the setup and the company’s core strategy? If so (or not), how and why is that (un)important?”

We present the coding table in **table 23**. Please review the **Appendix 7** for the linkage between original quotations and 1st level quotes.

Interviewee No.	1st level quotes	2nd level quotes	
1	Highly important	Importance level	
2			
5			
6			
7			
8			
9			
3			Not so important early stage
4			
1	Core strategy-driven	Long-term strategy fit	
2			
9			
10			
3	Limited resources	Reason for not so important	
4			
8	Fit between milestone and team	Short-term milestone fit	
10			
5	Fit between mission and team		

7		
6	Fit between phase and team	
6	Right people at right time	

Table 23 Coding summary of proposition 2

Most (80%) of the interviewees confirmed the importance level of team-core-strategy alignment. The answers echoed with the insights generated in the chapter 5.5.2.2-b: objective capability. The team members should be equipped with the right past experience to overcome the challenges they are facing, and reach the goal they have heard in mind for their entrepreneurial journey. ***For example, if we're selling a MedTech product that's very heavy on imaging, we for sure look for a CTO with a very strong background in imaging.—P9***

Yet, there were 2 interviewees (P3 and P4) reckoned differently. However, if we looked further into their reasons, it is not actually because they believe team-core-strategy alignment is insignificant. Instead, they were being practically and understood that as an early-stage startup, usually the team do not have the luxury of choosing the team. ***“I would say all of them except the strategic alignment. Because a new company usually doesn't have that many resources.”—P4***

Besides the team-core-strategy alignment, which focuses on the company’s long term vision, 5 interviewee participants highlighted the importance of milestone-team (short-term) alignment (P10 rooted for both short and long term alignment). Because of the high risks of startup in each phase and possibilities of teams being changed by investors according to milestones, investors focus more on if the current team is being able to solve problems and reach the next milestone. ***We usually look at what the company needs to achieve in the next two, three years. And if the composition of the team is ready actually to deal with that. It's about being able to actually reach the next milestones. —P9***

5.6.2.2 Conclusion and revision of proposition 2

The VC investors highly value the alignment between team and 1) long-term core strategy, and 2) the short-term milestone of the startup. However, the investors also understand that in the early stage, sometimes the startups don’t have the resources or “luxury” to get an ideal team targeting right at the milestones or core strategies. This point can be well linked to the research question 4: the team should have the flexible yet persistent mindset, be coachable and prepare for the possibility of getting their teams changed by the VC investors in a later phase.

Refined proposition 2:

The investors highly value the alignment between the medtech startup team’s functional composition and its long- and- short-term strategies and milestones. If the team does not yet have resources to align on this aspect, they should recognize the possibility team member(s) of being changed by the investors in the future time.

5.6.3 Proposition 3: Team size

Original proposition 3:

The team size should be acceptable if it is between 2 to 4 people. Teams having 3-4 members have the highest chance of passing the evaluation from investors.

Regarding acceptable core team sizes, we took the quantitative approach, and asked the interviewees to fill in the numbers regarding: 1) lowest acceptable team size, 2) highest acceptable team size, and 3) ideal range of team size. The **Table 24** below presents the results from the 10 interviewees:

Interviewee No.	Lower limit	Ideal range	Upper limit
1	2		5
2	1	3	5
3	2		4
4		3	6
5	2		4
6	2	2-5	
7	2	3	4
8	2	3-5	
9	2		
10	2		

Table 24 Coding summary of proposition 2

From the answers above, we learned that single founder is seen as a red flag by most interviewees (80%, the vast majority). The upper limit of team sizes range between 4 to 6. The interviewees 1 & 2 are both field experts, who to our view represent a general and average view of the interviewees. We reckon the upper limit of the team size will be 5. *“In biotech, it's easier to outsource everything. In medtech, you need to have a core team (more than 1). You need to have somebody who takes a CEO role, which could be more a generalist, but somebody entrepreneurial. You need one or two technical people in a founder's team. And you usually have somebody who understands regulatory or medical, something like that. You can't have it in one person all.” – P8*

Refined proposition 3:

A medtech startup should not have only one single founder if they want to get investors on board. The acceptable core team size range between 2 – 5 members. Exceeding 5 team members will be viewed as a dangerous signal.

5.6.4 Proposition 4: Gender and age diversity

Original proposition 4:

The gender diversity is not an important factor to be considered when composing a medtech startup team, while the age diversity plays a negative role in VC evaluation, therefore should be limited.

The questions to proposition 4 are quantitative. The **Table 25 & 26** below presents the summarized attitudes of the interviewees towards gender and age diversity within a medtech startup's core team, respectively.

Interviewee No.	Must have	Prefer to have: Active steer	Prefer to have	Does not matter	Prefer not to have	Must not have
1			y			
2			y			
3		y				

4			y		
5		y			
6				y	
7		y			
8			y		
9			y		
10			y		

Table 25 Answers regarding gender diversity

Interviewee No.	Age diversity	Lower threshold: nr. of years counted as effective	All young age (20s)	All old age (60s)
1	Like	10	Dislike	Dislike
2	Like	15	Dislike	Dislike
3	Not mind			Dislike
4	Like		Dislike	
5	Not mind			
6	Not mind		Dislike	Dislike
7	Not mind		Dislike	
8	Not mind		Dislike	
9	Not mind		Dislike	
10	Not mind		Dislike	

Table 26 Answers regarding age diversity

Regarding gender diversity, most interviewees (90%) believe it is good to have. However, only 3 (P3, P5, P7) participating VC firms will actively steer towards the gender diversity to happen, with their offered investment terms. Although not serving as a control variable initially, when we zoom into the background of the three VC firms, we found out that they have a common character: they are all Dutch government-backed funds. Although not being discussed by the interviewees during the interviews directly, we can reason that the Dutch government is promoting gender diversity in medtech startup teams. *“It’s not a showstopper if it’s very singularity (in gender), but we do we have it in our contracts that they strive for diversity in their hiring policy.”—P3*

Regarding age diversity, it is usually not something that a VC firm would care. Instead, the firms would be more concerned if the teams are composed by only young (in their 20s) or only old (in their 60s) core members. Notably, both general field experts rooted for age diversity in a medtech startup founding team. However, at the same time, they have also expressed their concerns about all-old and all-young teams. *“You would like to see sufficient experience in the team. If everybody is green on the table and does it for the first time, that is something that you consider. The team needs to have experience but also the energy to execute, therefore not too old either.”—P6*

Refined proposition 4:

Gender diversity of core team members in a medtech startup is welcome by most of the VC firms. If the startup wants to get funding from a Dutch government-backed VC firm, then gender diversity should be a focus for them, or at least something they will need to prepare for the upcoming future. Age diversity is

not valued by the VC firms in general. However, it is a dangerous signal to the investors if the team is composed by only young or only old founders.

5.6.5 Proposition 5: educational background and working experience

Original proposition 5:

It is easier for a startup to receive positive evaluations from VCs if they have diversity in terms of both educational and past working/functional background.

5.6.5.1 Data presentation

For proposition 5, we used a combination of qualitative and quantitative method. **Table 27 & 28** presents the importance and necessity of different educational backgrounds in a medtech startup founding core team, respectively.

Interviewee No.	Technical/ engineering	Medical	Business	Legal	Others
1	50%	50%			
2	75%	25%			
3	50%	25%	25%		
4	50%	40%	10%		
5	60%	40%			
6	60%	10%	30%		
7	50%	40%	10%		
8	80%	20%			
9	50%	50%			
10	30%	50%	20%		
Average	56%	35%	10%	0%	0%

Table 27 Answers regarding importance of different educational backgrounds

Interviewee No.	Technical/ engineering	Medical	Business	Legal	Others
1	y				
2	y	y			
3	y	y			
4	y	y			
5	y	y			
6	y				
7	y		y		
8	y				
9	y	y			
10	y	y			

Table 28 Answers regarding necessity of different educational backgrounds

Technical/ engineering is seen by all interviewees as the indispensable and most important educational background. The second and third important educational background in a medtech startup core founding team are medical and business, respectively. Regarding necessity of educational background, both technical/ engineering and medical are rooted for more than 50% of interviewees (100% and 60%, respectively). Therefore, we define these two educational backgrounds are the most important and indispensable.

Technical/engineering is voted as the most important educational background with consensus from all interviewees. The reason is also very clear: The core team must have member(s) understand the technology deeply, so that they could convince the investors that the innovation works for a specific application, meet an unmet need and have a big enough market. ***I think that the mechanism of action or the technology, especially how the technology works is very important because you have to convince investors that this technology you think can work for a specific application. -- P5***

However, interviewees also shared further insights regarding specificity of background in engineering and medical educations. Clinical applications go hand in hand with the innovative technology. Investors want to see the engineering and medical educational backgrounds align more specific and relevant to the application. ***If they're doing something in diagnostics, then of course we would look a bit more particularly for medical. if it's an engineer who studied chemical engineer, that's also engineering, it might not be as relevant. --P10***

Although in proposition 1, “commercial” was identified as one of the essential functional setup in a medtech startup core team, “commercial” is rarely nominated as an essential educational background by investors. Generally, investors see “commercial knowledge” as something a person can learn in the later work experience after graduation. It is more “general” knowledge, which does not require specific education, compared to the “technical/engineering” or “medical” fields, which is seen as “irreplaceable and indispensable” by the investors. ***An engineer can do the business management things. --P8***

Table 29 & 30 presents the importance and necessity of different working experience backgrounds in a medtech startup founding core team, respectively.

Interviewee No.	science/R&D/engineering	business/marketing	Medical	General mgt/entrepreneurial	Regulatory	Manufacturing	finance
1	40%	20%	40%				
2	35%	35%	15%	3%	10%	2%	
3	50%	25%	25%				
4	30%	15%	30%		20%		5%
5		20%		80%			
6	40%	40%	10%	10%			
7	40%	40%	20%				
8	60%		10%	10%		10%	10%
9	50%		50%				
10	30%	8%	30%	8%	8%	8%	8%
Average	38%	20%	23%	11%	4%	2%	2%

Table 29 Answers regarding importance of different working experience backgrounds

Interviewee No.	science/R&D/engineering	business/marketing	Medical	General mgt/entrepreneurial	Regulatory	Manufacturing	finance
1	y	y	y				
2	y	y					
3	y	y	y				
4	y	y	y				
5		y		y			
6	y	y					
7	y	y					
8	y						
9	y		y				
10	y		y				

Table 30 Answers regarding necessity of different working experience backgrounds

There are three types of past experience that have been selected as “indispensable” by the interviewees: Technical (90%, science/ R&D/ engineering), business/ marketing (70%) and medical (50%). They are also ranked as the top 3 in the importance levels. Therefore, we define these three working experience types are the ones that a medtech startup should equip when they build a core team.

5.6.5.2 Relation between proposition 1 and proposition 5

Past experience is about “how could you apply your demonstrated records and knowledge in the past at your current role”. Past experience is a combination of educational background and working experience. While the current functional setup is a presentation and externalization of the past experience, via the form of the current startup team. The investors will perceive the current team setup as the first impression, which is backed by the past experience (education and working experience).

Education typically happens before the working experience. Therefore, education serves as foundation of working experience, while working experience could fill some potential gaps left during the education period. The relationship between educational background, past working experience and current team setup is visualized in **Figure 10**.

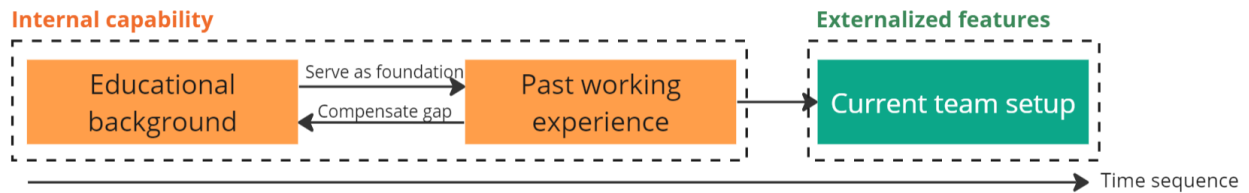


Figure 10 Relationship between educational background, working experience and current team setup

In essence, the investors only care about if the team have the capability to overcome the difficulties and meet the challenges (research question 4), without minding if the capability coming from past education or past work. However, there are some experience types that could be deemed as “more general and

lower barrier”, such as the “business” educational background. Even a team member did not get a degree in business, he/she could “learn on job” later. It is different for some other background types, such as medical and technical. They have much higher entrance barrier than business. If a person did not study these specializations specifically, it would be much less likely that they can catch up the required knowledge and experience in their later jobs. This explained why “technical/ engineering” and “medical” are regarded as essential by most interviewees in terms of both educational and working backgrounds, yet “business” is only indispensable for working experience.

5.6.5.3 Conclusion and refined proposition 5:

Design for the ideal team evolution plan

Connecting proposition 1 and 5, we could draw an “evolution timeline”, to describe how an ideal medtech startup team should select their team members, based on their past experience and current roles:

The ideal core team members should: have received medical and technical educations in school. In their later careers, they should get themselves (or at least one team member) become familiarized with the business domain. When they enter the startup, based on their specialized capabilities, they will take on roles such as medical, technical or commercial. However, at least one of the members should also be responsible for the general and entrepreneurial business build-up.

Refined proposition

Refined Proposition 5:

To be judged by VC investors positively, a medtech startup’s founding team should have educational and working experience backgrounds in three fields simultaneously: technical (science/R&D/ engineering), medical and business/ marketing.

5.6.6 Proposition 6: Personal affiliation

Original proposition 6:

It is preferred by the investors if the acquaintance among team members is featured as long-term and in a professional manner.

Questions to proposition 6 are quantitative questions. The **Table 31** below presents the answers from the interviewees regarding past personal affiliations.

Interviewee No.	Friends	Family	Couples	Professional	Minimal No. years starting to count as effective
1	Dislike			Prefer	2 years
2	Dislike			Prefer when multi-disciplinary	Not mind
3	Dislike	Dislike		Prefer	Not mind
4	Dislike	Dislike		Prefer	3 years
5	Not mind	Not mind	Not mind	Not mind	Not mind
6	Not mind	Not mind	Not mind	Not mind	Not mind
7	Not mind		No go	Not mind	Not mind

8	Dislike	Dislike		Prefer	
9	Not mind	Not mind	No go	Not mind	Not mind
10	Dislike	Dislike	No go	Not mind	Not mind

table 31 Answers regarding past affiliations

Significant numbers of interviewees dislike the founders originally knew each other from private relationships. Especially, 3 interviewees (P7, P9, P10) have specified that it would serve as a showstopper if the founders are a couple. Half of the interviewees judge the professional affiliations between the founders positively. However, the years of acquaintances seem not to matter. ***We don't invest in couples. Because of the risk. Something can happen between the relationship, and it's too high risk for a VCs. –P7***

Refined proposition 6:

Founders knowing each other initially via private friendship can be seen as a negative signal by investors, yet knowing each other from a professional setup will at least do no harm to the evaluation, or be perceived positively. “Couple-founders” could be seen as a dangerous signal by investors.

The **table 32** below summarizes the original and refined propositions

Proposition nr.	Original proposition	Refined proposition
Proposition 1	<i>Five essential functions need to be included in a medtech startup’s core team: 1) Science/ R&D/ engineering (technical), 2) sales/marketing (commercial/ marketing), 3) clinical development and education (medical), 4) regulatory, 5) financing.</i>	<i>There are three essential functions need to be included in a medtech startup team: 1) Science/ R&D/ engineering, 2) sales/marketing (commercial), 3) medical. “General/ entrepreneurial” role is also highly important in a medtech startup, but it should not be a separate role. Instead, it should be included into the responsibility of one of the three functions named above.</i>
Proposition 2	<i>The team functional composition should not be evaluated in an isolated way. An external link should be made between this composition and the core strategy of the startup. The quality of this link should be evaluated by the investors.</i>	<i>The investors highly value the alignment between the medtech startup team’s functional composition and its long- and-short-term strategies and milestones. If the team does not yet have resources to align on this aspect, they should recognize the possibility team member(s) of being changed by the investors in the future time.</i>
Proposition 3	<i>The team size should be acceptable if it is between 2 to 4 people. Teams having 3-4 members have the highest chance of passing the evaluation from investors.</i>	<i>A medtech startup should not have only one single founder if they want to get investors on board. The acceptable core team size range between 2 – 5</i>

		<i>members. Exceeding 5 team members will be viewed as a dangerous signal.</i>
Proposition 4	<i>The gender diversity is not an important factor to be considered when composing a medtech startup team. The age diversity (measured in absolute years) plays a negative role in VC evaluation, therefore the age difference level within a team should be limited.</i>	<i>Gender diversity of core team members in a medtech startup is welcome by most of the VC firms. If the startup wants to get funding from a Dutch government-backed VC firm, then gender diversity should be a focus for them, or at least something they will need to prepare for the upcoming future. Age diversity is not valued by the VC firms in general. However, it is a dangerous signal to the investors if the team is composed by only young or only old founders.</i>
Proposition 5	<i>It is more easily for a startup to receive positive evaluations from VCs if they have diversity in terms of both educational and working/functional background.</i>	<i>To be judged by VC investors positively, a medtech startup's founding team should have educational and working experience backgrounds in three fields simultaneously: technical (science/R&D/engineering), medical and business/ marketing.</i>
Proposition 6	<i>It is preferred by the investors if the acquaintance among team members is featured as long-term (measured in absolute years) and in a professional manner.</i>	<i>Founders knowing each other initially via private friendship can be seen as a negative signal by investors, yet knowing each other from a professional setup will at least do no harm to the evaluation, or be perceived positively. "Couple-founders" could be seen as a dangerous signal by investors.</i>

6. Discussion and conclusion

6.1 Key findings

6.1.1 Key findings and relevance to previous studies in RQ 1-4

6.1.1.1 Research Question 1

In research question 1, to identify of a medtech startup, the most striking finding is that “scalability of business model” is seen as the most important criteria. The previous traits identified in literature

research, such as newness, financial threshold, development level and innovativeness are seen only as potential features or outcomes of being a startup, yet the fundamental root cause of separating a startup from a scale up is “whether a company has figured out its valid and scalable business model”. This definition is more related to the “financial threshold” than other categories of criteria, as the financial performance serves as an indicator of the “business scalability and sustainability”. Referring back to literature review, The France and European Commission set the limitation of turnover of startups as 50 million and 10 million euros respectively (Bouhal et al., 2022); while startups in early stage and growth stages should have revenues between \$1 million and \$5 million and above \$5 million, respectively¹¹. However, in reality, it is hard for the VC investors to draw a clear number to represent this scalability and sustainability. This is due to the fact that different types of products and services in the medical sector are offered at significantly different prices, different margin levels and via different business models. Another key finding in research question 1 is about how to identify a successful innovation within a medtech startup. Referring back to literature review, according (Ferràs-Hernández et al., 2021; Hunady et al., 2018; Østergaard et al., 2011), the existence of PhD is a strong indicator of innovation. According to (Aggarwal et al., 2015; Baum & Silverman, 2004), the number of patents a startup owns has a positive correlation with the innovativeness judged by the investors. While (Brush et al., 2012) believes it is the existence, instead of number, that will create a positive impact on the innovativeness. Although all interviewees agree that innovativeness is highly important for a medtech startup, the criteria of “existence and numbers of PhD founders” and “existence and numbers of patents” are only partially supported: both existence are deemed as important, while both numbers are seen as insignificant. Additionally, new insights appeared in this research, regarding how a good innovation should be initiated: some interviewee participants believed it should be market-pull, while others reckoned it should be technology-pushed. Further research could be conducted in this field, by collecting larger sample sizes, and zoom into the context and reasons of these arguments, in order to achieve deeper insights.

In research question 2, referring back to literature review, (Gompers et al., 2020; Maxwell & Jeffrey, 2011; Ngassam, 2020; Tyebjee & Bruno, 1984) summarized the general VC evaluation process as: desk evaluation → Screening → Future Evaluation → Due Diligence. Our finding generally correspond to the summarized result of the literature studies (chapter 3.2). However, we were able to acquire more in-depth details regarding the steps. First of all, compared to the literature studies, we discovered the iterative process after desk evaluation and before due diligence. A lot of work and time is spent on validating the claimed unmet market needs by the startups. This also corresponds to the finding about the importance of unmet market needs in the RQ1. Additionally, we would like to highlight the fact about how briefly the VC firms evaluate the pitch decks for the first time. Originally, we were looking forward to finding out more insights regarding how to help the medtech startups to pass the first desk evaluation by improving their team quality. However, it turned out that the VC firms were not to judge the team quality during the first pitch deck evaluation. Instead, the focus at this team is mostly about sifting out the ventures that do not fit their investment scopes. Most “team evaluations” happen during face-to-face meetings. The judgement usually combines the “quantifiable/ objective” and “quantitative/ subjective” all together, instead of being taken in different procedures. Another interesting finding is about the in-depth investigation from the VC side after the face-to-face meetings: The investors will make a lot of calls and contacts to validate the reliability of the contents provided by the startups. In general, our research confirmed the literature studies in the corresponding chapters.

In research question 3, referring back to the literature studies summarized in chapter 3.3.1, (Brush et al., 2012; Douglas & Shepherd, 2002) found “technology”, “market” and “management” are the key evaluation criteria by VCs. Additionally, (Boocock & Woods, 1997, Groenewegen & de Langen, 2012; Lee et al., 2019) added finance, and (Keppler et al., 2015; Chatterji, 2008) added regulatory to the list. In our research project, we did not see misalignment between our findings and existing literature research. “Team, technology, market, regulatory and finance” are confirmed as the 5 important aspects in a medtech startup. The most important aspects are market, team and technology. However, attention should be given to the importance of being able to cover all aspects: 50% of the interviewees seeing missing quality levels in any of the five facets serving as a “red flag”.

In research question 4, together with part of the results from research question 3, we root for the unshakable importance of “team” aspect in a medtech startup team. The subjective and objective factors correspond with the left two quadrants and right two quadrants in the summarized theory framework of Figure 8, correspondingly. All interviewee participants agreed startup is a challenging journey. The subjective aspect stands for the “strong mind power” and the objective aspect refers to the “capability the team”. Both of them are indispensable when solving the challenges occurred during the journey. Additionally, cohesion (also align with the Figure 8) is needed, because the team needs to work together and communicate well, in order to achieve the goal. A new finding compared to the existing study is the “star-team exception”: the VC investors could make an exceptional investment decision if the team is composed by successful serial entrepreneurs, even some other key aspects are not ready yet.

6.1.2 Key findings and relevance to previous studies in RQ 5

6.1.2.1 Highlights in RQ 5

In research question 5, we firstly would like to highlight the three dimensions regarding professional background traits: educational background, past working background, and the functional setup in the current venture. We summarize the “best” professional traits of (at least one of) the core team members in the eyes of VC investors as: ***being educated in the medical and technical domains, later took on responsibilities in the business domain in (at least part of their) careers, and currently have developed an entrepreneurial spirit that would like to take an initiative in all aspects of forming a business.*** Secondly, regarding gender diversity, although most interviewees admit it is something not easy to achieve in a deeptech/ medtech startup, it would be a plus point, especially if the team wants to get support from government-back VC firms. Thirdly, if a medtech startup venture is formed by a couple (partners in romantic relationships), or an all-old-age/ all-young-age team, it will be much harder for them to convince the VC investors to get funding. Last but not least, a medtech startup venture should avoid being formed by a single founder, or having a core founding team of more than 5 people, if they would like to get VC investment.

An additional remark giving to the key findings is related to the control variables of the interviewees. We included 2 field experts (interviewee 1 & 2) and 8 VC investors (interviewee no.3 – 10) in our samples. However, we did not find remarkable differences in answers between these two types of interviewees. For this research, we would like to take it as a signal that the field experts that we interviewed are representative and know the general landscape of medtech startup field well.

6.1.2.2 Detailed findings in RQ5: proposition 1-5

The research project tested the VC investment criteria (especially regarding the team-objective aspects) summarized by the literatures focusing on the general high-tech startups in the Dutch medtech startup practices.

Proposition 1:

Five essential functions need to be included in a medtech startup's core team: 1) Science/ R&D/ engineering (technical), 2) sales/marketing (commercial/ marketing), 3) clinical development and education (medical), 4) regulatory, 5) financing.

In proposition 1, regarding the team functional setup, we confirmed the three functions mentioned in existing literatures as the top three most important functions for medtech startup: engineering, commercial and medical. The “engineering” and “commercial” functions are agreed by both (Beckman & Burton, 2008) and (McGee et al., 1995), while the medical function aligns with the study of (Mas & Hsueh, 2017). Yet we removed regulatory and financial from the original proposition: It is not because they are not important, but because they could be rather outsourced than kept in the core team, as the resources in a startup are always limited. Another new finding that was not addressed in the previous studies is the “general/ entrepreneurial” role. This role usually does not exist independently, but is an important checkpoint of investors, and should be incorporated within one of the three essential roles.

Proposition 2:

The team functional composition should not be evaluated in an isolated way. An external link should be made between this composition and the core strategy of the startup. The quality of this link should be evaluated by the investors.

In proposition 2, the literature from (McGee et al., 1995) proposed that the composition of the team's function should align with the company's core strategy. Our research not only confirmed the original proposition, but also enriched the existing studies: the team composition should not only align with the core strategy (long-term-oriented), but also the upcoming milestone (short-term-oriented). The investors will examine the alignment on both levels.

Proposition 3:

The team size should be acceptable if it is between 2 to 4 people. Teams having 3-4 members have the highest chance of passing the evaluation from investors.

In literature review, In Europe, the size of a startup's team should not exceed 4 people⁹ (Ziakis et al., 2022; Clarysse & Moray, 2004). The refined proposition 3 has partially confirmed the original proposition: the lower limit. Yet it advanced the accepted upper limit of team member number by 1, from 4 team members to 5 team members. In the future research, we are looking forward to seeing if medtech startup teams are usually preferred to be slightly bigger than general high-tech startups.

Proposition 4:

The gender diversity is not an important factor to be considered when composing a medtech startup team. The age diversity (measured in absolute years) plays a negative role in VC evaluation, therefore the age difference level within a team should be limited.

(Brush et al., 2012) argued that gender diversity is not something important for a startup team. (Amason et al., 2006) found age diversity is negatively correlate to the startups' performance. However, our finding regarding proposition 4 is quite striking different compared to the original proposition. In the literature research, the attitudes of investors towards gender diversity are indifferent. However, in this research project, we found out that 90% of interviewees prefer to have gender diversity in a medtech startup team. Additionally, the investors with governmental backgrounds would even actively steer for this diversity. The finding regarding age diversity is also opposite from the original proposition: In this research, we found out that the investors are typically (70%) indifferent towards age diversity in a general sense. In some specific situations, the investors even prefer age diversity to age uniformity: For example, most investors do not like a team when they are all old (in their 60s) members or all young (in their 20s) members.

Proposition 5:

It is more easily for a startup to receive positive evaluations from VCs if they have diversity in terms of both educational and working/functional background.

In literature review, (Franke et al., 2008) and (Foo et al., 2006) advocated for a diverse team in terms of education, while (Amason et al., 2006) held the opposite opinions. Regarding past working experience, (Vissa & Chacar, 2009; Beckman & Burton, 2008; Beckman et al., 2007) found positive relationship between the diversity and VC reviews/ company performance. Yet again, (Amason et al., 2006) believe the relationship is negative. Our refined proposition 5 repositioned the original proposition 5. In the original proposition, we highlighted the importance of diversity. Our finding suggested that it was not the diversity or uniformity that the investors judge. Instead, it was the right combination of specific experience type (both education and work) that draw the positive feedback from investors. Because of the limited resources a startup usually has, the extra diversity level in past experience could be seen as lack of focus and creating misalignments between the team and its long-and-short-term goals.

Proposition 6:

It is preferred by the investors if the acquaintance among team members is featured as long-term (measured in absolute years) and in a professional manner.

Research from both (Franke et al., 2008) and (Eisenhardt & Schoonhoven, 1990) made the positive relationship between the prior professional relationship and VC evaluation or company's performance. Our finding regarding proposition 6 aligns partially with the original proposition: the investors indeed prefer the founders previously knew each other from professional occasions instead of private ones. As an extreme situation, couple founders are marked as red flags by multiple investors. However, most interviewees did not think the years of acquaintance plays a strong role here: How well people know each other is not typically related to how long they have known each other.

6.2 Limitations

One of the biggest limitations is the potential selection bias of the VC interviewees. As we do not offer any incentives or bring direct value to the VC investors, whose top focuses are usually their deals. The kind of interviewees that we got are usually the ones who have a nice personality, love to help out, or have a positive attitude towards university research projects. We were not able to interview those VC investors who do not prioritize such university-based and research-oriented activities. Therefore, a

potential bias could be formed within this research project, as the attitudes the investors hold towards such interviews serve as a proxy of their attitudes towards startups.

The second limitation is that the research does not cover questions regarding “subjective/ qualitative” characters of the founding team members. However, through the interviews, we got the insights that subjective qualities such as cohesion is highly important in the evaluation. We hope the future researches will put a focus on the “subjective/ qualitative” aspects.

Last but not least, our sample size is small. Therefore, we were not able to find significant trends, similarities and differences between interviewees based on their control variables. We believe that further research, especially when it is done in a quantitative manner, will be able to resolve this point.

6.3 Future research

This research project brought up the “two-levels, four-dimensions” model (**Figure 7**) to categorize the “team-and-management-related” investment readiness criteria. This could, by future research, be continued to form a complete “micro-meso-macro” three-levels model, where the “individual” and “team” levels in this projects serve as the “micro” and “meso” levels, respectively. When taking the “macro” considerations into account in the future, the perspectives such as “heterogeneity and homogeneity in cultures and demographics” and “common/civil law governance systems” can be taken. Although this research opts for a semi-structured interview method, the future research could test the generality of the results by a survey-type deductive method.

A few angles are proposed for future research:

1. Recalling the model we built in **Figure 7**: with this research project, we have made a good coverage of the “team-objective” factors (top-left quadrant), which unavoidably also addressed a bit part of the contents from the bottom-left quadrant. For the future research, more attention should be given to the two quadrants on the right side of the model: meaning further research into the subjective judgement criteria.
2. In terms of geographic scope: as Netherlands is a relatively small country in Europe, we look forward to other researchers dig into the VC judgement criteria in other European countries, especially the “European big 5”, namely: Germany, France, UK, Italy, and Spain. We believe the results from the biggest European countries will form a more representative picture on the whole continent level.
3. In both literature research and practical interviews, we learned that the VC investors invest not only money in the startup, but also significant amount of coaching/ managing work: the “venture capital contracting” (governance) plays a significant role in the investment process. In this case, we believe it is an interesting angle for future research to look at the differences/ similarities in evaluation criteria between civil and common law countries, as the two systems are featured with significantly different corporate governance styles.
4. One of the findings from the RQ1 is about the initiation of a good innovation: should it be market-pulled or technology-pushed. We believe it will be interesting to find out the answer by inquiring more samples. The answers with deeper insights should be based on the subjects’ different control variables.

6.4 Practical implications

This research project has a significant practical value: It tells medtech startups how to prepare for their teams, to get better evaluation outcomes from venture capitalists. We summarize the actionable list into the **Table 33**.

Theme	Item	Strongly advised against	Prefer not to have	Prefer to have	Strongly advised
Team size	Single founder	Y			
	More than 5 core members	Y			
	Team size 2-4				Y
Gender/Age diversity	Gender diversity			y	
	All old/ all young team		y		
Strategic alignment	Short-term milestone aligning with team selection				Y
	Long-term core strategy aligning with team selection				Y
Functional setup	Engineering role in core functional team				Y
	Commercial role in core functional team				Y
	Medical role in core functional team			y	
	General/ entrepreneurial role in core functional team			y	
Educational background	Technical/ engineering educational background				Y
	Medical educational background				Y
	Business educational background			Y	
Past work experience	Engineering/R&D/science work experience				Y
	Business/marketing work experience				Y
	Medical work experience				Y
Founders' affiliations	Couple founders	Y			
	Friends/ family founders		Y		
	Founders who knew each other previously via professional reasons			Y	

Table 33 Practical implications/ actionable points based on this research projects

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Appendix 2: European startups landscape

Because of the swift dynamics of startups, the exact number of startup companies in Europe is difficult to find. However, based on several sources^{52,53}, we could estimate that there are roughly 40 thousand alive startup companies in Europe at this moment. If we zoom in to look at the division of industries, the top 10 industries all fall in the digital and technology sectors (see **Figure 10**).

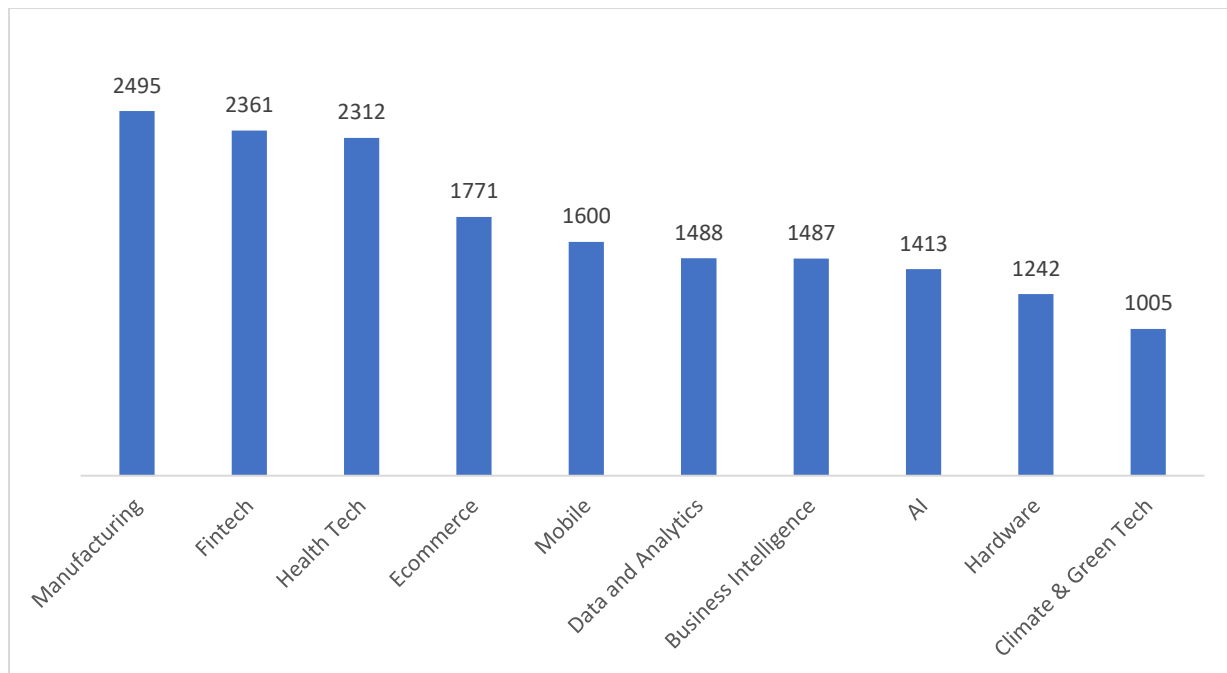


Figure 10 Startups in Europe per industry⁵⁴

However, the trend of investment in the past three years is somehow worrisome: The total funding value from 2021 to 2023 kept on dropping, from \$90 billion to \$75 billion, and then to \$45 billion^{43,55}. The main reason for the declining is due to the Ukrainian war and the worsening economy on the macro-scope level⁵⁶.

⁵² E-estonia, [Link](#)

⁵³ GlassDollar, [Link](#)

⁵⁴ Seedtable, [Link](#)

⁵⁵ Reuturs, [Link](#)

⁵⁶ Sifted, [Link](#)

Breaking the data down per countries, we find out that UK startups are the most successful in terms of both fund raising value⁵⁷ and number of deals on the country level (see Figure 11), while Estonia has the highest VC funding per capita(see Figure 12)⁵⁸.

Top European countries by VC investment

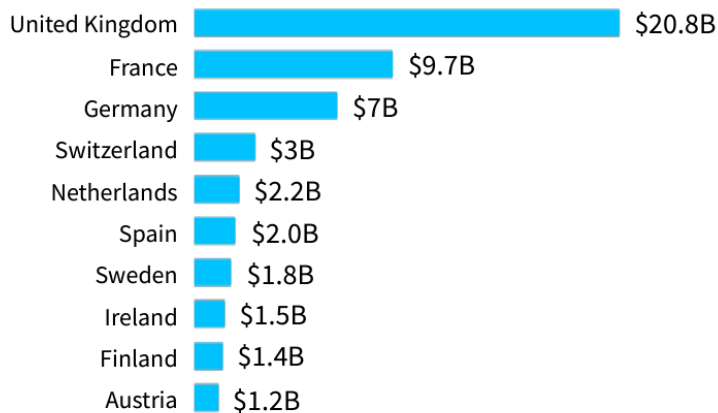


Figure 11 Top European VC funding countries, 2022⁵⁹

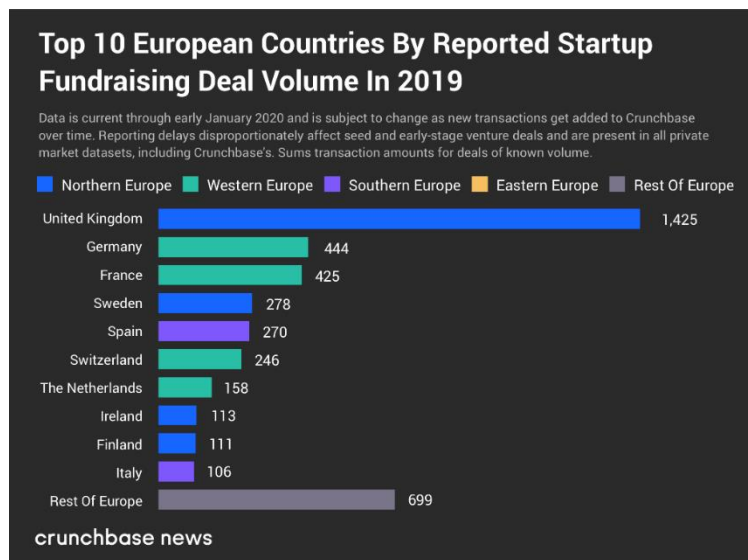


Figure 12 Top European countries in number of fundraising deals, 2019⁶⁰

In the medtech sector especially, there are currently more than 30,000 medical technology companies in Europe regardless sizes, and more than 90% of them are SMEs^{61,62}. When zooming into startups, the

⁵⁷ Dealroom, [Link](#)

⁵⁸ Sifted, [Link](#)

⁵⁹ Dealroom, [Link](#)

⁶⁰ Sifted, [Link](#)

⁶¹ MedTech Europe, [Link](#)

⁶² MedTech Europe, [Link](#)

number of companies the Medical Technology field in Europe is about 530⁶³ (including companies who “have raised up to €5M or its equivalent and are up to Series A in their investment round”, as well as “are already in clinical trials with their prototype device or beyond”¹³).

UK ranks number 1 in terms of both number of medtech startups and total investment raised. While the Netherlands, which counts for only 2% of the European population, has 7% of the European startup companies and counts for 6% of startup investments¹³ (Figure 13).

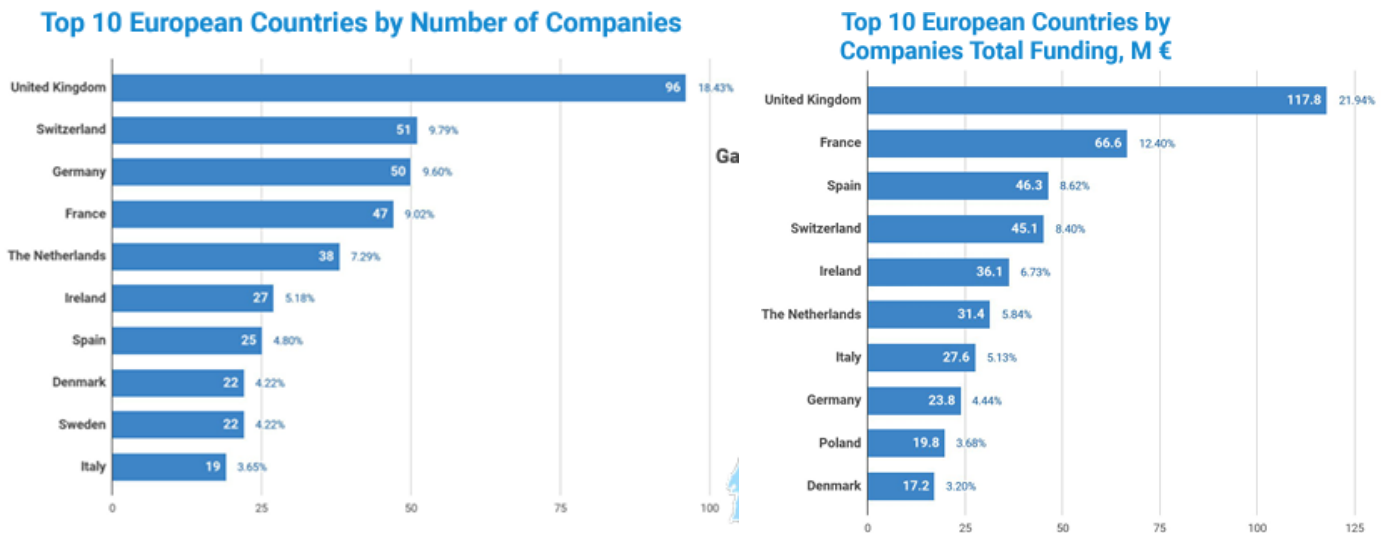


Figure 13 Top European countries in terms of startup number and value of investment in medtech sector¹³

Appendix 3: Differences of focuses before and after regulatory approval

1) Before regulatory approval (startup phase, first valley of death)

To be able to develop and certify a product for commercialization, the following steps usually need to be taken^{64,65} (Mejtoft, Lindahl, & Öhberg, 2022) (Chaanine & Houry, 2023) (Zajki-Zechmeister, 2023):

Product aspects:

- Empathizing and defining: Understanding the unmet needs of the potential users
- Intellectual property
- Ideating and prototyping: Addressing the needs with initial product development (with proprietary technologies)
- Prototype testing (with approved investigational model)⁶⁶ and clinical investigation
- Regulatory development

⁶³ Medtech Startups in Europe Overview, [Link](#)

⁶⁴ SigTuple, [Link](#)

⁶⁵ Irish Medtech Association, [Link](#)

⁶⁶ CCMO, [Link](#)

Team aspects:

- a) A development team should come first
- b) Then build a strong product development team
- c) Develop the team with members with appropriate business skills
- d) The roles of safety officer for Person Responsible for Regulatory Compliance/PRRC, as well as Medical Product Adviser in accordance to ISO 13485 are indispensable
- e) Usability engineer and monitor for clinical trials are also important to have.

Business plan aspects:

- a) Initial research and analysis for idea formation
- b) Market research: In-depth analysis for market capacity and competition
- c) Choose targeted users and business path: Already investigating if direct sales is a viable option
- d) Formulate business and financial model
- e) Investment strategies
- f) Insurance and reimbursement strategies

Process aspects:

- a) Adhering to ISO13485

2) After regulatory approval (scale-up phase, second valley of death)

The time between the startup has received regulatory approval and financially breaks even is also called “the second valley of death” (ten Bok , 2018). In Europe, after startups survive their initial 5 years, there is still 2/3 of the chance that they cannot survive till the 8th year⁶⁷. The following points should be given attention in order to survive in the phase of the second valley of death⁶⁸ (ten Bok , 2018):

Value proposition and needs of stakeholders

- a) **The added value of the product:** The product is more focused on the innovative technology, instead of addressing the true unmet needs of the hospitals.
- b) **Understanding of stakeholders:** In terms of their preferences and decision-making processes and policies.

Market landscape:

- a) **Understanding the health system:** Treated condition and corresponding diagnosis and treatment, as well as products addressed
- b) **Understanding of reimbursement landscape:** A good understanding of the reimbursement landscape, processes and policies will accelerate the adoption from the hospital side. Find out how to increase their willingness to pay.

Clinical evidence:

⁶⁷ Erasmus Centre for Entrepreneurship, [Link](#)

⁶⁸ Medium, [Link](#)

- a) **Quality of clinical studies:** The startup should be more prepared and experienced in conducting clinical studies.
- b) **Quality and diversity of key opinion leaders:** This will increase the level of acceptance and thus accelerates and smoothens the commercialization process.

Marketing and exposure:

- a) **Active use of social media:** Actively use of social media could increase end-user engagement.
- b) **Attending conferences:** Attending conferences could increase the level of product validation and acceptance by the clinicians.

Team:

- a) **Management team:** Create a more business-oriented team.

Appendix 4 Statistics of control variables

1) Industry focuses

We investigate the industrial focuses of both VC individuals and their firms in general.

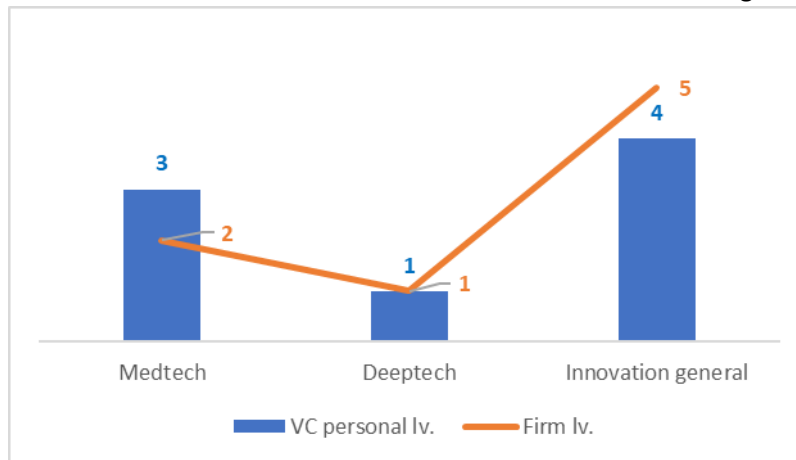


Figure 14: Industry focuses of the VC firms and investors

Within the 8 VC interviewees and their firms, 5 (62.5%) firms focus on innovative technological startups in general, 2 (25%) firms focus on medtech startups specifically, and 1 (12.5%) firm focus on deep-tech sector.

When looking at the investors' individual focuses, we got 3 (37.5%) investors specializing in the medtech startups (including one working in a firm that focuses on general innovative technologies), 1 (12.5%) specialize in deep-tech, and 4 (50%) analyze all kinds of innovative technology startups in general.

2) Geographic focuses

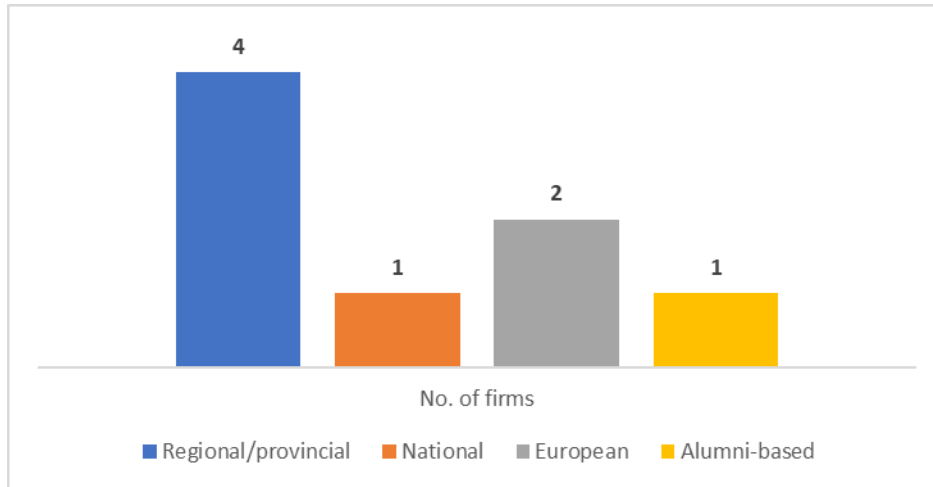


Figure 15: Geographical focuses of the VC firms

In terms of geographical focuses, 4 (50%) interviewees' firms focus on specific regions/ provinces within the Netherlands. 1 (12.5%) firm evaluates proposals from startups within the whole Netherlands. 2 (25%) are on European levels, and another 1 (12.5%) does not judge on geographic scope; instead, they require the founder being graduated from certain universities in the Netherlands.

3) Experience level

We investigate the experience levels of both the firms (years of establishment) and the individual VC investors (position level). In terms of the individual experience levels, we categorize them into four types: student part-time, associates, managers, partners.

We see a wide variety in terms of the age of the firms: from mere 2 years old to almost having their 50 years anniversary.

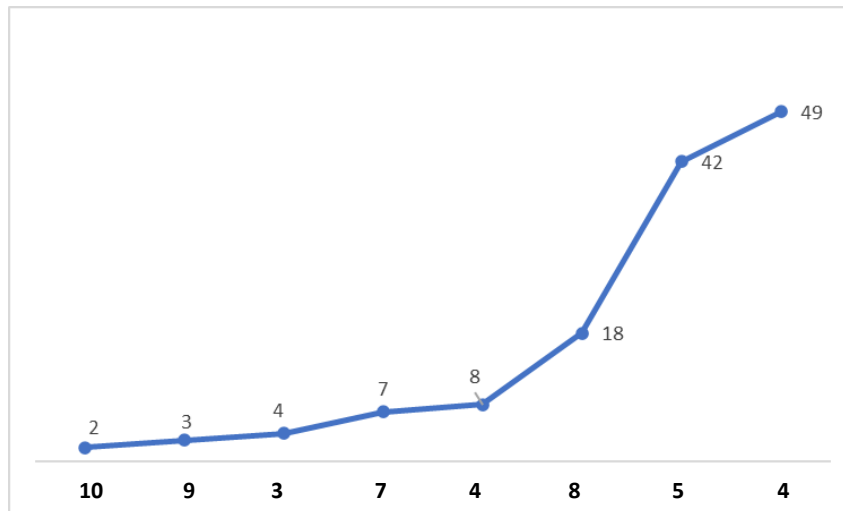


Figure 16: Years of establishment of the VC firms

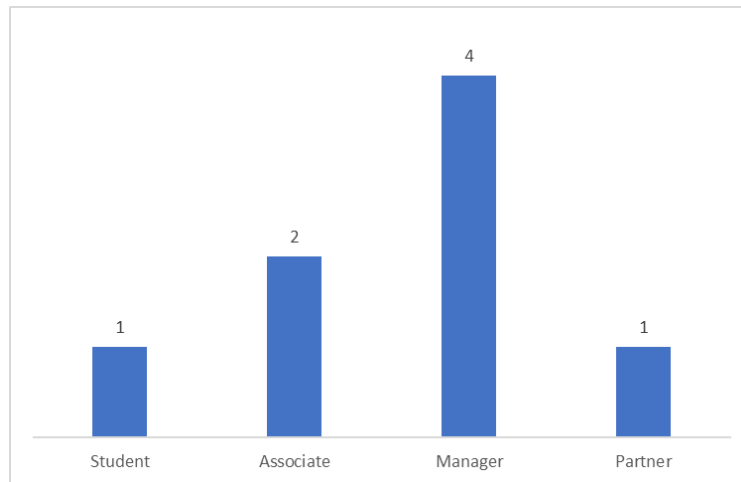


Figure 17: Experience levels of the VC investors

4) Firm sizes

To control firm sizes, we investigate the investment volume and number of investors of the VC firms.

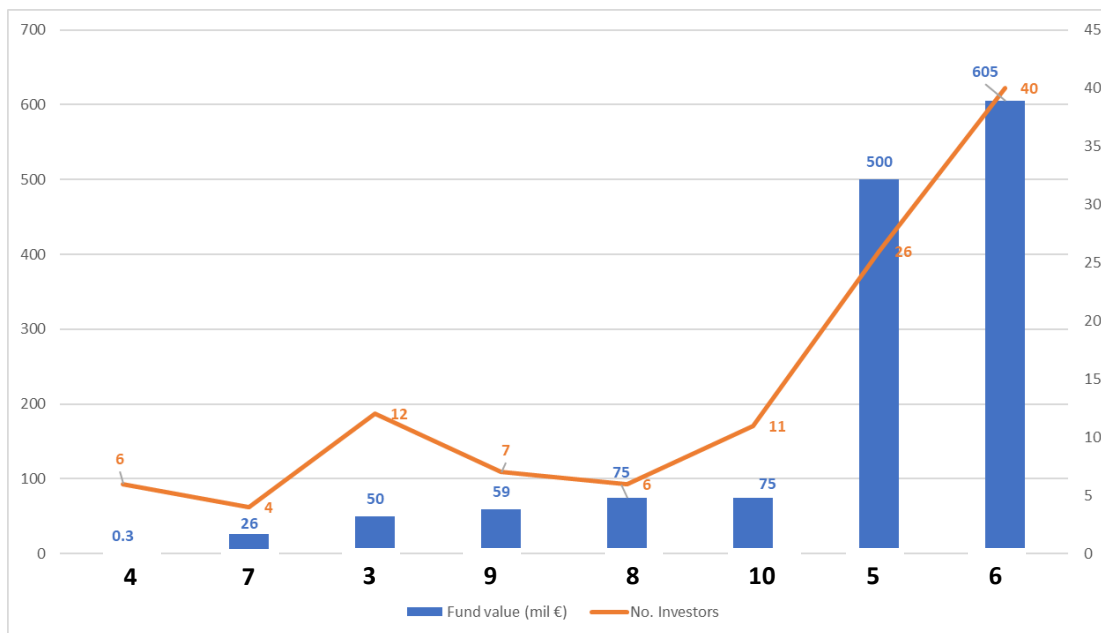


Figure 18: Firm sizes in terms of number of investors and volume of funds (mil €)

The VC firms vary significantly in sizes. The smallest student investment fund has 0.3 million euros investment volume, while the biggest and oldest governmental fund has invested more than 600 million euros. The average age of the firms is 17 years old, and the average investment volume is 164 million euros.

5) Investment stages

Most of our interviewees focus on early-stage investment. Only 1 interviewee’s firm invest in rounds above Series A. 4 (50%) firms invest from stage pre-seeds to series A, and 2 (25%) firms invest in only pre-seed and seed rounds.

Interviewee No.	Pre-seed	Seed	Series A	Above
3	Yellow	Yellow	Yellow	White
4	Blue	Blue	White	White
5	Yellow	Yellow	Yellow	White
6	Blue	Blue	Blue	Blue
7	Yellow	Yellow	White	White
8	Blue	Blue	Blue	White
9	Yellow	Yellow	Yellow	White
10	White	Blue	Blue	White

Table 16: Focused investment stages of the firms

Appendix 5 Statistics of answers in RQ 1

1) Newness

Reviewing the corresponding literature review, most sources are from governments and startup/ industrial associations. However, when we ask this question to the field practitioners, we got significantly different answers: 8 (80%) interviewees are not able to define a startup based on years of establishment. It is an irrelevant index for them. Instead, they believe it is reaching certain standard in business metrics that could separate a startup from a scale-up.

Figure 14 below presents the standards mentioned by the interviewees. 6 (60%) interviewees believe a company will enter the scale-up phase once it creates “scalability”. The 2 interviewees who indeed gave an answer in terms of threshold of years of establishment named the numbers as 5 and 7 years, respectively. Additionally, interviewee No. 9 sees the years of establishment more as an indication of attractiveness, instead of a threshold for defining startups: “If a company still has not entered scale-up phase, I would regard it as uninteresting.”

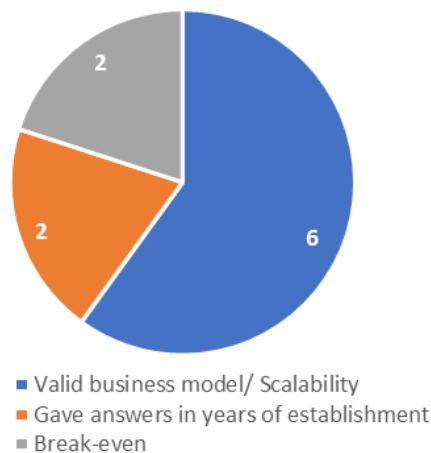


Figure 19: Define startups by newness

2) Financial thresholds

Revenue thresholds

From the answers in 5.2.1, we understood that the VCs identified the companies who successfully “graduated” from the startup phases are those who have found their “scalable business models”. Therefore, we could expect the “financial thresholds” are better criteria to identify the startups. However, as the results of the interviews, we found out that it is more about the relative growth, instead of absolute numbers of revenue or investment received, that serves as the criteria mentioned above.

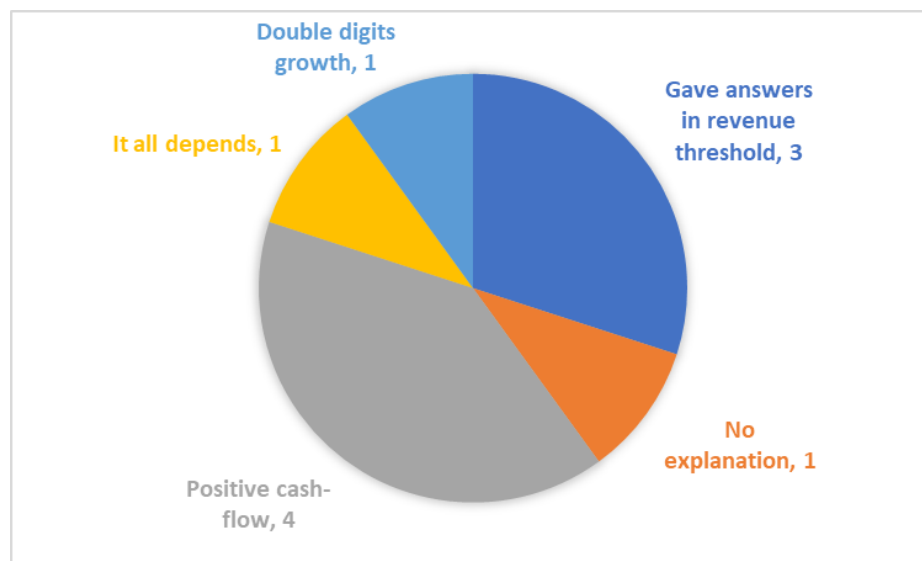


Figure 20: Define startups by revenue

4 (40%) interviewees mentioned that a company needs to be positive in cash-flow, to be qualified as a “scale-up”. While another 4 (40%) interviewees set the threshold on the revenue generated: 1 (10%) believes the standard should be “double digits growth”, and another 3 (30%) shared their opinions in absolute numbers. The two general field experts (interviewees no. 1&2) have both given absolute revenue thresholds. The numbers they gave are €3-5 million and €1 million, respectively. Because both interviewees are not tied to any specific VC firm, but are interacting with all kinds of medtech startups and investment firms on a regular basis, we could see their answers as a more industrial average value. The third interviewee who gave an absolute number as answer is interviewee no. 7. His answer is €250-300k. This value is much lower than the ones given by the two field experts, but with a good reason: his firm specializes in digital health sector.

Investment thresholds

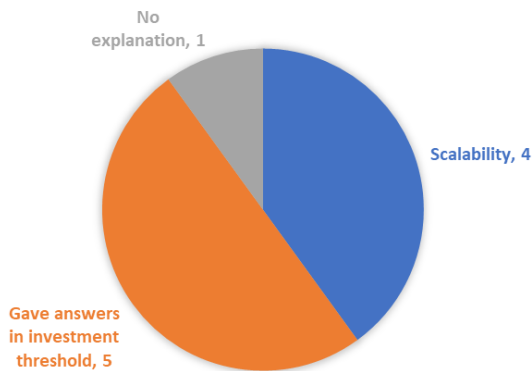


Figure 21: Define startups by investment

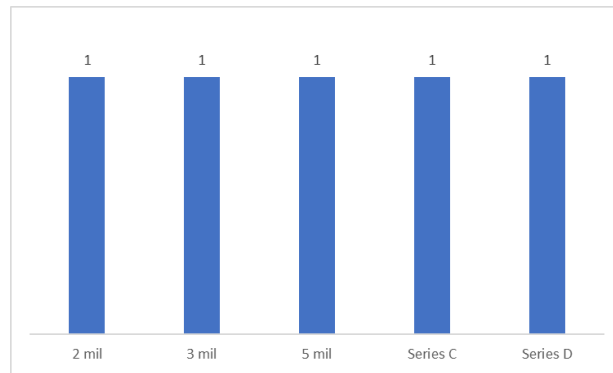


Figure 22: investment thresholds

When being asked to give a threshold to identify startups based on investment received, 4 (40%) interviewees still believe “being scalable” is a better criteria, while 5 (50%) interviewees were able to give a direct answer to this question. However, the answers provided by the 5 interviewees are highly different.

3) Development levels

In terms of development levels, we summarized regulatory levels and TRL levels from literature research.

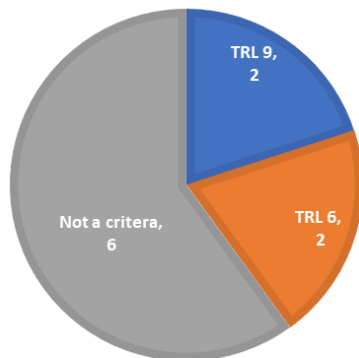


Figure 23: Define startups by TRL



Figure 24: Define startups by regulatory approval

Regarding the TRL standards, 2 (20%) interviewees believe that the technology has to reach the highest lv. 9 to “graduate” from the startup phase. Another 2 (20%) interviewees set the line at lv. 6, which means at the moment of the investigational model is approved. However, the majority (60%) of the interviewees do not see the TRL as a criteria of defining startups.

In terms of regulatory approval, all (100%) interviewees do not see it as a criteria of defining startups. However, 5 (50%) of the interviewees believe that is a prerequisite of startups turning into scale-ups.

4) Innovativeness

Importance of innovativeness

As it is an open question, we ask the interviewees “how do they see the importance of innovativeness in medtech startups?” All interviewees (100%) responded that innovativeness is highly important to medtech startups. However, there are two clearly different voices regarding what “being innovative” mean.

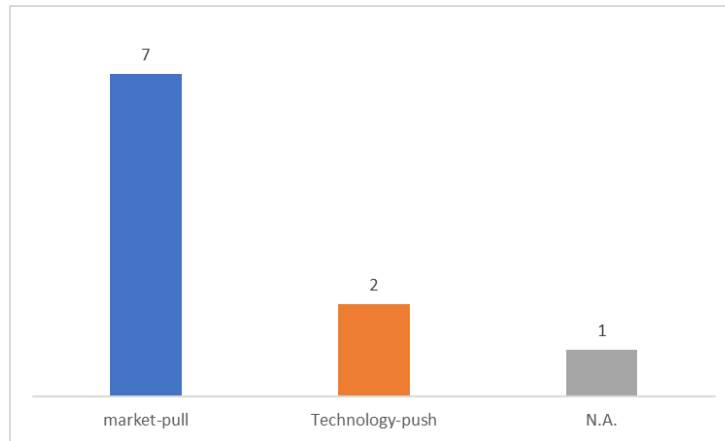


Figure 25: Importance of innovativeness

7 (70%) interviewees believe medtech innovation are the most valuable when they come from “market-pull”. This means that, the solution should be “addressing the unmet needs, problem-solving, showing competitive and uncopyable advantages”. Only 2 (20%) interviewees believe the innovation should be “technology-push”, with highlighting the importance of “having a ground-breaking and clearly differentiating” technology.

Existence and numbers of PhD founders and patents

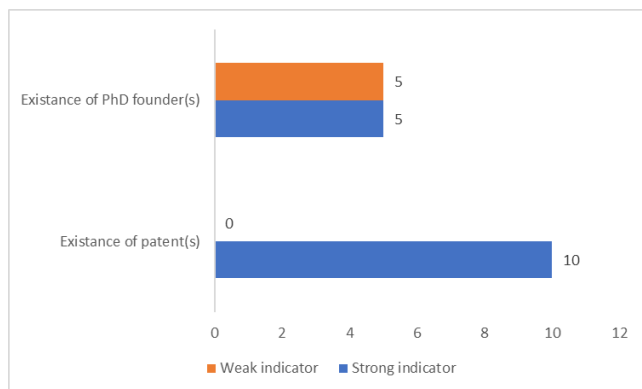


Figure 26: Signal levels of existences of PhD founder(s) and patents

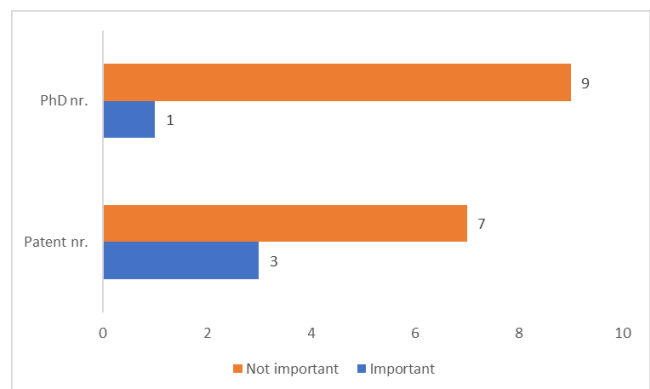


Figure 27: Importance of number for PhD founder(s) and patents

All (100%) interviewees believe that having patents is a strong signal of the medtech startup being innovative. However, 9 out of 10 interviewees strengthened that the patents must be “good enough”. By this, 3 interviewees have generally mentioned “quality matters”; next 3 interviewees have made the point “the patents have to form a portfolio strategy”; another 3 interviewees believe that the patents are only good when they can protect the competitive advantages and core technologies of the startup.

Comparing to the 100% vote for “existence of patent(s)” as strong signal of innovativeness, only 5 (50%) interviewees believe the “existence of PhD founder(s)” is such an indicator. 2 interviewees who chose

“weak indicator” shared the reasons: they both believe that “title does not matter”. 3 out of 5 interviewees opt for “strong indicator” think that it is the norm to have PhD founders in the team.

The numbers for PhD founders and patents are both insignificant for the interviewees, when discussing their meaning of representing innovation levels. The reasons are given above, most of which highlight the importance of “practical impacts”, instead of “titles”.

5) Medtech definition

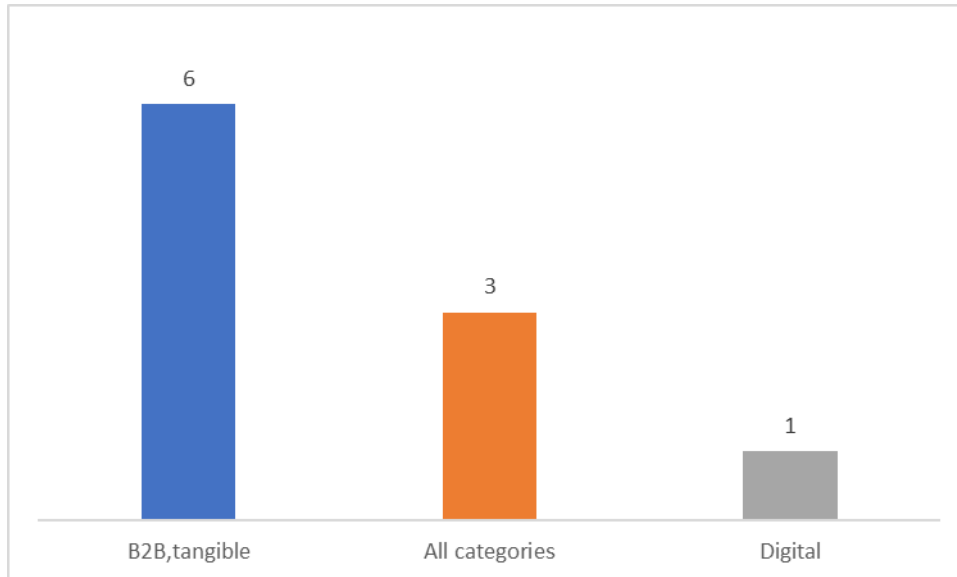


Figure 28: Medtech definition

According to literature review, the medtech could include the scopes of medical devices, IVD, digital solutions, and active implantable. However, in the interviews, different answers were provided: 6 (60%) interviewees define medtech as “B2B and tangible”, meaning the customers of the medtech startup has to be hospitals and other healthcare providers, instead of individual consumers, and the solution cannot be digital. 3 (30%) interviewees include all categories being proposed as the scope of medtech. The sole VC firm that focuses on digital healthcare opted for “digital solutions” as their definition of medtech.

Appendix 6: RQ4—Original quotations vs. 1st level quotes

Interviewee no.	Original quote	1st level quotes
1	<p>(In terms of team's importance) that's sort of the two flavors: You either have this stellar team that knows the field very well and they just go out and find the best solution; Or, the majority of the people that I see in my program are the people that have developed the technology and now try to find the best application. And then the investors might say, OK, we know the people that we can put in. We know the regulatory experts that we can put in there. We have CEOs with MedTech business experience.</p> <p>Of course, if you have all of that, it makes it easier to invest. But</p>	"Star-team" exception
		Secondary important
		Coachability

	<p>I do see investments being made where the team is not complete and the investors will put in the right people.</p> <p>If there is a very big unmet need and a great solution and clinical validated results, then they care less about the team because the investors in this space will then make sure that the right people are added to the team.</p>	Investors can replace team
2	<p>Opposed to normal startups where all these people need to be working there full time, I think for MedTech, it is more widely accepted that people can also do this as an advisory role or just part time. Because, you know, you need very senior people in this industry to really get your innovation to be sold to hospitals and all these other people.</p> <p>regarding with regards to what I just said, I think the team would be on number one.</p>	Senior experience
		Most important factor
3	<p>Yeah, team is for us very important: how they are complementary towards each other.</p> <p>We don't really like single founders. So diverse team is ideal. The team quality is important: that they know what they are doing, that they really focus on the problem. So when I look at this startup or new proposition, definitely team quality, maybe 50%.</p> <p>In the first meetings or the second, if we think the team has a red flag: for example, they are not coachable or they don't listen to their potential customers.</p> <p>The team are the ones that have to make it work. So definitely (the team) is very important.</p>	Indispensable factor
		Team cohesion
		Goal-driven
4	<p>The founders have to have the mentality: that if their product or strategy doesn't really work out, They have to know how to pivot. I think that's a very crucial aspect. Because I see it quite often that we have a startup and then something doesn't go well, then they just get a bit depressed and it doesn't work out and they don't work as hard anymore. So I think someone is able to pivot and is motivated.</p> <p>There has to be good team cohesion, so everyone can work together and that they're able to also solve conflicts.</p> <p>If the team is not good enough, it will be a show stopper.</p>	Pivotability
		perseverance
		Indispensable factor
		Team cohesion
5	<p>We look always first for the market opportunity and then the team. And if you look at the weight, if there's no market opportunity or less market opportunity, we don't go any further. But if the team isn't right and it's not coachable, we</p>	Secondary important

	<p>don't look any further as well. I can say the team is like a vital criteria.</p>	<p>Indispensable factor</p>
		<p>Coachability</p>
6	<p>the team has to do the work. The team has to make sure that you reach the goals. The team has to run like hell for a small amount of money. And they have to be at the steering wheel. We are just financing parties. They have to do the job. SYou can have a very good team with a bad product, it gets nowhere. And a bad team with a very good product also gets nowhere. So, it has to be a bit in balance. And of course, you can always expand the team if time goes by that at first there is more importance on the development. And after a certain development period, you need more business type of people, commercial people. Each phase, you need the right team.</p>	<p>Indispensable factor</p>
		<p>Team-milestone alignment</p>
		<p>perseverance</p>
		<p>Goal-driven</p>
		<p>Make things happen</p>
7	<p>I think team, product-solution fit, growth are the three key ones. So if the team is really not good and they communicate badly and are not motivated or they're not coachable (then that is not ok.)-- like that's also good to know that coachability is important-- We don't want to be in the driver's seat because that is, of course, their company. If they have like an amazing team that already did like multiple exits, then that's very interesting. So, yeah. The team was so good that the other things become a little bit less important.</p>	<p>"Star-team" exception</p>
		<p>Team cohesion</p>
		<p>Highly important</p>
		<p>perseverance</p>
8	<p>If you need to develop a medical device, which is regulated, it is quite a challenge. You like to have people in the team who understands that challenge. To give you an example, if you have a team which compromise of only academics, you know for sure they do not understand actually what they have to do. So you like to have people in a team who maybe have worked in a more mature company, or at least understand the needs of a more mature company. Because otherwise, they will underestimate actually the challenge. If the CEO doesn't understand actually the need for strengthening the team, then every time you suggest actually that he should make a new hire, it's an uphill battle. You have to convince him every time for, you know, let's say you need to hire a chief medical officer and he doesn't understand why.</p>	<p>Coachability</p>
		<p>Highly important</p>
		<p>Senior experience</p>

9	<p>In reality, team and market size are very important to investors. And why is team important? Well, because we can discuss the products right now, we can discuss the market right now, and we can discuss the go-to-market and everything. But we also know that everything will change in some way. So we are trying to predict the future, but we're not really sure. And there's one thing we know for sure is that this team needs to build a big company. So if the team is unable to deal with challenges, then we know for sure that it won't be a success. So that's why we very much depend on having an amazing team in place. And if we don't, then we're screwed for sure. So that's why it's sort of the common ground for everything.</p>	perseverance
		Solve challenge
		Indispensible factor
		Pivotability
10	<p>If the team is not good, that's definitely a red flag. If they got really good technology and a really good team, then they'll figure out the regulatory aspect, you can hire a consultant, that's fixable, but if the technology sucks or the team's not good, then there's really no beginning.</p>	Indispensible factor
		Solve challenge

Appendix 7: RQ5, proposition 2—Original quotations vs. 1st level quotes

Interviewee No.	Original quotation	1st level quotes
1	<p>Yes. So that is important. It's very important. I would not, I would in the MetaX space never go for cost leadership. So I would, that would be definitely a market differentiator or a technical differentiator. Yeah.</p>	Highly important
		Core strategy-driven
2	<p>Definitely look at the strategy. So, for example, one example is the, we have another spinoff here, XXX (Foudner's name) with XXX (Company's name), makes a camera on a shoe to look at the posture of the runner. It can be a revalidation case or it can be a sporting case where you just support a high level. At first I thought like, hey, I'm going to make a shoe. And then I was like, well, no, probably not. Because then you're competing with these Adidas and Nike on top of your branding. And that would require a totally different team than it would be, let's say, a revalidation. And then</p>	Highly important
		Core strategy-driven

	<p>just purely focusing on the technology and servicing or selling it as an add-on.</p> <p>Then your team composition would be entirely different because the first thing would be entirely sales/marketing oriented, not necessarily on the technology itself. That's why (based on the current strategy) they only have a CTO and CEO.</p>	
3	<p>I think in the beginning, sometimes very early stage and they are just starting up and then it needs to be developed.</p> <p>So maybe a bit less focus on that.</p>	Not so important early stage
		Limited resources
4	<p>I would say all of them except the strategic alignment. Because a new company usually doesn't have that many resources. The only thing it would have is the idea for the MedTech startup, so the product idea. But usually you don't have that much resource to pick a team</p>	Not so important early stage
		Limited resources
5	<p>Actually, we are on top of that because we have a white paper written. I can send you that. We have a white paper and the white paper actually describes how we think about a company and it's not only the venture building or the business model canvas, but there's a strong linkage towards the mission and the team.</p> <p>And we think that only if there's a good mission and a good team that the team executes well. So we have a lot of team products to assess the team, to assess the interaction between the team. So actually, that's how we do that.</p>	Fit between mission and team
		Highly important
6	<p>We certainly look at the team in relation to the phase where the company is in. If you know the company is going to be in a development stage for years, you need other people and other strengths.</p> <p>Then if you think, hey, we can reach the market within a year, then you need other experience and other strengths. Certainly you look at that side. If you have to do all the technical development inside, or you can do it outside.</p> <p>So there is quite a lot of difference in the expertise you need within a team. You need to have right people at the table at the right time. I think the team is the most important and the most difficult thing to assess and to guide through the early phases of a company.</p>	Fit between phase and team
		Right people at right time
		Highly important
7		Fit between solution and team

	For us, a clear problem solution fit is very important. So did you able to be, is the startup able to identify a clear problem that is backed by scientific research? And can you can you actually show that your solution could help this problem? That's for us very important. So you need right people for that	Highly important
8	That is what we do. We usually look at what the company needs to achieve in the next two, three years. And if the composition of the team is ready actually to deal with that. It's about being able to actually reach the next milestones.	Fit between milestone and team Highly important
9	Absolutely. So for example, if we're selling a MedTech product that's, I don't know, very heavy on imaging, we for sure look for a CTO with a very strong background in imaging. And typically also for a CEO with a network in imaging and a COO with experience in scaling imaging tech. So in that respect, we always look for alignment and ideally in all roles that are crucial. But we try to match the network needed to scale a certain tech with the experience of the founder.	Core strategy-driven Highly important
10	Yeah. I mean, of course. If the strategy, say, requires scaling up, say, a large production line, then we would want—for example, what we would want is somebody who has experience scaling up production lines in that team. And so now it's important to us to have the strategic alignment between the goal of the startup and the team as well.	Core strategy-driven Fit between milestone and team