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THE ROLE OF THE NON-FINANCIAL CONTRIBUTION OF VENTURE CAPITAL IN THE GROWTH OF ESTONIAN DEEP TECH STARTUPS

Bachelor's Thesis

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I have written this Bachelor Thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

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Introduction

Venture capital, commonly abbreviated as VC, is an attractive source of startup funding that can help firms raise capital to realize high-potential and high-risk ideas on top of garnering value-added support services (Pearce & Barnes, 2006; Tariq, 2013; Zhang, 2017). The plethora of previous studies have suggested ample evidence that VC-backed companies prevail over their comparable counterparts without such external funding in many respects (e.g., Baum & Silverman, 2004; Chemmanur et al., 2011), including most importantly higher growth rate and productivity (Croce et al., 2013; Hirukawa & Ueda, 2011), a greater degree of financial success and survival rate (Large & Muegge, 2008), and increased possibility of IPO (Croce et al., 2013; Large & Muegge, 2008; Manigart & Sapienza, 2017).

This is due in no small measure to the fact that VC can serve to alleviate the burden of financial constraints (Bertoni et al., 2013; Quas et al., 2021; Riepe & Uhl, 2020) often faced by capital-intensive ventures with longer time to market such as deep technology startups for which adequate accessibility of suitable funding continues to be a major recurring challenge (De la Tour et al., 2021; Gigler, 2018; Granath, 2021). A generally accepted definition of the deep technology startup, or deep tech startup for short, is lacking in the academic literature, notwithstanding how rapidly the notion is rising in popularity among academic and startup communities. However, the term is typically used to refer to startups centered around the development of disruptive innovations and sophisticated technology advancements arising from the groundbreaking research, as exemplified in the definition coined by Gebru and Awal (2021): "deep technology (deep tech) startups are those whose business models are focused on high-tech innovations and major scientific discoveries" (p. 11).

What is somewhat less discussed about VC though is that venture capitalists (VCs) are not solely limited to financial assistance because, in pursuit of monetizing the investment, their role also entails presenting non-financial resources in the form of providing human capital, influencing business decisions of portfolio companies, and performing many other functions in return for harvesting a portion of startup's profits and receiving equity stakes (Anson, 2008; Markova & Petkovska-Mirčevska, 2009; Talmor & Vasvari, 2011). Noting the compelling nature of the topic, several attempts have already set the stage to examine VC's non-financial support and its impact on the growth performance of investee startups from different angles (e.g., Baum & Silverman, 2004; Bertoni et al., 2011; Croce et al., 2013). Yet so far non-financial value-added

of VC remains relatively overlooked, understudied, and in need of further research (Baum & Silverman, 2004; Large & Muegge, 2008; Quas et al., 2020; St-Pierre et al., 2011).

Given that the financial aspect of VC contribution has been traditionally at the heart of the research emphasis, the present work takes the opposite route, and so the main research question of the thesis is "What is the role of the non-financial contribution of venture capital in the growth of deep-tech startups in Estonia?". The expected results of the research will be 1) a proposition of a novel, holistic model of the non-financial contribution of VC, 2) a suggestion of a new integrated definition of deep tech startups, 3) an identified importance of the non-financial contribution of VC and its most prominent value-adding services to the growth of deep tech startups, 4) practical takeaways for the further development of deep tech startup ecosystem in Estonia. In other words, this study seeks to contribute to a growing area of research dedicated to the non-financial contribution of VC and deep tech startups by analyzing the already available literature on both topics and bridging the research gap with an examination of the subject matter in the context of the Estonian startup ecosystem.

Regarding the country of choice for the study, Estonia was selected as a widely acclaimed startup hotspot and the European leader with the highest startup density, number of unicorn companies, and investment volume per capita as of 2021 (Atomico, 2021; Estonian Investment Agency, 2022b; Google for Startups et al., 2021). The country is of great research interest as it continues climbing up startup ecosystem rankings and is set to enable the creation of 25 unicorn companies by 2025, according to Andres Sutt, the Minister of Entrepreneurship and Information Technology of Estonia (Estonian Investment Agency, 2022a). Moreover, speaking of the deep tech startups, there is a sensible lack of adequate and accessible funding for capital-intensive ventures in Estonia (Civitta, 2020), all of which is a promising fertile ground for the research.

For the purpose of achieving the research aim, the following tasks have been formulated within the scope of the present paper:

- To conduct a literature review of the non-financial contribution of VC and synthesize the main findings of previous empirical studies on its importance for the growth of startups;
- To propose a new integrated model of the non-financial contribution of VC, encompassing non-financial resources outlined in the latest academic research;

- To give an overview of deep tech startups, their key specifics, and common growth barriers;
- To provide a synopsis of the Estonian startup ecosystem, its local VC industry, and deep tech landscape;
- To compose and conduct semi-structured interviews with venture capitalists and deep tech experts to test the validity of the proposed model of non-financial contribution of VC and gain insights as to how the non-financial value added facilitates the growth of Estonian deep tech startups;
- To draw conclusions from empirical results of the present research about how the non-financial contribution of VC impacts the growth of deep tech startups in the context of the Estonian startup ecosystem and revisit the proposed model;
- To outline the practical takeaways for the future development of the deep tech ecosystem in Estonia and contribute to the groundwork for further research on the topic.

The structure of the paper consists of the theoretical and empirical parts. The first part of the main body of research is dedicated to exploring the nature of the non-financial contribution of VC and its importance for the growth performance of startups through the synthesis of previous academic literature. Further, the scope of the study will be narrowed down to the deep tech startups; the concept of deep tech startups along with the attributes that characterize deep tech and key growth challenges will be presented at the beginning of the second chapter. That is to be followed by a snapshot of the Estonian startup ecosystem and an account of local VC and deep tech landscapes. The empirical part consists of a description of the methodology and a synthesis of insights collected through semi-structured interviews with Estonian venture capitalists, who have investment experience of working with deep tech startups, and deep tech experts from the Estonian startup ecosystem with extensive knowledge on the topic. The interviews are going to address the non-financial contribution of VC, verify the integrated definition of deep tech startups, reveal the validity of the proposed model of the non-financial contribution of VC and also point out the necessary adjustments for modifying it. Additionally, conducting the interviews with VCs and deep tech experts will uncover important non-financial value-adding services offered by VCs. The results of the interviews are further to be finalized and bring out the expected results at the end of the empirical part.

Finally, the author is deeply grateful to all the interviewees for their immense contribution in gaining unique first-hand insights into the non-financial contribution of VC in the case of deep-tech startups, Startup Estonia team for connections to interviewees and investor tickets to Latitude59, his supervisor for providing meaningful guidance, as well as his dear family and friends (especially Eleni Alexandri, I wouldn't be able to do it without you) for unwavering love and unconditional support throughout his studenthood. I dedicate this bachelor thesis to all of you for always seeing the best in me.

Keywords: venture capital, the non-financial contribution of venture capital, deep tech startups, Estonian startup ecosystem.

1. Non-financial contribution of venture capital

The purpose of this chapter is to introduce the concept of the non-financial contribution of VC, present a synthesis of various non-financial contribution variables through literature review, and propose a new integrated categorization model for the non-financial contribution of VC.

1.1 Synopsis of the relevant literature on non-financial contribution of venture capital

To begin with, it is important to note that the non-financial contribution of VC goes by many different names in the academic literature with interchangeable terms like "non-financial value-added" (e.g., Large & Muegge, 2008; Luukkonen et al., 2011), "non-financial resources" (e.g., Quas et al., 2021; Riepe & Uhl, 2020; Silenius, 2021), and "non-financial support" (e.g., Boiardi & Hehenberger, 2015; Mityushina et al., 2019) being among the most prominent ones. A starting point to characterize the totality of features that the non-financial contribution incorporates emerges from drawing parallels to the "resource-based view of the firm" that has repeatedly made up the theoretical foundation of the available literature on the subject. Hence, the non-financial contribution, hereafter referred to as "NFC", can be regarded as a diverse range of valuable, rare, specialized, non-substitutable, inimitable, lasting resources that give startups a sustainable competitive advantage (Arthurs & Busenitz, 2006; Barney, 1991; Quas et al., 2020; St-Pierre et al., 2011; Theinert et al., 2017). In particular, the NFC of VC encompasses such activities like "assisting in additional financing rounds, recruiting management and boards of directors, acting as sounding boards, monitoring financial and operating performances and providing access to networks and contacts" (Gebru & Awal, 2021, p. 20). Furthermore, due to their industry expertise and experience in guiding startups through different development stages, venture capitalists can help portfolio companies accumulate and leverage firm-specific, not easily transferable assets in the form of human, physical or financial resources, which explains the value-adding nature of NFC and may further translate into startups' enhanced performance (St-Pierre et al., 2011).

As it was earlier brought out in the introduction, much research has extensively reported that the presence of VC tends to positively accelerate the growth of startup companies (e.g., Bertoni et al., 2011; Manigart & Sapienza, 2017; Smolarski & Kut, 2009). By the same token, VC generally results in superior performance over non-VC-backed firms in terms of higher employee count (Bertoni et al., 2011; Davila et al., 2003; Smolarski & Kut, 2009), sales revenue

(Manigart & Sapienza, 2017; Peneder, 2010), asset value (Manigart & Sapienza, 2017), level of innovation (Khan et al., 2021; Lin et al., 2018; Peneder, 2010), new venture internationalization activity (Devigne et al., 2018; Fernhaber & McDougall-Covin, 2009; Smolarski & Kut, 2009), R&D expenditures (Manigart & Sapienza, 2017), and the likelihood of a successful exit (Chemmanur et al., 2011; Manigart & Sapienza, 2017; Megginson & Weiss, 1991). It is without a doubt that this positive influence on the venture-backed companies is connected to the injection of financial resources provided by venture capitalists (Bertoni et al., 2011; Carpenter & Petersen, 2002; Theinert et al., 2017; Quas et al., 2020) since startups often have trouble accessing external sources of funding and satisfying their capital needs owing to a lack of track record, colossal failure risk, and damaging consequences of potential reputational risk for the venture capital firm (Maula, 2001). On the other hand, the reason for the increase in performance also lies in the active monitoring of investee companies as well as coaching and legitimacy offered by VCs (Baum & Silverman, 2004; Bertoni et al., 2011; Large & Muegge, 2008). Consistent with this reason, Quas et al. (2020) postulate that a scrupulous screening process of a startup's quality and fit to their portfolio and various non-financial value-adding activities also account for driving a better performance of VC-backed companies apart from financial assistance. As for more exact reasons to provide non-financial support to the investees, they concern optimization of the use of financial resources, paving the way for increasing economic value of the venture, attraction of follow-up investments, successful exit, and ultimately a motivation of VCs to maximize monetary return on their investment (European Venture Philanthropy Association, 2018; Scarlata et al., 2012; St-Pierre et al., 2011). It follows, therefore, that it is imperative for VCs to cater to non-financial needs of startups.

Nevertheless, what appears to be a persistent limitation of most of the research to date and a hindrance in fully grasping the whole spectrum of VC's impact is that studies rarely disentangle or effectively isolate the effects of screening, financial and non-financial value contributions of VC, especially struggling to concretely attribute and even more so to quantify the startups' growth and performance improvements in connection with post-investment value-adding activities (Baum & Silverman, 2004; Bertoni et al., 2011; Large & Muegge, 2008; Quas et al., 2020; St-Pierre et al., 2011). That is not to mention greatly varying categorization of non-financial value-added and contrasting views of the most important value-adding contributions in previously published literature as has been demonstrated by Large and Muegge (2008). Hence,

there is still a need for additional research to expand upon the non-financial value-adding resources by VC and ascertain its attributable impact to the growth performance of startups. It is in this vein that we proceed with succinct review of the literature on the specificities of NFC scattered among numerous research works. The following synthesis delves into six chronologically arranged by their publication date studies (Landsgård, 2007; Large & Muegge, 2008; Luukkonen & Maunula, 200; Luukkonen et al., 2011; Silenius, 2021; St-Pierre et al., 2011;), each of which presents a unique approach to categorize and group non-financial variables of VC, as put together in detail in Appendix A. The choice of these particular studies for scrutiny was grounded on their relative recency; Large and Muegge (2008) carefully reviewed 20 empirical investigations on the topic that were published within the period from 1986 to 2005 in their critical evaluation, although new research shedding light upon the NFC of VC has been made available since then.

One of the more recent discussions on comprehensive classification of non-financial support of VC was undertaken by Luukkonen and Maunula (2007), who proposed to break down the value-added into four different forms, which are "screening investment targets, monitoring portfolio companies, and value-adding services" (p. 6) as well as signaling effect, although it has been intentionally left outside the scope of the analysis (please, see Appendix A for more clarity). The study differentiates between formal and informal means of monitoring portfolio companies and argues that monitoring is a critical factor for the investee's success (Luukkonen & Maunula, 2007). Silenius (2021) also underlined the need to monitor investments in the managerial recommendations for VCs, but generally none of the other research placed such importance on monitoring; Large and Muegge (2008) included it the variable as one of the non-financial support elements that make up the category of operating activities, but still cautiously questioned whether monitoring should be referred to as one of the non-financial value-adding activities. Unlike the rest of studies under consideration, Luukkonen and Maunula (2007) also group all the remaining value-adding services under one single category without drawing distinctions between each one of the individual NFCs. Even though Luukkonen and Maunula (2007) did not further elaborate on the signaling effect of VC apart from quickly mentioning it among other forms of the value-added, interestingly Large and Muegge together with Luukkonen et al. (2011) singled out the effect as separate categories of "legitimation" and "quality" to mark

its significance for portfolio companies, whereas St-Pierre et al. (2011) and Silenius (2021) also slightly comment on the importance of legitimizing startups through endorsements.

Being rooted in resource-based theory, Landsgård et al. (2007) instead preferred to categorize value-added contributions through the prism of five distinct knowledge areas comprising product development, marketing, organizational, economics, financials (please, see Appendix A for more clarity). Likewise, St-Pierre et al. (2011) and Silenius (2021) adopted "resource-based theory" in their theoretical framework too; the idea also finds support in the view expressed by Large and Muegge (2008) that more significant strides forward should be made towards theorizing. Expectedly, the empirical results of the work revealed that financial activities of VC, including variables such as additional funding, valuation process, and exit, were found to be the most crucial part of VCs contribution, followed by strategic alliances, network building, strategy, and professionalism as the next most prominent activities (Landsgård et al., 2007). All the while, product development knowledge turned out to be the least value-adding contribution (Landsgård et al., 2007).

The principal difference of a major study by Large and Muegge (2008) from the others is that the authors discern between externally and internally oriented NFCs, where legitimation along with outreach belong to the former group and recruiting, mandating, strategizing, mentoring, consulting, and operating activities refer to the latter group respectively (please, see Appendix A for more clarity). Above all, Large and Muegge (2008) devised a provisional cause-and-effect model of VC exit success and proposed a detailed eight-category typology of NFCs drawing on collected, classified, and scrutinized relevant literature. According to the paper, "operating and outreach are the most important categories of VC value-adding inputs" (Large & Muegge, 2008, p. 49) with consulting, mentoring, and recruiting having lower, but nevertheless, high added value (Large & Muegge, 2008).

A different perspective has been adopted by St-Pierre et al. (2011), who categorized NFC of VC in accordance with strategic capabilities that can be influenced by VC, measured as innovation, market development, networking, and HRM capabilities (please, see Appendix A for more clarity). As opposed to the rest of research, St-Pierre et al. (2011), unfortunately, did not manage "to establish any causal relationship between their presence and the strategic capabilities or potential of the VC-backed firms" (p. 115). And despite the fact that the author has been largely employing quantitative methods to gain empirical results (St-Pierre et al., 2011), the issue

with quantifying the value-adding variables and value-added outcomes still analogously persists as in other works under review.

Another noteworthy study categorizing the NFC of VC was carried out by Luukkonen et al. (2011), the distinctive features of which are comparison between the value-added of governmental venture capital and independent venture capital and investigation of "potential adverse effects of venture capitalist involvement on the investee firm" (p. 5). In light of the present thesis, the most relevant part of the research conducted by Luukkonen et al. (2011) is a substantive and expansive categorization of forms of value-added that covers 28 activity areas across eight general categories, namely strategy, technology position, market position, professionalization, financial function, quality, internationalization, and exit orientation (please, see Appendix A for more clarity).

Lastly, Silenius (2021) presents a rather simplified version of categorization for non-financial resources that combines them into two groups: managerial resources (including investment experience, entrepreneurial experience, industry knowledge) and strategic resources (including investor contacts, industry contacts, contacts to find managers), as exhibited in Appendix A. This categorization essentially revolves around the expertise and network that VCs can offer to the portfolio companies if we take into account the elements that make up the proposed categories (Silenius, 2021). The coverage of non-financial resources could still be sufficient given that the paper is mainly laser-focused on early internationalization of startups; nonetheless, the classification category of "internationalization" from the research by Luukkonen et al. (2011) seems to give a clearer understanding of specific activities that the notion entails.

Overall, NFCs of VC are not limited to the categories highlighted above and this subchapter has demonstrated only some of them and their corresponding non-financial value-adding services of VC found in the recent empirical literature. Having a solid grasp on the latest available typologies of non-financial value-added, it is now necessary to put together all the reviewed material and evaluated categorization approaches in the next subchapter to create a unified visual model that will summarize the complexity and scope of the NFC of VC.

1.2 Proposition of a new model of non-financial contribution of venture capital

To date, the evidence from the discussion indicates that the existing typologies for the NFC of VC are widely differing, incomplete, and inconsistent. Therefore, it became evident that there is a need to redefine what constitutes non-financial value-added and create a novel, all-

inclusive, holistic model that would encompass all commonly cited non-financial value-adding services in logical categories based on a reasonable degree of similarity between the variables in terms of shared characteristics and overall focus. It is in this light that the author proposes a new integrated model to conceptualize NFC of VC (please, see Figure 1), drawing on the conducted literature review and close examination of different categories with their non-financial resources from the previous subchapter:

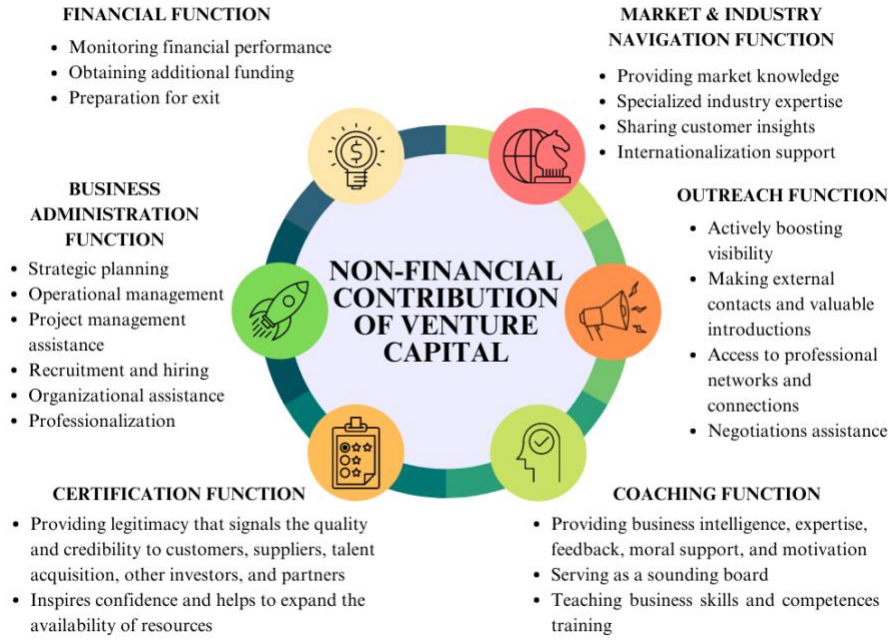

Figure 1. Model of the non-financial contribution of venture capital

Sources: Compiled by the author based on Landsgård et al. (2007), Large and Muegge (2008), Luukkonen and Maunula (2007), Luukkonen et al. (2011), St-Pierre et al. (2011), Silenius (2021)

With regard to the proposed model in Figure 1, it is highly appropriate to explain what the distinguishable functions stand for and the reasoning behind suggested categorization, hence, the rest of this subchapter proceeds to elaborate on this.

Certification function represents the legitimacy, also known as “signaling effect”, that reputable VCs are capable of providing to startups to elevate the third parties’ trust in the venture given its immaturity (Large & Muegge, 2008; Luukkonen & Maunula, 2007; Luukkonen et al., 2011; Megginson & Weiss, 1991; Silenius, 2021; Theinert et al., 2017). VC-backed companies can leverage the entrusted credibility to positively signal about their quality and latent potential to “customers, alliance partners, skilled workers and other financial intermediaries” (Luukkonen

et al., 2011, p. 3). Not only certification instills confidence in prospective partners and spurs beneficial collaborations (Luukkonen & Maunula, 2007), but also "attract talents that otherwise would not consider working in such a small and unexperienced organization" (Silenius, 2021, p. 30). Notably, certification is also reported to encourage other venture capitalists to co-invest before IPO (Luukkonen et al., 2011) and to tap into "resources that would otherwise have been unavailable" (St-Pierre et al., 2011). Certification function is considered as a separate category in the model due to its meaningful implications for portfolio companies and lack of comparability to the rest non-financial resources provided by VCs.

Coaching function boils down to serving as "an advisor or sounding board" (Luukkonen & Maunula, 2007, p. 25) to portfolio companies and equipping them with business knowledge and know-how they lack in the administrative, financial, strategic management, marketing and other dimensions (Large & Muegge, 2008; Luukkonen et al., 2011; Quas et al., 2021; Theinert et al., 2017). Although Large and Muegge (2008) dealt with mentorship and consulting individually, coaching function of the model can be viewed as both informal mentorship and more formal consulting required by management of the investee that cover the necessary guidance and increase the level of competencies and skills among staff (Large & Muegge, 2008). It should be emphasized that such support is especially needed for early-stage high-technology companies that lack critical entrepreneurial experience (Luukkonen et al., 2011), which is in line with the findings indicating that coaching function of VCs appears to boost human capital (Quas et al., 2021), lead to "improved innovation performance" (p. 20), and ultimately qualify as a crucial factor for firm's success (Theinert et al., 2017).

Even though the coaching function stands apart for encapsulating the advisory role of VCs, the proposed model also differentiates it with the market and industry navigation function which primarily addresses the special needs of portfolio companies in terms of market- and industry-specific information. Specialized market knowledge and industry expertise that VCs can transfer to their investees have been found to help obtain a more accurate picture of the market environment, develop a better understanding of customer needs and seize new business opportunities in the marketplace, thereby resulting in a more efficient use of firm's resources (St-Pierre et al., 2011; Silenius, 2021). The market and industry navigation function also incorporates internationalization because the activities that involve expansion to foreign markets such as seeking distribution channels, equity financing, recruitment of managers and other staff

abroad (Luukkonen et al., 2011) are closely intertwined to market and industry knowledge accumulation as it is shown to mitigate risks involved arising from internationalization (Silenius, 2021).

Business administration function brings together many non-financial variables of VC that would normally be divided into stand-alone categories in different variations, as presented in other studies (please, see Appendix A for clarity). In case of the proposed model, these variables are: overarching strategic planning with a focus on the longer-term direction (Landsgård et al., 2007; Large & Muegge, 2008; Luukkonen et al., 2011), organizational and project management assistance (Landsgård et al., 2007), operational management (Landsgård et al., 2007; Large & Muegge, 2008), professionalization of the management team (Hellmann & Puri, 2022; Landsgård et al., 2007; Luukkonen et al., 2011), human resource management (Landsgård et al., 2007; Large & Muegge, 2008; St-Pierre et al., 2011). The decision to aggregate all these vital services under one common category is motivated by the fact that the listed non-financial activities of VCs are heavily internally oriented and essentially geared towards smoothly running business, effectively fulfilling short- and long-term tasks, and achieving set business objectives.

As far as the financial function is concerned, the proposed model suggests that a separate category should be composed of the following value-adding activities: monitoring and controlling financial performance (Gebru & Awal, 2021; Landsgård et al., 2007), assistance with obtaining additional financing (Gebru & Awal, 2021; Luukkonen et al., 2011), and supporting the preparation for IPO and alternative exit routes (Luukkonen et al., 2011; Megginson & Weiss, 1991). Contrary to the categorization by Landsgård et al. (2007) that individually recognizes economical knowledge offered by VCs in addition to their help with financial activities, the proposed model does not present both analogically, nor does the financial function merge them as one. The reason is “liquidity management, budgeting and accounting” (Landsgård et al., 2007, p. 16) attributed to the economical knowledge do not appear to be particularly reflected as a part of the NFC of VC in other studies. However, the value-adding services connected with exit orientation are embedded into the financial function of the model as opposed to the working paper by Luukkonen et al. (2011) that puts it forward as an independent category.

In concluding the explanation of the proposed model, we finally ought to consider the outreach function that picked up a lot from the eponymous category formed by Large and Muegge (2008) in terms of the non-financial variables that comprise boosting the visibility of

portfolio company, making valuable introductions, providing access to extended professional network of resourceful industry contacts (service providers, investors, other collaborators) and negotiations support. The activities of the outreach function largely correspond to how Quas et al. (2021) asserts that VCs add social capital to startups through endorsing to external stakeholders, providing access to networks, and promoting new alliances. Several other studies paid a special attention to networks; Theinert et al. (2017), Silenius (2021), and St-Pierre et al. (2011) agree that access to networks enables portfolio companies to overcome their lack of internal resources and expertise.

All in all, the proposed model is not only a catalogue of the diverse non-financial value-adding services offered by VCs that complements their financial support, but also an attempt to holistic reconceptualization of the NFC of VC and alternative presentation of its typology.

2. Deep tech and the Estonian startup ecosystem

The second chapter of this thesis is divided into two parts. The first part proposes a definition of deep tech startup and dives into an overview of deep tech. It then goes on to give a concise snapshot of the Estonian startup ecosystem with a focus on the local VC landscape and the situation of deep tech startups in Estonia.

2.1 The definition of deep tech startups, their key specifics, and growth challenges

Deep tech startups are increasingly becoming popular in the academic literature (e.g., Edström & Klinger, 2020; Siegel & Krishnan, 2020; Taupin et al., 2021), startup ecosystem reports (e.g., Dealroom & Sifted, 2021a; Portincaso et al., 2021; Startup Genome, 2021), and investing news headlines, but to date, there is little consensus about what the term precisely means since it has not been thoroughly addressed and interpreted by many scholars. Yet still, a profound understanding of deep tech startups can be consolidated through deconstruction of fragmentary definitions introduced in the prior studies that not only describe their nature but also clarify the notion of deep tech, as summarized in Appendix B.

One of the earliest definitions of deep tech startups is credited to Chaturvedi (2014), who characterizes them intentionally vaguely for inclusivity as “companies that are founded on a scientific discovery or true technological innovation.” The definition caught on in consecutive research on the topic (Gebru & Awal, 2021; Granath, 2021; Siegel & Krishnan, 2020; Taupin et al., 2021), and we can trace evident commonalities in the more recent works that also refer to “scientific discovery” and “technological innovation” as the cornerstones of deep tech startups.

Diving deeper into the definitions (please, see Appendix B for more clarity), we can indeed observe that technological novelty is one of the emerging central aspects of deep tech startups. It is noticeable that studies under evaluation often highlight technological advancements as an underlying basis of the concept (De la Tour et al., 2019; Gebru & Awal, 2021; Granath, 2021; Schuh et al., 2022; Siegel & Krishnan, 2020). At the same time, Edström and Klinger (2020), Harlé et al. (2017), Nedayvoda et al. (2020), and Taupin et al. (2021) omitted to explicitly mention complex high-tech innovations altogether, leaving definition open for a more arbitrary interpretation.

A vast majority of published research on the issue is also in agreement regarding a solid research foundation as another common, pervasive aspect of deep tech startups (De la Tour et al., 2019; Gebru & Awal, 2021; Granath, 2021; Harlé et al., 2017; Nedayvoda et al., 2020; Schuh et al., 2022; Taupin et al., 2021). Conversely, the definitions put forward by Siegel and Krishnan (2020) and Edström and Klinger (2020) can be treated as outliers because they did not include any reference to a strong research base that drive innovations.

As claimed by De la Tour et al. (2019), deep tech startups "have the power to create their own markets or disrupt existing industries" (p. 7). Harlé et al. (2017), Siegel and Krishnan (2020), Edström and Klinger (2020), Gebru and Awal (2021) also seem to concur that deep startups are likely to be disruptive and bring fundamental changes either to the markets, industries, or business models.

It is clearly visible from the various definitions that addressing acute problems with social impact is another overall theme associated with deep tech startups. As Granath (2021) put it, deep tech startups "solve "big issues" that can truly have an impact on the world (e.g environmental or societal)" (p. 10); the definitions by De la Tour et al. (2019), Siegel and Krishnan (2020), Gebru and Awal (2021), Granath (2021), and Taupin et al. (2021) further corroborate that deep tech startups tackle global challenges. Collectively, several definitions also point out the interdisciplinary nature of deep tech startups (Edström & Klinger, 2020; Nedayvoda et al., 2020; Siegel & Krishnan, 2020). Notably, only Nedayvoda et al. (2020) specifies examples of technology fields closely tied to deep tech: "artificial intelligence (AI) and machine learning (ML), materials, advanced manufacturing, biotechnology and nanotechnology, drones and robotics, photonics and electronics, cleantech, spacetech, and life sciences" (p. 2).

Thus, building on the reviewed definitions, the author of the present thesis suggests an alternative way to refer to deep tech startups throughout this research, which hopefully will hopefully provide an integrated definition that can expand the spectrum of the term and facilitate future studies on the topic:

A deep tech startup is a research-intensive, interdisciplinary company rooted in cutting-edge scientific discoveries that focuses on developing sophisticated state-of-the-art technological innovations, which can potentially spearhead new or nascent markets, disrupt existing industries, challenge business models as well as solve or lessen critical societal, environmental, and other issues.

It should be also made clear that deep tech startups operate across a spectrum of technology fields, including, but not limited to advanced materials, biotechnology and nanotechnology, blockchain, artificial intelligence and machine learning, photonics and electronics, quantum computing, drones and robotics, space tech, energy, Internet of Things, virtual and augmented reality (Dealroom & Sifted, 2021a; De la Tour et al., 2019; Gebru & Awal, 2021; Nedayvoda et al., 2020; Schuh et al., 2022). To better understand the concept of deep tech startups, it is also useful to briefly go over key specifics of deep tech. Both Harlé et al. (2017) and De la Tour et al. (2017) acknowledge that a large investment need and advanced research base are inalienable part of deep tech startups. The difference between their reports on deep tech is Harlé et al. (2017) also brings out challenging business model as an extra attribute, while De la Tour et al. (2017) features a heavy industrialization process and undetermined commercial application. As regards the later works, De la Tour et al. (2019) note that the distinctive features of deep tech are fundamentally transformative impact of their innovations on society, prolonged duration of reaching market-ready maturity from R&D groundwork to prototypes and practical applications, and substantial capital requirement for financing time-consuming research efforts and technological development. By contrast, De la Tour et al. (2021) and Portincaso et al. (2021) present a different set of four attributes that differentiate successful deep tech startups among which are 1) problem-oriented mindset with a focus on the market-fit instead of merely technology, 2) multidisciplinary approach to leveraging fusion of available and up-and-coming technologies to build solutions and produce defensible intellectual property, 3) transition of implementing innovations from developing software and digital products towards physical ones, 4) active involvement within the ecosystem of various closely interrelated

participants, such as universities and research centers, corporations, governmental institutions, investors, and other facilitators. And lastly, deep tech startups usually tend to simultaneously face product-market fit and technology risks (Dealroom & Sifted, 2021a; Portincaso et al., 2021).

Many of the challenges to the growth of deep tech startups originate exactly from their specific characteristics. De la Tour et al. (2021) list four of such challenges as follows: the difficulty with reimagining products and processes, the relative infancy of scientific progress in poorly studied technology fields, the complexity and costliness of scaling up pioneering physical products, and lack of funding. It stands out that deep tech startups are particularly vulnerable to "a capital gap with insufficient and imbalanced investment" (Portincaso et al., 2021, p. 9) as reflected in a considerable amount of literature emphasizing the challenge with high capital intensity (De la Tour et al., 2017; Hargrave, 2021; Harlé et al., 2017). What is alarming is that venture capitalists "lack the necessary talent to understand science and technology risks and support ventures" (De la Tour et al., 2021, p. 31). De la Tour et al. (2017) additionally outline that the challenges lie in long time to market, commercial application, and regulatory framework. Hargrave (2021) also brings up that it is difficult for deep tech startups to access networking resources and penetrate new markets, compete for top-notch talent with necessary skillset, and maintain the expanding demands for innovations.

To sum up, this subchapter began by uncovering five fundamental aspects that constitute deep tech startups and suggesting the integrated definition of the term based on the earlier interpretations. It proceeded with a short breakdown of the characteristic features that distinguish deep tech startups and touched upon the pressing growth challenges to which deep tech startups are most often subjected to.

2.2 Deep tech startups in the Estonian startup ecosystem

This section brings Estonian startup ecosystem into the spotlight and specifically gives an account of the local VC and deep tech landscapes.

Estonia is a country in northeastern Europe with a small population of 1.33 million people, which boasts technologically advanced free economy, flagship e-government solutions and well-developed digital public services, the most tax competitive system among OECD member countries, and entrepreneurial-friendly environment (Bunn & Asen, 2021; Paraskevopoulos, 2021; Peeterson, 2021; The Heritage Foundation, 2021). The country is renowned for a vibrant startup ecosystem that has been expanding at an average annual growth

rate of 30% in the last 5 years (Peeterson, 2021) and serving as a springboard to 10 unicorn companies valued at over $1 billion and nearly 1400 startups as of April 2022 (Estonian Investment Agency, 2022b; Reinumägi, 2022b). In fact, Estonia is at the forefront of the whole of Europe in terms of startup density with 1107 start-ups per 1M inhabitants, which is almost five times higher than the European average, but also has the second-highest cumulative capital invested per capita at the European level, in an amount equal to 1252$ from 2017 to 2021 (Atomico, 2021). These findings are in consonance with statistics from Google for Startups et al. (2021), according to which there are "more than 1 startup per 1,000 people in Estonia" (p. 38); the report also points out that Estonian startups have raised the largest amount of venture capital investment — 2.62 billion euros from 2015 to 2021 — among Central and Eastern European countries and the most VC funding per capita — namely, 1967 euros — compared to all the other European countries (Google for Startups et al., 2021). The success of Estonia as a startup country further reflects in the advancement of its startup ecosystem from 14th to 6th place in the ranking of emerging ecosystems of 2021 by Startup Genome (2021). A summary of key startup ecosystem indicators is presented in Table 1:

Table 1

Brief overview of the Estonian startup ecosystem for the period 2018-2022

Indicator	2018	2019	2020	2021	2022*
Number of startups	550	1000	1117	1301	1363
Number of unicorns	4	4	5	8	10
Number of employees in Estonian startups	4529	5998	6072	8187	8948
Number of funding deals	40	73	76	90	22
Number of funding deals > 1M (€)	20	30	32	47	16
Amount of investments to Estonian startups (€)	328M	266.4M	440.9M	928M	906.6M
Employment taxes paid by Estonian startups (€)	53M	78M	97M	125M	39.5M
Annual turnover generated by Estonian startups (€)	363.8M	548M	782M	1.4B	417M
Ecosystem value ($)	2.0B	2.1B	5.5B	7.2B	12.6B
Ranking in the Global Startup Ecosystem Index by StartupBlink	-	13	11	13	-

Notes. * - figures for 2022 are presented only for the first quarter of the year. Due to some inconsistencies across Startup Estonia reports, the latest updates from their most recent reports on the yearly figures have been taken into consideration for the purposes of this table.

Sources: Compiled by the author based on Dealroom (2022), Mällo & Sillavee (2019, 2020), Mällo et al. (2021), Reinumägi (2022a, 2022b), StartupBlink (2019, 2020, 2021), Villig (2022)

Having considered the general snapshot of the startup ecosystem in Estonia, it is also relevant to touch upon the local deep tech scene. Deep tech startup ecosystem in Estonia is still in its infancy; according to Dealroom & Sifted (2021a), only 16% of total VC invested in Estonia from 2015 to 2020 was allocated on deep tech startups. While requiring almost the largest investments for being very capital- and research-intensive, deep tech startups in Estonia experience a critical underfinancing greater than other ventures, especially the early-stage deep tech startups without an experienced team (Civitta, 2020). Nevertheless, various initiatives are currently under way to promote the creation and growth of deep tech startups in Estonia such as the launch of a Health Research Accelerator (Tehnopol, 2022) and Creative Destruction Lab (CDL Team, 2022).

3. Empirical research of non-financial contribution of venture capital on deep tech startups

This chapter describes the methodology of the investigation, specifying selected research approach, sampling strategy, methods of data collection and analysis as well as the rationale behind the design choices. The second part of the chapter presents a discussion of research findings, which lays the foundation for revision of the proposed model of NFC of VC and answering the research question of this study.

3.1 Methodology

The present thesis deploys an exploratory approach to dive into the NFC of VC and its impact on the growth of deep tech startups. Exploratory research enables the discovery and development of new ideas, initial hypotheses, overlooked explanations (Brink & Wood, 1998; Reiter, 2017; Stebbins, 2001; Swedberg, 2020). Hence, it is well suited to use, since this thesis seeks to better conceptualize deep tech startups, redefine what constitutes the non-financial value-added of VC, and compose the novel integrated categorization model of NFC of VC, using the secondary research conducted in the form of a literature review as presented in the first chapter. In other words, the work attempts to enrich the existing knowledge and facilitate the discovery of new insights about the non-financial resources of VCs and its importance for deep tech startups to serve as a foundation for further studies on the topic, which Swedberg (2020) claims as the two main purposes for carrying out an exploratory study.

In that regard, the abductive reasoning is applied to this research as according to Halpin and Richard (2021) it "forwards explanations for novel or surprising observations" (p. 1). While induction and deduction have been deemed rather unfitting for inventing, refining or expanding theories (Robson & McCartan, 2016; Swedberg, 2020), abduction, on the contrary, "aims to combine the strengths of both inductive and deductive inquiry" (Halpin & Richard, 2021, p. 1) and allows to "go beyond the data and pre-existing theoretical knowledge by modifying, elaborating upon, or rejecting theory if needed, or putting old ideas together in new ways to examine, understand, and explain the data" (Kennedy, 2018, p. 5), which is very pertinent in the context of this thesis.

To achieve the research objective of identifying the role of the NFC of VC and its most important value-adding services in the growth of Estonian deep tech startups, the present study adopts qualitative research methods to collect primary empirical data. Despite a widespread application of the qualitative approach in exploratory research, the reason for the choice is that qualitative methods offer an effective way of drawing from respondents' experiences and perspectives to obtain detailed and rich insights, uncover new ideas, and build a robust understanding of a topic (Leavy, 2017; Miles et al., 2014; Taylor, 2015). It was decided that the best method to adopt for collecting qualitative data was to conduct semi-structured interviews. Not only semi-structured interviews are popular in social sciences, but the approach is attractive due to its flexibility to hold a free-ranging conversation over specifically outlined topics, vary the sequence of questions, ask follow-up questions for further elaboration, and offer a latitude on discussion to interviewer and interviewees (Bryman & Bell, 2011; Denzin & Lincoln; 2018; Roulston & Choi, 2018).

Given the subject of the research, the present work uses a non-probability sampling, focusing particularly on the venture capitalists with an experience of providing financial and non-financial support to Estonian deep tech startups as one group of interviewees and Estonian startup ecosystem experts with extensive knowledge of deep tech startups in Estonia as the second group. VC funds that invest in Estonian deep tech startups were identified for the purpose of the research using open-source database designed by Kaari Kink from Superangel (2022) and relevant webpages of Startup Estonia (2022) and Estonian Private Equity and Venture Capital Association (2022), featuring key Estonian startup ecosystem organizations, including the venture capital funds of the research interest. Apart from learning the insightful opinions of

venture capitalists, it was considered that the perspective of deep tech experts outside the venture capital funds would usefully supplement and extend the understanding of the non-financial value added of VC and the needs of deep tech startups in Estonia. Hence, the research sample of the second group of interviewees comprises Vaido Mikheim, Deep Tech Project Lead at Startup Estonia and former Project Manager at Tartu Science Park, and Mari Vavulski, the Member of the Management Board of SmartCap and former Head of Startup Estonia.

In total, 33 venture capitalists from 15 VC funds were repeatedly contacted mostly via LinkedIn as shown in Appendix C. Eventually, to achieve the theoretical saturation of data, six interviews were carried out with target venture capitalists (as summarized in the Table 2) and two more were hosted with hand-picked deep tech experts. Cooperation with participants was largely made possible due to common connections from the Estonian startup ecosystem, who kindly made introductions to the interviewees. Partaking in the interviews was stimulated by the Startup Estonia team that generously offered the interviewed venture capitalists four investor tickets to Latitude59, flagship startup and tech conference in Tallinn.

Table 2

Overview of the VC funds and interviewed venture capitalists

VC fund	HQ	Geographies	Focus areas	Stage	Ticket size	Interviewee	Job Title
Karma VC	Tallinn	Europe, including Baltics & Nordics	Deep Tech and Software	Seed & Series A	<5M€	Linda Võeras	Associate & Early-Stage Deep Tech Investor
Superangel	Tallinn	Global, including Baltics & Nordics	AI, Software, Fintech, Mobility, Robotics, SaaS	Pre-Seed & Seed	25k-500k€	Kalev Kaarna	Venture Development Manager
Change Ventures	Tallinn	Baltics	Agnostic	Pre-Seed & Seed	400k-2M€	Yrjö Ojasaar	Investment Partner
Inventure	Helsinki	Nordics & Baltics	Agnostic	Seed & Series A	250k-3M€	Lauri Kokkila	Partner
DEPO Ventures	Prague	CEE & Baltics	Deep Tech, Fintech, Marketplaces, Web3, Blockchain	Pre-Seed, Seed & Seed	50k-250k€	Sebastian Sulma	Investor, Analyst & Venture Scout
Superhero Capital	Tallinn	Baltics & Finland	Agnostic	Pre-Seed & Seed	50k-1M€	Ivo Remmelg	Venture Partner

Sources: Compiled by the author based on Estonian Private Equity and Venture Capital Association (2022), Kink (2022), Startup Estonia (2022)

The interview questions were divided into four main thematic categories: 1) the questions concerning general ideas and perceptions of the NFC of VC (and additionally deep tech startups in the interview guide for deep tech experts); 2) the questions concerning the accuracy and validity of the proposed model of the NFC of VC; 3) the questions concerning the most important and fundamental value-adding services provided by VCs; 4) the questions concerning the practical recommendations for developing the deep tech startup ecosystem in Estonia. All the interview questions were drawn from the topics covered in the first two chapters and preliminarily reviewed by the supervisor of this thesis to ensure their clear articulation. The whole set of interview questions for the interviewed venture capitalists and deep tech experts listed below in the Table 3 can be found in Appendix D and Appendix E respectively.

Table 3

Overview of the conducted interviews

VC fund	Interviewee	Job Title	Date	Duration	Format	Language
Karma Ventures	Linda Võeras	Associate & Early-Stage Deep Tech Investor	5.05.2022	37 min	Online	English
Superangel	Kalev Kaarna	Venture Development Manager	6.05.2022	49 min	Online	English
Change Ventures	Yrjö Ojasaar	Investment Partner	9.05.2022	24 min	Online	English
Inventure	Lauri Kokkila	Partner	9.05.2022	21 min	Online	English
DEPO Ventures	Sebastian Sulma	Investor, Analyst & Venture Scout	5.05.2022	12 min	Online	English
Superhero Capital	Ivo Remmelg	Venture Partner	6.05.2022	-	Written	English
Startup Estonia	Vaido Mikheim	Deep Tech Project Lead	6.05.2022	34 min	Online	English
SmartCap	Mari Vavulski	Member of the Management Board	9.05.2022	56 min	Online	English

Sources: Compiled by the author

The first category of questions from one to three in Appendixes D and E was designed to give a general understanding of the pre-existing knowledge that the interviewed venture capitalists and deep tech experts have about the central concepts of this thesis. The main point of these questions was to reveal the unbiased views and tap into personal thoughts of the

interviewees on the NFC of VC and deep tech startups before introducing them to the proposed categorization model. Turning to the second category of questions, the questions four and five from Appendixes D and E served to help evaluate the proposed model of the NFC of VC and seek feedback of the interviewed experts for its further fine-tuning. The third category of questions from six to nine in Appendixes D and E was posed to find out the overall impact of the NFC of VC for Estonian deep tech startups and gain insights into the most influential non-financial resources provided by VCs, which strengthen the growth performance of deep tech startups. The last question from the interview guides presented in Appendixes D and E inquired into steps that may be directed to further propel the development of deep tech startup ecosystem in Estonia. Regarding the interview process, the questions were asked in the order they follow in Appendixes D and E; however, some questions were purposefully left out or added by the author during the course of the interviews, thanks to the semi-structured format of the discussions. All the research participants received access to the interview guides in advance and were asked for permission to be audio recorded for further transcription and analysis of findings.

For examination of the interviews, the author of this thesis conducted a thematic analysis, since it "is a powerful yet flexible method for analyzing qualitative data that can be used within a variety of paradigmatic or epistemological orientations" (Kiger & Varpio, 2020, p. 1). The deductive approach was taken for theme identification because the theoretical framework of the present research was applied to establish the basis for uncovering preconceived themes (Kiger & Varpio, 2020; Vaismoradi et al., 2013), stemming from previously described four categories of interview questions. To engage in thematic analysis, the present study utilizes the six-step method developed by Braun and Clarke (2006), consisting of familiarizing with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, producing the report; this process of conducting thematic analysis widely lines up with the similar steps outlined in other literature on the topic (Castleberry & Nolen, 2018; Williamson et al., 2018). The analysis of the themes does not only reflect and interpret the discussions held with interviewees of this research, but also refers to the literature review on the NFC of VC and deep tech startups in support of findings.

3.2 Analysis of the findings and revision of the proposed categorization model

The final subchapter draws upon the main insights obtained from the thematic analysis of conducted interviews and the literature review's findings from the theoretical part of the thesis to

re-address the concepts of NFC of VC and deep tech startups, adjust the proposed model of NFC of VC, discuss the role of VCs' non-financial support in the context of Estonian deep tech startups' growth, and offer practical recommendations on how to encourage the further development of deep tech startup ecosystem in Estonia.

Non-financial contribution of venture capital. Interviewed venture capitalists and deep tech experts characterize what constitutes the NFC of VC in a variety of ways, stressing different non-financial value-adding services to describe its essence. Lauri Kokkila from Inventure define the NFC of VC as "all the value-adding activities that the VC firm performs in order to increase the valuation of a portfolio company". Among the non-financial activities that the deep tech startups often seek from VCs, he outlined the support in terms of helping to hire talent, raising the next financing round, developing business model and strategy on which markets to tackle. It is noteworthy that as distinct from the non-deep-tech startups, he argues that the approach to providing the NFC to deep techs startups is less focused on commercialization and scaling and mostly diverted to finding the first pilots and product building, even though this is where VCs have less value to add.

Yrjö Ojasaar from Change Ventures argues that a primary value added of the NFC of VC is a network of investors for securing the next investment round, as well as a network of partners, service-providers, and clients. Additional non-financial support that he highlights to describe the concept comprises giving advice on hiring and managing the team. As for the difference in the approach of offering the non-financial resources, Ojasaar asserts that deep tech startups usually struggle with a business side of running the venture and need a lot more help with product positioning, optimizing sales, understanding unit economics, figuring out their business model and target customer profile.

Notably, Linda Võeras from Karma Ventures draws a clear distinction between the NFC and non-financial value-added, arguing that the NFC does not add value to the startups by default unlike the non-financial value-added. Võeras emphasizes that sometimes, depending on the company and its challenges, the best VCs can do is to step back and not stand in the way of founders; although, she also suggests that "hiring, introductions to business advisors, providing insights into the history and experiences of other portfolio companies" are among the valuable activities of the NFC of VC.

Kalev Kaarna from Superangel presented a detailed two-fold response, delineating how VC funds generally offer non-financial support and what Superangel does differently. Kaarna contends that the NFC of VC generally revolves around the VC fund's brand that positively signals about the quality of a startup, network of experts and portfolio companies from whom founders can learn, fundraising activities and consultations for speeding up the learning process. What distinguishes Superangel is a strong focus on personal development of founders. As Kaarna describes, Superangel provides their investee firms with a six-month opportunity to work with personal coaches for free, helps to set KPIs, formulate a sales story and instill a culture of accountability through in-house trainings, conducts two-month long sprints with experts for building business infrastructure and automating core processes, runs hackathons and organizes training sessions with outstanding startup ecosystem builders.

Sebastian Sulma characterizes the NFC of VC from the perspective of DEPO Ventures, which lends support to secure follow-on investments and resolve practical issues with hiring and sales as well as provides access to a mentoring program, an internal community of portfolio companies, and business networks. Ivo Remmelg from Superhero Capital understands the NFC of VC in terms of activities like "advisory, consultation, and introductions to other people", but surprisingly does not differentiate between approaches to deep tech and non-deep-tech startups.

The non-financial resources of VC from the empirical findings match those observed in the studies discussed in the literature review on the topic and confirm the idea of the diverse and value-adding nature of the NFC of VC. Nevertheless, the provided characteristics are too narrow suffice for putting forward a concrete definition of the NFC of VC to draw parallels with the author's general interpretation of the term that was based on the "resource-based view of the firm".

Deep tech startups. Vaido Mikheim from Startup Estonia and Mari Vavulski from SmartCap are in general agreement that deep tech startups are companies with "a product or service development that is based on the scientific advancement and development or meaningful engineering innovation" as well as "defensible commercializable intellectual property" that stems from the research. The distinctive features of deep tech startups brought by these two ecosystem experts also indicate that deep tech startups have a disruptive power to redefine and create new markets in addition to causing profound long-term changes in their respective industries. Vavulski notes that deep tech startups are subject to market and technology risks at

the same time, which is consistent with findings by Dealroom and Sifted (2021a) and Portincaso et al. (2021). This accords with the author's definition of deep tech startups that was presented earlier in the second chapter of the thesis based on the reviewed academic literature. Interestingly, Mikheim states that the definition of a deep tech startup is dynamic and ever-changing; he argues that technological fields that are currently regarded as deep tech will eventually be substituted by new up-and-coming areas because complex technologies of today will be a commonplace in the future.

Regarding the common struggles of deep tech startups in Estonia, both experts indicate a lack of qualified A-level talent, lack of capital availability, lack of competent deep-tech-specialized service providers for establishing sales, HRM, manufacturing and other structures in companies and bringing product to the market, and a lack of big industry players to develop proof of concept for conducting market discovery and validation process. To top it off, Vavulski acknowledges a lack of understanding of deep tech among investment teams and touches upon the fact that "usually VC mandate doesn't target deep techs". Sulma, Võeras, and Kaarna concur with investors' issues in understanding complex technicalities of deep tech startups and their cautiousness to invest into deep tech. These challenges overlap substantially with the difficulties of deep tech startups previously outlined based on the insights from De la Tour et al. (2017), Harlé et al. (2017), De la Tour et al. (2021), Portincaso et al. (2021), and Hargrave (2021).

The findings of the current study also demonstrate different non-financial needs of deep tech startups from various technological fields. Among the experts interviewed, Sulma, Kaarna, Kokkila, Mikheim and Vavulski agreed that because of individual differences of the companies, their products or services, business models, and development stage, the industry-specific expertise required by deep tech startups from VCs varies; however, some universally applicable value-adding services such as support with hiring could still be equally attractive regardless of contrasting specializations. Ojasaar underlines that sophisticated technological fields with a limited number of professionals pose more difficulty of finding and attracting top-level talent, while Mikheim and Vavulski assert that the main difference lies in the regulatory framework and legal certification that deep tech startups must comply with.

Fundamental non-financial value-adding activities of VCs. Before proceeding with the important NFCs of VC, it is interesting to note that according to the accounts of Vavulski, Kaarna, Ojasaar, and Võeras, most of the deep tech startups do not know what type of the non-

financial support they are looking for from VCs. All the interview participants agreed on the importance of introductions, investor contacts and associated value-adding activities for securing follow-on investments and almost all of them also mentioned how significant it is for deep tech startups to receive the help with recruitment and hiring talent.

The current research also found that there is a need for emotional support for founders and "having an open and honest atmosphere for them to voice their concerns and talk about the challenges they are facing" as put by Võeras; a special attention to the human aspect of running a startup is corroborated by Kaarna, Mikheim and Ojasaar, who confirm how demanding, lonely, and mentally draining the startup process is. This goes along with the importance of reassurance from other experts and founders with relatable experiences, specified by Võeras, Sulma, Vavulski, as well as the need in leadership and personal growth training for the founders of deep tech startups, mentioned by Kaarna and Mikheim. It was discovered during the research that market insights and industry knowledge provided by VCs are also very actual NFCs in the view of Vavulski and Mikheim on a par with the guidance on formulating go-to-market strategy and internationalization highlighted by Kokkila and Ojasaar. Apart from that, Mikheim pointed to the value of certification function, although he was not sure if regional VC funds can provide it to the deep tech startups.

The results of the study indicate that building and protecting intellectual property and patents portfolio is an additional important element missing in the proposed model of the NFC of VC, as reported by Mikheim, Kaarna and Vavulski. The non-financial support in terms of sales and set up of business model was also prominent in the opinions of Ojasaar, Remmelg, and Kaarna, and hence could be more explicitly showcased in the model. In contrast, the non-financial value added in the form of project and operational management assistance is not significant in accordance with Kaarna, Mikheim, and Vavulski, who share the opinion that these activities should be handled entirely by the deep tech startups themselves. Furthermore, assistance in preparation for exit was deemed as rather irrelevant by Kaarna and Mikheim for early-stage deep tech startups due to their long time to market.

Another important finding was that early-stage deep tech startups mostly need assistance with setting KPIs, figuring out the business model, finding a product-market fit and customer discovery as well as accessing potential investors, while late-stage deep tech startups could

benefit more from acquiring extra talent, stimulating operations and sales, obtaining additional funding and internationalization.

For the most part, the findings generally support the proposed categorization model of the NFC of VC that was constructed upon the literature review. Based on the identified important value-adding services and taking into account the comments and suggestions of the interviewed experts, the following revision of the model is suggested (please, see Figure 2), which would be more applicable, comprehensive, and reflective of the main services offered by VCs in the context of Estonian deep tech startups:

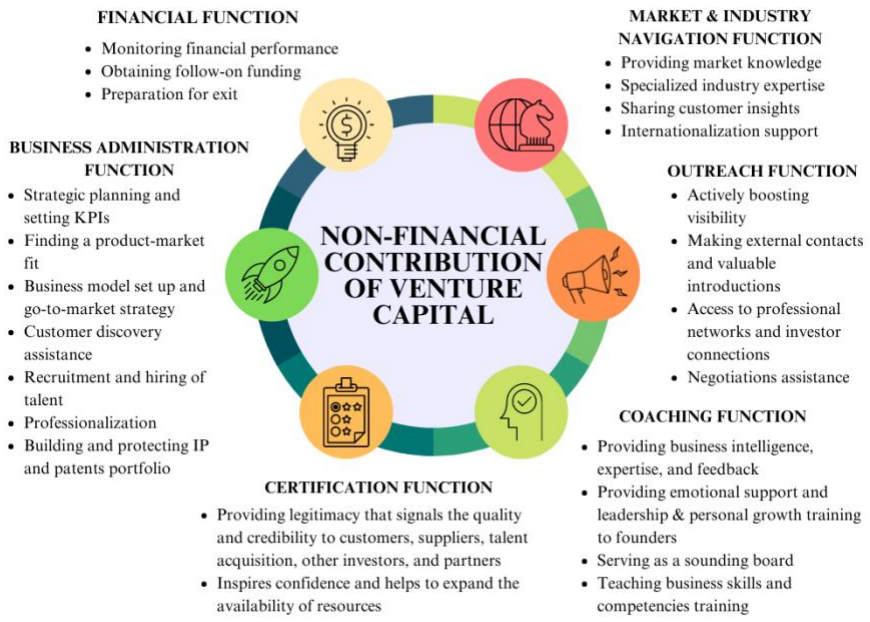

Figure 2. Revised model of the non-financial contribution of venture capital

Sources: Compiled by the author based on the conducted interviews as well as Landsgård et al. (2007), Large and Muegge (2008), Luukkonen and Maunula (2007), Luukkonen et al. (2011), St-Pierre et al. (2011), Silenius (2021)

Importance of NFC of VC. The findings observed in the present thesis reasonably mirror those of the previous academic studies that have examined the effect of non-financial value added on the growth performance of VC-backed startups (e.g., Baum & Silverman, 2004; Bertoni et al., 2011; Chemmanur et al., 2011; Manigart & Sapienza, 2017; Quas et al., 2021). Sulma and Ojasaar point out that many startups in the early stages with a lack of business knowledge and operating experience do need and appreciate the appropriate non-financial assistance from VCs in its different forms to learn and advance faster in their development.

Mikheim endorses Ojasaar's point of view and states that "startups cannot live off only advice, but if they just have the money, they will burn it completely in the wrong way", while according to Sulma "it is really up to the founders themselves how they make use of all the available resources provided by VCs". Kaarna, Kokkila, and Mikheim recognize the importance of the NFC of VC, but they also emphasize that the non-financial support does not have to come from VCs and could be sought from other startup ecosystem players such as angel investors, incubator and accelerator programs and so on. One unanticipated finding was that the NFC of VC is not important for the growth performance in accordance with the view of Remmelg, who suggests that "VC-s invest, when there is a hope that startup will succeed with or without NFC". Last but not least, Vavulski admits that there are cases where the NFC of VC can prove to be useful and crucial, but under the condition that "there is a good match between investor and the company". Hence, as a result of research, it was found that the NFC of VC tends to positively boost the growth of Estonian deep tech startups.

Practical recommendations for developing the Estonian deep tech startup ecosystem. As it was noted by Mikheim and Kaarna, the development of a deep tech startup ecosystem in Estonia is a complex problem that requires system-wide solutions. Ojasaar, Remmelg, Kokkila and Mikheim mention that Estonia is small and there is a lack of deep tech mentors, founders, and investments, even though the country has a solid startup community and "a lot of brilliant technologists and scientists" as stressed by Võeras. What Kaarna and Võeras suggest addressing the situation is to intensify collaborations between deep tech startups, investors, and universities and incentivize more researchers to translate their ideas into entrepreneurial ventures; Võeras encourages "to make sure that people who have the ambition to build companies would know where to go and find people to support them, but also foster our own and commercial talent in Estonia." Vavulski likewise sees the need to improve capital availability for science-based and deep tech companies and involve more startup ecosystem players, apart from VCs, in providing non-financial support to deep tech startups. On top of that, Mikheim supports the idea of building a community of deep tech founders in Estonia because they have a different road to market compared to other entrepreneurs and tapping into the international scene of VCs, deep tech startups, service providers, and customers for deepening external networks and accessing attractive opportunities available for other countries in order to propel Estonia as an emerging deep tech startup hub to the world.

Conclusion

This thesis set out to determine the role of the non-financial contribution of venture capital in the growth of deep tech startups in Estonia. Whilst the positive impact of the non-financial valued added could not be quantified within the scope of the research, the evidence from this study shows that the NFC of VC to a larger extent plays a significant role in promoting the growth of Estonian deep tech startups.

The findings from this thesis make several noteworthy contributions to a growing body of literature on the NFC of VC and deep tech startups, particularly regarding the Estonian startup ecosystem. The first part of the theoretical analysis in the undertaken research provides a new understanding of what constitutes the NFC of VC through an in-depth literature review of six different typologies found in the most recent academic research and their constituent non-financial value-adding services. Taken together, the results of the literature review gave rise to the redefined, comprehensive categorization model of the NFC of VC, which can serve as a base for future studies.

The second part of the theoretical analysis examined the concept of deep tech startups, their key distinctive features and growth challenges as well as proposed an integrated definition of the term based on the interpretation of ten fragmentary definitions presented in the prior research on the topic. The theoretical analysis of the thesis summarized the key facts about the Estonian startup ecosystem and provided additional evidence with respect to the emerging deep tech landscape in Estonia.

The empirical analysis of the current study enabled the author to readdress the concept of the NFC of VC, verify the proposed definition of deep tech startups and their key challenges in the context of Estonia as well as reevaluate and revise the categorization model of the NFC of VC upon completing the interviews with six venture capitalists with experience in investing into Estonian deep tech startups and two Estonian deep tech experts. The findings obtained from the empirical analysis suggest that the important non-financial value-adding activities offered by VCs comprise help with securing follow-on investments, recruitment and hiring of talent, providing emotional support for founders, sharing market insights and industry knowledge, formulating the go-to market strategy and setting up the business model, building and protecting intellectual property portfolio.

The empirical analysis also shed a light on the practical recommendations for facilitating the progress of the deep tech startup ecosystem in Estonia. In short, the main suggestions focus on the establishing closer relationships between deep tech startups, investors, and universities in the ecosystem, improving capital availability for research-intensive companies, integrating Estonia deeper into the international scene of VCs, deep tech startups, service providers, and customers.

Finally, several imitations need to be acknowledged. Even though the findings substantiate the role of the NFC of VC in the growth of the Estonian deep tech startups, the generalizability of results is limited because the empirical analysis of the research is qualitative in nature and the outlined impact of the NFC of VC is not quantifiable since it is based on a rather small sample of interviewed participants. Another limitation of this study lies in the fact that the present thesis evaluates the impact of the NFC of VC only from the perspective of venture capitalists and startup ecosystem experts but does not offer insights into the views of deep tech startup founders to learn from their first-hand experiences. Although the research has successfully proposed a novel categorization model of the NFC of VC, it may not exhaustively encompass all the non-financial value-adding activities offered by VCs and may not be effectively applicable in case of the other startup ecosystems.

This thesis also opens up different potential avenues for future research. It is without a doubt that further research should concentrate on attempting to quantify the impact of the NFC of VC on the growth performance of deep tech startups in Estonia. Further research could assess the effects of the NFC of VC on the deep tech startups of different development stages and specializations. Alternatively, it is recommended to look into the impact of non-financial support from other types of startup ecosystem organizations such as incubation and acceleration programs. It would also be interesting to examine the proposed model of the NFC of VC outside the Estonian startup ecosystem.

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Appendix A

Previously suggested approaches to categorize the non-financial variables of VC.

Source	Proposed categorization	Corresponding non-financial value-adding activities of VC	Benefit for the portfolio company
Luukkonen & Maunula, 2007	Screening investment targets	Extensive evaluation of the companies, also known as pre-investment scouting, aimed at identifying promising startup ventures for financing.	To meet the investment criteria of VCs, companies are incentivized to develop their business plan, operations, management team's competences and other aspects. Whether the investment decision would be positive or negative, the feedback provides companies with learning points for improvement and maps a further direction for their development.
	Monitoring portfolio companies	Formal means of monitoring (p. 16): • Presence in the Board of Directors • Establishment of contractual arrangements • Adoption of financial reporting systems Informal means of monitoring (p. 16): • Regular contact with the management of portfolio companies	Monitoring keeps companies on track to achieving milestones such as bringing offering to the market, reaching R&D and sales objectives, generating cashflows and others specified in investment contracts for attracting follow-up financing.
	Value-adding services	Management support in the following activity areas (p. 32): • Strategic planning • Internationalization • Obtaining additional financing • Providing business contacts	Companies can gain new competencies and enjoy potentially useful connections thanks to VCs, who act as sounding boards and advisors with a valuable business network.

	Signaling effect	"Stamp of approval" from a reputable VC that instills external parties with confidence about the venture.	Signaling effect provides VC-backed companies with certification that endorses their hidden value and potential in the eyes of prospective partners for future collaborations.
Landsgård et al., 2007	Product development knowledge	Contribution in the form of (p. 10): • Involvement in the development of production or service techniques • Assistance with product, production, and R&D processes • Network within product development	As a result of accumulated product development support, companies can (p. 10): • Expedite time to market of their product • Tap into extended network of potential suppliers and strategic partners
	Marketing knowledge	Contribution in the form of (p. 11): • Market knowledge and its structure • Specialized industry know-how • Insights on potential customers • Network within the market	As a result of accumulated market and industry expertise as well as network connections, VCs can support investees to advance in the following aspects (p. 22): • Relationship building • Internationalization • Customer knowledge • Marketing • Sales • Logistics/Distribution
	Organizational knowledge	Contribution in the form of (p. 11): • Strategic advice • Assistance with project and operational management • Recruitment and hiring, especially within the management team • Network building • Professionalism	As a result of accumulated organizational support, companies enjoy (p. 22): • Building strategic alliances and capturing new contracts • Guidance on project, operational, and crisis management
	Economical knowledge	Contribution in the form of (p. 12): • Liquidity management	As a result of oversight from VCs, companies benefit from having (p. 12):

		• Budgeting • Accounting management knowledge	• A pressure to timely submit clear financial statements • A secure liquidity situation • A network of lawyers and accountants to rely for consultancy
	Financials	Contribution in the form of (p. 12): • Additional funding • Valuation process • Exit	As a result of financial support from VCs, companies benefit from (p. 12): • Acquiring follow-up investments from the same or new funding source through their network • Higher IPO valuations and better performance post-IPO
Large & Muegge, 2008	Legitimation	A passive process that encompasses "providing credibility, reputation, legitimation, validation, comfort, certification" (p. 41).	VC-financing enables companies to accrue certification that goes a long way to signal their quality and credibility, which is important for a successful technology commercialization.
	Outreach	Proactive activities that encompass "providing active promotion, introductions, negotiations, winning deals" (p. 41).	Similarly to networking, outreach can "generate value for the venture by establishing direct connections to key external stakeholders (e.g. potential customers, marketing partners and other financial partners), and gaining their commitment." (p. 40).
	Recruiting activities	Encompass "advising, doing reference checks, recruiting, negotiation, assessment, replacement" (p. 42).	The benefit lies in locating "the most talented managerial and professional individuals, and gaining their commitment to join." (p. 44)
	Mandating activities	Coordinate management team and provide "contract and policy terms, control rights, stock rights,	"They generate value for the venture by focusing the management team on the key performance indicators and

		contingent rights, performance targets, reports, controls" (p. 42)	preventing distracted undertakings." (p. 44)
	Strategizing activities	Encompass "developing business concept/strategies, doing strategic planning, keeping focus on longer-term strategic direction (p. 42)	They "add value to the venture by providing to the venture managers and directors the overarching strategic plans that provide guidance for senior and middle management decisions." (p. 44)
	Mentoring activities	Encompass "mentorship, advice, coaching, guidance, facilitation, feedback, motivation, patience, moral support, friendship; acting as confidant, sounding board, implanting entrepreneurial orientation" (p. 42)	"They add value to the venture by providing the senior managers with the more spontaneous off-the-record less structured support that is often required now by the executive managers to cope with the high-speed environment typical in a start-up." (p. 44)
	Consulting activities	Focus on "providing business intelligence, contacts, expertise, competence, teach business skills" (p. 43)	They "provide the arm's-length planned and structured knowledge that is required by the senior managers and professionals" (p. 44)
	Operating activities	Encompass "monitoring, controlling, decision making, compensation and incentives, appraisals, discipline, day-to-day hands-on management, professionalization, managing crises and problems" (p. 43)	"They provide value to the venture by the direct managerial involvement of the VC, complementing and completing the day-to-day capacity of the management team until the right management recruit is located." (p. 44)
St-Pierre et al., 2011	Innovation capability	Consists of activities pertaining "product innovation and development" (p. 106).	"By transferring their knowledge, VCs are able to reduce product development period and time to market, thereby allowing the firms to capitalize on the low cost of information acquired during the transfer" (p. 106)

	Market development capability	Focuses on (p. 106): • Sharing insights on market and customer development • Helping a firm to identify appropriate markets and find its niche in the marketplace	VCs help companies to obtain an accurate knowledge of the business environment, customer needs as well as "a more focused market-oriented resource deployment" (p. 107)
	Networking capability	Focuses on (p. 107): • Accruing social capital • Ensuring local embeddedness • Providing legitimacy	VCs provide an opportunity to leverage the "resources and expertise of other collaborators" (p. 107) as well as offer "a level of legitimacy that allows firms to obtain resources that would otherwise have been unavailable" (p. 107)
	HRM capability	Comprises assistance to a management team in the form of (p. 107): • Introducing reward systems • Establishing recruitment, evaluation, and performance policies • Enriching their competencies and resources in the field of remuneration and employment conditions • Providing insights into organizational issues and their implications	VCs can help firms to adopt better HRM practices and align their strategies for an optimized pursuit of their goals.
Luukkonen et al., 2011	Strategy	Forms of value-added include (p. 10): • Business plan • Strategic focus • Capabilities	VCs help portfolio companies to set KPIs, formulate a go-to-market strategy, and develop a long-term growth trajectory.
	Technology position	Forms of value-added include (p. 10): • R&D function improvement • Strong legal IP base • Partnerships for technological development	VCs provide firms with the right resources and contacts to enhance their product development and innovation processes.

Market position	Forms of value-added include (p. 10): • Sales and marketing position • First sales pressure • Accelerate growth pressure	VCs help portfolio companies with their product positioning, pricing strategies, customer discovery and finding a product-market fit.
Professionalization	Forms of value-added include (p. 10): • Cost base control • Corporate governance systems • Change in management team • Finding board members	VCs can recommend the best practices for business conduct and ensure the high quality of business operations.
Financial function	Forms of value-added include (p. 10): • Obtaining non-equity finance • Raising follow-on investments • Attracting new venture capital investors	VCs provide the necessary visibility and connections to secure the next round of investments to help their firms grow further.
Quality	Forms of value-added include (p. 10): • Credibility for other investors • Credibility for customers • Credibility for suppliers and partners • Credibility for recruiting employees	Provides legitimacy to the portfolio company.
Internationalization	Forms of value-added include (p. 10): • Finding marketing and distribution channels abroad • Seeking equity financing abroad • Recruiting management team members abroad	VCs can provide useful knowledge and insights on how to expand and penetrate new markets and successfully establish business processes there.

		• Recruiting other staff members abroad • Looking for international board members	
	Exit orientation	Forms of value-added include (p. 10): • Prepare IPO • Finding acquirers for trade sale • Prepare for other exit routes	VCs can help portfolio companies to increase their attractiveness to potential buyers and make sure to help receive a high return on investment.
Silenius, 2021	Managerial resources	Investment experience	Positive and long-term investment experiences is linked to good reputation of VCs, which has been "observed to increase the value of their portfolio companies during the investment period, leading to better chances to exit successfully and with better results" (p. 20)
		Entrepreneurial experience	VCs can help the companies to accumulate entrepreneurial experience through learning. In turn, previous entrepreneurial experience of founders is likely to help them attract more capital over startups' life cycle, internationalize early, build an effective team, and achieve higher sales and productivity.
		Industry knowledge	VCs are also known for sharing industry-specific knowledge, which can help startups to navigate adversities, exploit business opportunities, and function more efficiently more easily.
	Strategic resources	Investor contacts	Access to investor contacts through VCs network increases the changes of securing follow-up investment opportunities,

		especially the ones that may arise from VC syndication.
	Industry contacts	"The value of direct industry contacts for startups with limited networks is rather self-explanatory; they provide access to potential customers, suppliers and other important actors in the industry" (p. 29) "When VCs take care of attracting potential customers and business partners, the startup can focus on product/service development which ultimately gives them the competitive advantage." (p. 29)
	Contacts to find managers	VCs' contacts may also come in handy to find new capable managers

Sources: Compiled by the author based on Luukkonen and Maunula (2007), Landsgård et al. (2007), Large and Muegge (2008), St-Pierre et al. (2011), Luukkonen et al. (2011), Silenius, (2021)

Appendix B

Definitions of deep tech and deep tech startups by various scholars in chronological order

Source	Definition	Constituent aspects
Chaturvedi, 2014	"Companies that are founded on a scientific discovery or true technological innovation."	1 – Apparent 2 – Apparent 3 – Not Apparent 4 – Not Apparent 5 – Not Apparent
Harlé et al., 2017, p. 2	"Deep tech is different in several ways: it involves a strong research base, a challenging business model, and large investment needs. Given their ambition — and often their complexity — truly disruptive deep technologies can require considerable development time before being brought to market."	1 – Not Apparent 2 – Apparent 3 – Apparent 4 – Not Apparent 5 – Not Apparent
De la Tour et al., 2019, p. 7	"Deep technologies are novel and offer significant advances over technologies currently in use. They require substantial R&D to develop practical business or consumer applications and bring them from the lab to the market. Many of these technologies address big societal and environmental challenges and will likely shape the way we solve some of the most pressing global problems. These technologies have the power to create their own markets or disrupt existing industries. The underlying IP is either hard to reproduce or well protected, so they often have a valuable competitive advantage or barrier to entry."	1 – Apparent 2 – Apparent 3 – Apparent 4 – Apparent 5 – Not Apparent
Siegel & Krishnan, 2020	"Deep Tech (technology that is difficult to develop today, with the potential to become a pervasive and easy-to-implement basic need in the future)" (p. 6) "Deep Tech solutions are reimaginations of fundamental capabilities that are faithful to real and significant problems or opportunities, rather than to one discipline." (p. 8)	1 – Apparent 2 – Not Apparent 3 – Apparent 4 – Apparent 5 – Apparent
Nedayvoda et al., 2020, p. 2	"Deep tech is a term for technologies that are based on scientific or engineering breakthroughs and have the potential to be commercialized. These technologies include artificial intelligence (AI) and machine learning (ML), materials, advanced manufacturing, biotechnology and nanotechnology, drones and robotics, photonics and electronics, cleantech, spacetech, and life sciences. Deep tech companies are research and development (R&D) intensive and multidisciplinary."	1 – Not Apparent 2 – Apparent 3 – Not Apparent 4 – Not Apparent 5 – Apparent
Edström & Klinger, 2020, p. 18	"It is the technology that lies behind end-user facing services and products. It is the next wave of digital disruption	1 – Not Apparent 2 – Not Apparent 3 – Apparent

	fueling the firepower behind existing digital disruptors. As investment in deep tech startups also increases significantly, these startups are using converging technologies to craft real value in large, global, and complex industries that VCs perceive and want a share in profits."	4 – Not Apparent 5 – Apparent
Gebru & Awal, 2021, p. 21	"According to the BCG and Hello Tomorrow, deep tech startups are founded on a scientific discovery or meaningful engineering innovation and are involved in attempting to solve big issues that truly affect the world. Unlike the existing technology startups, deep-tech startups built on scientific and technological innovations aiming at finding solutions to issues with a global impact and resulting in the disruption of existing markets."	1 – Apparent 2 – Apparent 3 – Apparent 4 – Apparent 5 – Not Apparent
Granath, 2021, p. 9 – 10	"Thus in response and out of necessity, a new term has emerged; "deep-tech" or "deep-technology", referring to the more "heavy" kind of innovation, such that are more aligned with radical characteristics. More specifically, such technology is often viewed as of being based on more tangible and scientific discoveries, and deep-tech business are in turn often built upon the idea of using such scientific discoveries or technological innovation(s) to solve "big issues" that can truly have an impact on the world (e.g environmental or societal)."	1 – Apparent 2 – Apparent 3 – Not Apparent 4 – Apparent 5 – Not Apparent
Taupin et al., 2021, p. 1	"According to Bpifrance, the French public investment bank, deeptech start-ups are defined as young and innovative companies pursuing a social or environmental impact and for which technologies come from research results."	1 – Not Apparent 2 – Apparent 3 – Not Apparent 4 – Apparent 5 – Not Apparent
Schuh et al., 2022, p. 4	"Startups with a key physical offering to be manufactured that is based on deep technology, originate in a high-tech or medium-high-tech industry and are driven by the founding team's self-developed knowledge edge in a deep technology."	1 – Apparent 2 – Apparent 3 – Not Apparent 4 – Not Apparent 5 – Not Apparent

Notes. 1 – Focus on developing sophisticated state-of-the-art technological innovations; 2 – Research-intensive and rooted in cutting-edge scientific discoveries; 3 – Capable of jump-starting new markets, disrupting existing industries, and radically transforming business models; 4 – Aimed at solving or lessening critical societal, environmental, and other issues; 5 – Interdisciplinary

Sources: Compiled by the author based on Chaturvedi (2014), De la Tour et al. (2019), Edström and Klinger (2020), Gebru and Awal (2021), Granath (2021), Harlé et al. (2017), Nedayvoda et al. (2020), Schuh et al. (2022), Siegel and Krishnan (2020), Taupin et al. (2021)

Appendix C

Overview of the contacted venture capitalists

VC fund	Name	Job title	Outcome	Contacted via
Superangel	Velio Otsason	Founding Partner	No response	LinkedIn
	Kalev Kaarna	Venture Development Manager	One interview	LinkedIn
	Marko Oolo	General Partner	No response	LinkedIn
	Kaari Kink	Network and Brand Manager	No interview	LinkedIn
Specialist VC	Karina Univer	Investment Manager	No response	LinkedIn
	Riivo Anton	Founding Partner	No response	LinkedIn
	Gerri Kodres	Founding Partner	No response	Email
Karma VC	Linda Võeras	Associate & Early-Stage Deep Tech Investor	One interview	LinkedIn
	Marili Merendi	Principal	No response	LinkedIn
Nordic Ninja	Rainer Sternfield	Managing Partner	No response	LinkedIn
	Marek Kiisa	Managing Partner	No response	LinkedIn
Tera Ventures	Andrus Oks	Founding Partner	No response	LinkedIn
	Stanislav Ivanov	Founding Partner	No response	LinkedIn
	Kristi Kurvits	Associate	No response	LinkedIn
Change Ventures	Yrjö Ojasaar	Investment Partner	One interview	LinkedIn
	Kärt Siilats	Investment Partner	No response	LinkedIn
	Kärt Rääbis	Associate & Community Manager	No interview	LinkedIn
Siena Secondary Fund	Rando Rannus	General Partner	No response	LinkedIn
	Lauri Isotamm	Founding Partner	No response	LinkedIn
	Rain Tamm	Founding Partner	No response	LinkedIn
Inventure	Tuomas Kosonen	Partner	No response	LinkedIn
	Lauri Kokkila	Partner	One interview	LinkedIn
Metaplanet Holdings	Rauno Miljand	Managing Partner	No response	LinkedIn
Iron Wolf Capital	Kasparas Jurgelionis	Managing Partner	No response	LinkedIn
Superhero Capital	Ivo Remmelg	Venture Partner	One interview	Email
Voima Ventures	Veera Pietikäinen	Investment Analyst	No interview	LinkedIn

	Inka Mero	Founder & Managing Partner	No response	LinkedIn
Butterfly Ventures	Anti Kodar	Venture Partner	No response	LinkedIn
	Tanya Marvin-Horowitz	Partner	No response	LinkedIn
Maki VC	Pauliina Martikainen	Investment Director	No response	LinkedIn
	Thomas Bacon	Investment Analyst	No response	LinkedIn
DEPO ventures	Sebastian Sulma	Analyst & Venture Scout	One interview	LinkedIn
	Eliška Vamosova	Head of Marketing & PR	No response	LinkedIn

Sources: Compiled by the author

Appendix D

Interview questions for the VCs with an experience of working with Estonian deep tech startups:

1. What constitutes the non-financial contribution (NFC) of venture capital (VC) in your understanding? Could you please give a short explanation of what you understand by the term “non-financial contribution of venture capital”, also known as “non-financial value-added”, “non-financial resources, and “non-financial support”?

2. What non-financial support Estonian deep tech startups are mostly seeking to receive?

3. How different is your approach to providing NFC as a venture capitalist when supporting deep tech startups compared to other portfolio companies?

4. Are there any essential NFCs missing from the proposed model? And what NFCs, which are specifically relevant for Estonian deep tech startups, are missing from the suggested typology?

5. Are there some NFCs of VC included in the model as a part of a general international practice, which are not common in the case of deep tech startups in Estonia? Or does the model, on the contrary, include NFCs that are relatively unimportant for startups?

6. What are the most fundamental NFCs of VC for Estonian deep tech startups? Which ones are especially significant when it comes to growth performance?

7. What are the most crucial NFCs of VC for deep tech startups in their nascent stage? And does a priority given to particular NFCs shifts as the deep tech startup matures?

8. Would you say that a need for certain NFCs varies among deep tech startups of different technological fields and specializations?

9. Would you say that the NFC of VC generally plays a vital role in the growth of deep tech startups? Is non-financial support always necessary for deep tech startups to thrive or are there any cases when the financial support alone would suffice?

10. What actions are needed to be undertaken to facilitate further the development of the deep tech startup ecosystem in Estonia, and what role non-financial support from VCs is playing in contributing to the progress?

Appendix E

Interview questions for the Estonian experts in deep tech startups:

1. What are the distinctive characteristics of deep tech startups? Could you please give a definition and interpret the term “deep tech startup”?

2. What are the most common struggles of deep tech startups in the Estonian startup ecosystem?

3. What non-financial support Estonian deep tech startups are mostly seeking to receive?

4. Do you think deep tech startups take advantage of all the non-financial support services presented in the model? Which of the NFCs are utilized more often than others?

5. Are there any essential NFCs missing from the model? And what NFCs, which are specifically relevant for Estonian deep tech startups, are missing from the suggested typology?

6. What are the most fundamental NFCs of VC for Estonian deep tech startups? Which ones are especially significant when it comes to growth performance?

7. What are the most crucial NFCs of VC for deep tech startups in their nascent stage? And does a priority given to particular NFCs shifts as the deep tech startup matures?

8. Would you say that a need for certain NFCs varies among deep tech startups of different technological fields and specializations?

9. Would you say that the NFCs of VC generally plays a vital role in the growth of deep tech startups? Is non-financial support always necessary for deep tech startups to thrive or are there any cases when the financial support alone would suffice?

10. What actions are needed to be undertaken to facilitate further the development of the deep tech startup ecosystem in Estonia, and what role non-financial support from VCs is playing in contributing to the progress?

Resümee

Riskikapitali mitterahalise panuse roll Eesti süvatehnoloogia startupide kasvus

Merey Beisembayev

Käesolevas töös käsitleti riskikapitali mitterahalise panuse rolli Eesti süvatehnoloogia idufirmade kasvu edendamisel. Kuigi lisandunud mitterahalise väärtuse positiivset mõju ei olnud võimalik uuringu raames kvantifitseerida, näitavad selle uuringu tulemused, et riskikapitali mitterahaline panus mängib olulist rolli Eesti süvatehnoloogia idufirmade kasvu edendamisel.

Käesoleva töö tulemused annavad mitmeid märkimisväärseid panuseid riskikapitali ja süvatehnoloogiliste idufirmade mitterahalise panuse, eelkõige Eesti startup-ökosüsteemi käsitleva kirjanduse lisanduvasse kogusse. Teoreetiline käsitlus annab uue arusaama riskikapitali mitterahalisest panusest, uurides põhjalikult värskemaid akadeemilisi tulemusi, tuues välja mitterhalise panuse kuus erinevat tüpoloogiat ja nende komponendid, mis oma olemuselt ei ole rahalist väärtust lisavad teenused. Kirjandusülevaate tulemuste põhjal koostati riskikapitali mitterahalise panuse defineeritud ja täiustatud terviklik kategoriseerimismudel, mis võib olla aluseks tulevastele uuringutele.

Teoreetilise analüüsi teises osas vaadeldi süvatehnoloogia idufirmade kontseptsiooni, nende põhiomadusi ja kasvuprobleeme. Selle tulmusel pakuti välja mõiste integreeritud definitsioon, mis põhineb kümne fragmentaarse mõiste tõlgendamisel. Töö teoreetilises analüüsis võeti kokku peamised faktid Eesti startup-ökosüsteemi kohta ning anti ülevaade Eesti areneva süvatehnoloogiamaastiku kohta.

Käesoleva uuringu empiiriline analüüs võimaldas autoril tutvuda riskikapitali mitterahalise panuse kontseptsiooniga, kontrollida süvatehnoloogia idufirmade väljapakutud definitsiooni ja nende peamisi väljakutseid Eesti kontekstis ning hinnata ja revideerida riskikapitali mitterahalise panuse kategoriseerimismudelit intervjuude läbiviimisel kuue Eesti süvatehnoloogia idufirmadesse investeerimise kogemusega riskikapitalisti ja kahe Eesti süvatehnoloogia eksperdiga. Empiirilise analüüsi tulemused näitavad, et riskikapitalistide pakutav oluline mitterahaline lisandväärtus hõlmab abi jätkuinvesteeringute tagamisel, talentide värbamisel ja palkamisel, asutajate emotsionaalsel toetamisel, turuteadmiste ja tööstuse teadmiste jagamisel, turustrateegia sõnastamisel ning ärimudeli loomisel, intellektuaalomandi portfelli loomisel ja kaitsmisel.

Empiiriline analüüs heidab valgust ka praktilistele soovitustele süvatehnoloogilise startup-ökosüsteemi arengu soodustamiseks Eestis. Lühidalt, peamised ettepanekud keskenduvad tihedamate suhete loomisele süvatehnoloogia idufirmade, investorite ja ülikoolide vahel ökosüsteemis, teadusmahukate ettevõtete kapitali kättesaadavuse parandamisele, Eesti sügavamale integreerimisele riskikapitalistide, süvatehnoloogia idufirmade, teenusepakkujate ja klientide rahvusvahelisse areeni.

Märksõnad: riskikapital, riskikapitali mitterahaline panus, süvatehnoloogia start-upid, Eesti startup ökosüsteem.

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