

THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Early Development of New Technology-Based Firms

How Internal and External Resource Dimensions
Impact and Structure the Firm

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Early Development of New Technology-Based Firms:
How Internal and External Resource Dimensions Impact and Structure the Firm
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Abstract

How do founders' and firms' business environment impact the early development of new technology-based firms (NTBFs)? In order to answer this question, this thesis explores how internal and external resource dimensions impact and structure the early development of NTBFs.

NTBFs are known for their technological innovation and their abilities to boost economic growth and development. These new, young firms are vulnerable in their first years of development, and their development is dependent on resources related to the founders and external business environment. Impacts from these internal and external resource dimensions provide means for firms to develop. Explaining how these dimensions together influence the early development of NTBFs would broaden the perspective on these firms in their first years, clarifying the type of support required for these firms.

Examining NTBFs both qualitatively and quantitatively, the thesis analysed the structuring of the early development and the impacts on it, including business- and innovation performance, and initial business models. Findings reveal that the early development is affected by internal resource dimensions, such as founders' previous business experiences and relationships within their business environment, and by external resource dimensions such as the type of business networks and firm localisation. However, impacts from these internal or external resource dimensions differ over time depending on founders' experiences, maturity, and self-trust, and hence one dimension or the other dominates the early development.

The thesis contributes to the research on NTBFs and entrepreneurship, describing and analysing imprinting effects of the aforementioned dimensions, such as founders' attitudes, on the firms' early development. It also discussed how the external business environment becomes less influential on the firms' development as the founders rely more on own decisions to do business.

Keywords: new technology-based firm, early development, internal resources, external resources, founder, business environment, business model, performance

List of appended papers

This thesis is based on the work contained in the following papers:

Paper 1:

Rydehell, H., and Isaksson, A. (2016). Initial configurations and business models in new technology-based firms. *Journal of Business Models*, 4(1), 63–83. doi.org/10.5278/ojs.jbm.v4i1.1241

Paper 2:

Rydehell, H., Isaksson, A., and Löfsten, H. (2019). Effects of internal and external resource dimensions on the business performance of new technology-based firms. *International Journal of Innovation Management*, 23(1), 1–29. doi.org/10.1142/S1363919619500014

Paper 3:

Rydehell, H., Isaksson, A., and Löfsten, H. (2019). Business networks and localization effects for new Swedish technology-based firms' innovation performance. *The Journal of Technology Transfer*, 44(5), 1547–1576. doi.org/10.1007/s10961-018-9668-2

Paper 4:

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Rydehell, H., and Isaksson, A. (2015). Perceptions of initial business models in new technology-based firms. *RENT XXIX – Research in Entrepreneurship and Small Business*, 18-20 November, Zagreb, Croatia.

Rannikko, H., Tornikoski, E., Isaksson, A., Löfsten, H., and Rydehell, H. (2018). Empirical exploration of a cohort of new technology-based firms in Sweden: What happens to them during their early years? In Hytti, U., Blackburn, R., and Tegtmeier (eds.), *The Dynamics of Entrepreneurial Contexts: Frontiers in European Entrepreneurship Research*. Edward Elgar Publishing, Cheltenham, chapter 9, 166–211.

Rydehell, H., Isaksson, A., and Löfsten, H. (2019). Human capital, external relations, and early performance of new technology-based firms. In Laveren, E., Blackburn, R., Hytti, U., and Landström, H. (eds.), *Rigour and Relevance in Research, Resources, and Outcomes: Frontiers in European Entrepreneurship Research*. Edward Elgar Publishing, Cheltenham.

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1 Introduction

This thesis addresses issues pertaining to new technology-based firms and their early development. The first chapter introduces the importance, characteristics, and definition of new technology-based firms and provides a short explanation of characteristics of their early development. This is followed by problem discussion and the purpose of the thesis. The concluding part presents an outline on the rest of the thesis.

1.1 New technology-based firms

Owing to their significant impact on an economy's long-term development, new technology-based firms (henceforth NTBFs) have received attention from researchers and policymakers (Storey and Tether, 1998; Spencer and Kirchoff, 2006). An increased focus on NTBFs has highlighted the need to develop new firms based on technology that will support employment and regional development. Besides these incentives, NTBFs can contribute to an economy through exports, research and development, knowledge spillover, and innovation (e.g. Bollinger et al., 1983; Autio and Yli-Renko, 1998; Almus and Nerlinger, 1999; Brinckmann et al., 2011; Xiao, 2014; Arantes et al., 2019). These firms can also be seen as drivers and sources of technology transfer and dissemination (Jones-Evans and Klofsten, 1997; Autio and Yli-Renko, 1998; Kollmer and Dowling, 2004; Saemundsson and Candi, 2014). As stated by Rickne and Jacobsson (1999), "*A nation needs to have firms with the ability to innovate and diversify into new technologies, products and industries*" (p.216). The authors analysed the contribution of NTBFs to the process of industrial renewal in Sweden and discussed the early conceptualisation and operationalisation of the phenomenon NTBFs. Although 20 years have passed since this study, NTBFs continue to play an important role in developing new technologies outside the corporate agenda of established firms and in assisting established firms with new technology development (and products and services) (Spencer and Kirchoff, 2006; Arantes et al., 2019). For example, NTBFs enable and support industries to innovate and devise new technologies and ways of doing business in response to the new digitalisation trends. However, their early development lay prerequisites for future outcomes.

1.1.1 Characteristics of NTBFs

It is important to note that NTBFs have disadvantages as other new firms, such as they lack legitimacy and are considered riskier as they are based on the exploitation of new concepts in the market (Penrose, 1959; Bhide, 2000; Brinckmann et al., 2011). Stinchcombe (1965) called this the 'liability of newness'. This vulnerability is no exception related to only NTBFs.

However, NTBFs are praised for their innovativeness¹ despite their vulnerability (Fudickar and Hottenrott, 2019).

As a group, NTBFs are not homogenous (Jones-Evans, 1995; Heydebreck et al., 2000), yet certain characteristics have been argued to interlink NTBFs. For example, NTBFs have been characterised as new entrepreneurial firms and spin-offs from technical universities and corporations (Autio and Yli-Renko, 1998; Löfsten and Lindelöf, 2002, 2005), and therefore these firms often closely interact with universities. Thus, these firms benefit from the knowledge spillover from universities (Audretsch and Lehmann, 2005; Audretsch et al., 2005; Fudickar and Hottenrott, 2019).

Moreover, employees and founders of the NTBFs are usually highly educated and possess technological know-how, as per studies on NTBFs located both on and off science parks (Klofsten and Jones-Evans, 2000; Löfsten and Lindelöf, 2002, 2005). Highly educated employees play an effective role in developing and establishing production facility (Brinckmann et al., 2011) and in capturing requisite knowledge for the development of the firm's technology (and their products or services). However, NTBFs lack other resources, such as financial resources (Kollmer and Dowling, 2004), which are important to enable NTBFs to establish a market position when competing with established firms. Furthermore, these firms also experience difficulties owing to problems attracting venture capital; small employee size; and a lack of organisational assets, intellectual property, and market awareness (e.g., Bollinger et al., 1983; Westhead and Storey, 1997; Storey and Tether, 1998; Eisenhardt and Schoonhoven, 1990; Clarysse et al., 2011; Brinckmann et al., 2011). Research has also argued that NTBFs differ from other small firms in terms of their focus on advanced technology (e.g., Bollinger et al., 1983; Westhead and Storey, 1997), which provides them with a short window of opportunity (Westhead and Storey, 1997; Storey and Tether, 1998; Virasa, 2007).

1.1.2 Definition of NTBFs

Characteristics of NTBFs provide some indication of what distinguishes NTBFs from other new firms. This leads to the question of how we can define NTBFs. There are different views about NTBFs, especially regarding what is 'new' and what is 'technology-based'. This lack of a mutual understanding has created problems in the empirical application (Arantes et al., 2019; Mathisen and Rasmussen, 2019).

¹ It refers to the ability of the firm to create something different with their product/service or business activities when compared to other firms.

In an earlier definition, Little (1979) defines NTBF as an independently owned firm not older than 25 years and based on technological innovation, which implies that the firm has substantial technological risks over other (new) firms. However, the distinctions between what is ‘new’ and what is ‘technology-based’ is still unclear.

‘New’ can either refer to the age of the firm—a young newly established firm—or it can refer to the newness of the technology in the market, implying innovativeness (Storey and Tether, 1998; Rickne and Jacobsson, 1999; Norrman, 2008). In this thesis, the former is connected to the focus of early development, since it indicates the early stage of the firm and conveys that the ideas and the firm itself are young, undeveloped, and characterised by vulnerability. According to this, 25-year-old firms are not considered new, and hence studying firms of that age may not help us understand their early development. Hence, a considerable amount of research has been conducted on NTBFs that are around 3 to 10 years old (see e.g., Löfsten and Lindelöf, 2002, 2003; Kolmer and Dowling, 2004; Gao et al., 2010; Ganotakis, 2012; Löfsten, 2015; Fudickar and Hottenrott, 2019).

‘Technology-based’ refers to a focus on the technology of the product or service and on facilitating development for the commercialisation of this technology, including sectors viewed as technology-intensive (Storey and Tether, 1998). Nevertheless, technology-based can also include scientific spin-offs that are knowledge-based (e.g., Löfsten and Lindelöf, 2002). It is not restricted to high-technology, such as manufacturing technology, because NTBFs also exploit technological know-how based on human capital (knowledge) (Autio and Yli-Renko, 1998). Thus, technology-based also refers to knowledge-intensive sectors (Torrecilla García et al., 2015; Fudickar and Hottenrott, 2019). Accordingly, to distinguish what is high-technology and low-technology-based industries, extant research focused on firms within technology- and/or knowledge-intensive industries, such as biotechnology, information and communication technology (ICT) and computer science, or high-tech manufacturing industry (e.g. Colombo and Delmastro, 2001; Colombo and Grilli, 2005; Maine et al., 2010; Bertoni et al., 2011; Löfsten, 2015; Torrecilla García et al., 2015).

The competitive edge of NTBFs, which are new by age and operate within technology- and knowledge-intensive industries, depends on the know-how of its founder (Cooper and Bruno, 1977; Norrman, 2008), although several resources are needed for the development of the firms. In the case of NTBFs, such know-how not only relates to engineering but also to natural science and medicine (Rickne and Jacobsson, 1999). Accordingly, to understand the development of NTBFs, these firms are defined based on Rickne and Jacobsson’s (1999: 203) extended

definition of Klofsten (1994). As per the authors, NTBF is *‘a firm whose strength and competitive edge derives from the know-how within natural science, engineering or medicine of the people who are integral to the firm, and upon the subsequent transformation of this know-how into products or services for a market’*.

1.2 Early development of NTBFs

NTBFs are young firms by age, which indicates that they are in an early stage of development. While this stage can be defined in different ways, the process of early development has been argued to be a process that *‘roughly begins with the idea for a business and culminates when the products or services based upon it are sold to customers in the market’* (Bhave, 1994: 224). Due to the heterogeneous characteristics of NTBFs, development timespans may vary considerably depending on the industry and the prerequisites for technology launch (Klofsten, 1994, 2005; Rizzo et al., 2013), it might be more relevant to regard individual characteristics such as the degree of business maturity when outlining the process of development (Norman, 2008). In this context, early development begins *‘with the realisation of the idea whereby one or more founders take concrete action to set up a commercial enterprise’*. (Klofsten, 1997: 149). This process is established when the firm institutes a business platform model² to initiate independent operations, including the commercialisation of products or services (e.g., Klofsten, 2005).

Moreover, a substantial amount of research on the early development of NTBFs, has focused on the performance of these firms, especially what may impact their growth (e.g., Lindholm-Dahlstrand, 1997; Almus and Nerlinger, 1999; Lindström and Olofsson, 2001; Löfsten and Lindelöf, 2002, 2003; Brinckmann et al., 2011; Clarysse et al., 2011). Several quantitative studies presented measures of performance focused on sales growth, employment growth, and number of firms left in the market after some years (e.g., Lindelöf and Löfsten, 2002; Siegel et al., 2003; Ferguson and Olofsson, 2004; Brinckmann et al., 2011; Rannikko et al., 2019). Additionally, owing to the innovative orientation of these technology-based firms and their ability to exploit new concepts in the market, extant research has focused on their innovation performance in terms of patents or R&D expenditures (Löfsten and Lindelöf, 2005; Colombo et al., 2006; Börjesson and Löfsten, 2012; Löfsten, 2015; Löfsten, 2016b).

² According to Klofsten (2010:12) the business platform is *‘the first, very important step towards a stable, growing firm’*. This platform model consists of eight cornerstones that make up a business. This thesis uses the concept of business model to understand the early development of NTBFs, which is described in detail in Chapters 2 and 3.

In relation to growth, the survival of NTBFs has been another focus area in research (Löfsten, 2016a; Rannikko et al., 2019). The survival rate of NTBFs has differed, and many studies have argued that few (between 30 and 50 percent) of these firms survived in their first years (Geroski et al., 2010). However, Ejermo and Xiao (2014) studied Swedish NTBFs and found that the chances of survival was higher for NTBFs than for other new firms; however, NTBFs were more sensitive to recessions during the early stage. Further, a more recent study on NTBFs in Sweden by Rannikko et al. (2019) showed that as many as 70 percent of NTBFs founded in 2006 operated in the market in 2014. The authors also found that a negligible fraction of NTBFs experience high growth (sales and employment) in their first 7 years. This finding adds to research on Swedish NTBFs, spun from universities, demonstrating that these firms often experience limited growth and stay small (Löwegren and Bengtsson, 2010).

Moreover, research has linked survival and growth with firms' initial resources and local (external) dimensions (e.g., Almus and Nerlinger, 1999; Aspelund et al., 2005; Clarysse et al., 2011). This implies that several resource dimensions—both internal and external—enable NTBFs to gain a competitive advantage with their technology, which is critical to their survival and growth.

From a resource-based view on NTBFs, internal resources related to the founders' experiences and knowledge create a basis for developing the firm and improving its chances of gaining a competitive advantage (e.g., Autio and Yli-Renko, 1998; Alvarez and Busenitz, 2001). Particularly, it is essential to examine the role of the founder to understand the early development of NTBFs (e.g., Aaboen et al., 2006; Torrecilla García et al., 2015). This is because, in the case of NTBFs (as well as other new firms), the individual founder, owner and CEO are often the same person (Aaboen et al., 2006). Since the firm's behaviour reflects the founder's behaviour and decisions, the firm depends on the founder's personality and abilities (O'Shea et al., 2004), which includes the (internal) resources possessed during the early stage of development. Additionally, the founder's skill, experiences, and relationships enable the founder to recognise and develop business ideas, and the founder has a high-level of drive and engagement in the firms (Klofsten, 1994, 2005). These attributes make the role of founders crucial to the firm. Founders' growth strategies and ambitions are, for example, internal dimensions that can explain NTBFs' early development (e.g., Feeser and Willard, 1990; Autere and Autio, 2000; Saemundsson, 2003; Rydehell et al., 2019); these individual characteristics of founders can impact and imprint the structure of the business and, eventually, its performance (Gao et al., 2010).

Nevertheless, it also becomes important to obtain certain resources from the surrounding business environment, which are external to the firm. These external resources (often sector-based) provide the means to develop and compete in the market and can be possessed based on the founders' external networks (De Massis et al., 2018).

Moreover, the different industry sectors (in which NTBFs operate) exert varying imprinting effects on the firms' development (e.g., Boeker, 1988, 1989; Clarysse et al., 2011; Simsek et al., 2015). This variance can be explained by the availability of resources in different industries and different resource needs of NTBFs. For example, Colombo and Delmastro (2001) demonstrated differences in education and previous work experiences of founders in different industry sectors. They compared the information and communications technology (ICT) manufacturing and Internet-based industries and found that IT firms have lower human capital. This can be explained by the fact that emerging markets (i.e., IT as new paradigm) make previous knowledge and experiences obsolete, and that barriers to entry in Internet-based industries are lower than that in other manufacturing industries. Ejermo and Xiao (2014) further argued that financial capital requirements (investments) may differ between NTBFs in different industry sectors as some firms need only a computer, whereas others require larger production assets.

Depending on resource needs of and entry barriers to different industries, founders of NTBFs may need to seek different types of alliances and build business networks to acquire lacking resources (e.g., Yli-Renko et al., 2001a; Rydehell et al., 2019). Business networks can further support the firms' legitimisation (Elfring and Hulsink 2003), opportunity recognition (Ardichvili et al., 2003; Hoang and Antoncic, 2003), and facilitate first sales (Baron, 2007). Nevertheless, the business environment and founders' networks may not only support NTBFs but can also constrain their development in order to ensure that the NTBFs conform to the boundaries of the industry sector in which they operate (e.g., Amit and Zott, 2015; Reymen et al., 2015). Thus, the business environment may impact the firms' early development in different ways. Hence, the founder and his or her operating context are crucial to gaining an understanding of NTBFs' early development.

1.3 Problem discussion and purpose

As previously mentioned, NTBFs play an important role in meeting the emerging demands of new technology and innovation, and they are important for economic development. Research on these firms connect to the literature on entrepreneurship and new firm creation and growth, where NTBFs constitute a special case of new firms.

The entrepreneurship literature focuses on the founder (the entrepreneur) to explain the development of new firms. This aspect has been examined as the decisions of the founder reflect the firm's behaviour, especially in regard to the human capital and the relationships they introduce for firm's development (e.g., Davidsson and Honig, 2003; Baron, 2007). Except the internal resource dimensions of the firm (related to the founder), the external factors have been emphasised for their impact on the entrepreneur and the firm (Eisenhardt and Schoonhoven, 1990; Edelman and Yli-Renko, 2010; Brinckmann and Hoegl, 2011; Clarysse et al., 2011). Thus, both internal and external resources' dimensions must be recognised as important (Kellermanns et al., 2016) in order to understand how different resources combined can enhance NTBFs' development (and competitive advantage).

However, regarding NTBFs, the aforementioned dimensions have previously been studied separately. It shows that extant research on NTBFs has not properly connected these (internal and external) resource dimensions, and, unlike the entrepreneurship literature, the founder and the effects of the environment on him/her are less emphasised in research on NTBFs³. A lack of emphasis on this aspect diverts attention from the primary decision-maker of the firm. The founder of the NTBFs is the one making decisions about what direction the firm will take, how the firm will focus towards growth, and how the firm will do business. The founder brings knowledge, expertise, and relationships (networks) to the firm (Klofsten, 1994; Simsek et al., 2015; Billström, 2018); the founder is also responsible for the operations and decisions made, for example, to structure different business activities. These attributes make the founder crucial to the firm. However, most of the research conducted on NTBFs focus either on the external effects (including business networks and localisation effects for NTBFs in science parks or incubators) or the internal dimensions (e.g., human capital resources). Additionally, empirical studies often present contradictory and mixed findings, such as different effects of founder's human capital on NTBFs' performance (see e.g., Colombo and Grilli, 2005; West and Noel, 2009). This narrows the understanding of the early development of the firm. There is a need to

³ Certain studies emphasise the role of the founder in the development process, such as Klofsten (1994, 2005)

conduct research on resources acquired externally by NTBFs, especially research on the role of the founder (Saemundsson and Candi, 2017).

Research has further demonstrated that a firm's prospects for development are affected by resources available during the firm's founding and by the founder's decisions (e.g., Boeker, 1989; Bamford et al. 2000; Aspelund et al. 2005; Gao et al., 2010; Geroski et al., 2010). However, less is known about the impact of different resource dimensions on firm's early development and business activities, which, in turn, structure firm's foundation and affect its prospects for growth and survival. Especially, our knowledge concerning the early development of NTBFs and how different resource dimensions impact the firms is far from complete. The majority of the research discuss NTBFs between 3 and 10 years, leaving a knowledge gap on the early stage of development when firms are newly established (i.e., the first 1 to 3 years). Especially, nowadays with digitalisation accelerating the development of the majority of NTBFs, research on these initial years can explain future outcomes (e.g., performance).

In the aforementioned, a better understanding of the internal and external resource dimensions associated with the early stage of NTBFs would clarify the impacts of the early development of NTBFs and how the firms will be structured to innovate and perform in future. Therefore, the **purpose** of this thesis is **to explore how internal and external resource dimensions impact and structure the early development of NTBFs**.

1.4 Outline of thesis

This doctoral thesis is a compilation thesis, comprising an extended summary and five appended papers. The thesis starts with Chapter 1. It introduces the research background and generates problem statement that the thesis aims to answer. Chapter 2 presents a literature review of the research referred to in this thesis; it concludes with a discussion of the research questions. Chapter 3 presents the methodology and describes how the studies in the thesis were planned and performed, including limitations of the chosen methods. Chapter 4 presents a brief summary of each of the appended papers. This is followed by a discussion of the core insights and conclusions related to the research questions in Chapter 5. The thesis is finalised in Chapter 6; it summarises the main conclusions, contributions to and implications for research and practice, and suggestions for future research on NTBFs.

2 Frame of reference

This chapter presents an overview of research on new firm development in order to provide knowledge on the development of NTBFs sharing similar features. This is followed by an overview of the resource-based view in relation to entrepreneurship. Subsequently, the chapter presents an overview of research on the internal and external resources' dimensions that contribute to NTBFs' early development. The chapter ends with three research questions connected to the purpose of this thesis.

2.1 Development of new firms

Several classical studies have focused on gaining an understanding of development in new firms (e.g., Penrose, 1959; Cyert and March, 1963; Stinchcombe, 1965; Gartner, 1985); these studies have laid the foundation for emerging entrepreneurship research. The development of new firms has been studied from several firm aspects (Rothaermel et al., 2007) and has been outlined as a process that can either be represented stage-wise (e.g., Kazanjian, 1988; Clarysse and Moray, 2004) or as a complex, heterogeneous process (Rizzo et al., 2013).

Researching early development of new firms⁴, extant research has also emphasised the individual (i.e., the entrepreneur/founder) in terms of the behaviour and decisions of the individual in the initial years. These studies also focused on how firms utilise their internal resources in the initial years and how the founders are influenced by the firms' external environment. Research showed that previous experiences of the founder and the environmental background impact the firm's (strategic) direction, in other words these dimensions will have an imprinting effect on the founder's (entrepreneur's) decisions' (Boeker, 1988, 1989; Bamford et al., 2000; Mathias et al., 2015). Moreover, Gartner (1985) explained that the early development of a firm not only depends on the founder but also on the organisation (kind of firm and its strategic orientation), its environment (industry and networks), and the business process (actions undertaken by the founder). Other studies have also emphasised the founder (entrepreneur) in relation to the business environment, network, and resources (e.g., Bhave, 1994; Klofsten, 1994, 2005; Kirkley, 2016). In their comprehensive literature review of university entrepreneurship, Rothaermel et al. (2007) demonstrated how several themes of research about new firm creation explain different key aspects of new firm development. These

⁴ It must be noted that NTBFs represent a special case of new firms. However, this section discusses research on the early development of firms like NTBFs. Therefore, the phrase 'new firms' is used in this section. However, similar features of early development can also be assumed to exist in the case of NTBFs.

include the founder's and founding team's experiences, founder's social capital, networks, the strength of the ties, and external conditions.

Although firms' early development process depends on the interactions between the founder and his/her environment, in the early stage of development, founders' behaviour and decision-making are also influenced by their perceptions and intentions (Williams Middleton, 2010; Edelman and Yli-Renko, 2010; Kirkely, 2016). In other words, founders' prior knowledge, experience, and skill influence their perceptions and decisions (Gavetti and Levinthal, 2000; Sarasvathy, 2001; Baron, 2007; Neill et al., 2017). Additionally, through its impact on cognition, founders' daily experiences further influence decision-making both positively and negatively (Baron, 2007). For example, founders' positive experiences have been found to enhance their tendency to expect positive outcomes, and thus increase optimistic bias. It has also been found to simplify and enhance strategic decisions in uncertain conditions (e.g., Busenitz and Barney, 1997; Baron, 2007). Entrepreneurs use heuristics and beliefs to understand the environment and their situations, which Gavetti and Levinthal (2000) called a 'forward-looking' approach. Additionally, Sarasvathy (2001, 2009) demonstrated how expert entrepreneurs with more prior knowledge and experiences use effectual reasoning for decision-making in uncertain situations. This effectual logic is based on five principles— the use of available resources (related to prior knowledge and experiences), minimisation of losses, and cooperation with pre-committed partners. The latter is further related to the business environment, which, in turn, impacts the founder(s) of the firm. Research have demonstrated the effect of environment on new firms' development and founders' decision-making (Boeker, 1988; Mathias et al., 2015), and decisions implemented during the early development of the firm are expected to influence operations and, ultimately, the firm's prospects (Boeker, 1989; Eisenhardt and Schoonhoven, 1990).

The aforementioned studies show that the development of new firms is influenced by the behaviour, perceptions, and intentions of the founder as well as the operating environment, implying a relationship between the firm and environment.

2.2 Resources and new firms

NTBFs need different resources for development. The bundling of these resources create value for the firm, and thereby influence the new firm's development. The resource-based view (RBV) deals with how firms' resources provide the basis for competitive advantage (e.g., Wernerfelt, 1984; Barney, 1991); these resources comprise internal rather than external

resources that are tangible and intangible (Barney, 1991). To achieve competitive advantage, RBV states that resources must be heterogeneous, immobile, valuable, rare, costly to imitate, and non-substitutable (Barney, 1991; Peteraf, 1993). According to Barney (1991), there are three categories of heterogeneous resources that can provide a basis for competitive advantage: physical capital (plant and equipment), human capital (skills and expertise), and organisational capital resources. For new firms, human capital, such as experiences and knowledge, play a significant role in the early development as they rely on the founder in this period (De Massis et al., 2018). Combining RBV and entrepreneurship, innovative outcomes, such as NTBFs' technologies, requires firms to create new ways to bundle resources (Alvarez and Busenitz, 2001; De Massis et al., 2018). This would include utilising founders' experiences and abilities to recognise and exploit new opportunities (Alvarez and Busenitz, 2001). Accordingly, the RBV is relevant for NTBFs because their activities are based on the exploitation of technological knowledge, and considerable fraction of this knowledge exists in the form of human capital (e.g., Autio and Yli-Renko, 1998). Moreover, for NTBFs, initial internal resources are antecedents of their survival as these resources set up the founding conditions and exert an imprinting effect on the firms (Aspelund et al., 2005).

Although the traditional RBV focuses on the internal resources of a firm, research has recognised the importance of extending the view, by adding firm relationships (Dyer and Singh, 1998) and network resource endowments (Gulati, 1999), for enhancing firms' competitive advantage. This has led to the extension of RBV to include external resources (e.g., Mathews, 2003; Arya and Lin, 2007; Clarysse et al. 2011).

New firms lack the resources needed to develop their businesses (Bhide, 2000; Aspelund et al., 2005). Hence, they must collaborate with other firms to gain access to vital resources. An extended RBV should consider collaboration outcomes (Arya and Lin, 2007). Moreover, it is not necessary for founders to be in control of all resources, but they can have access to others' resources that can provide them with the likely competitive advantage (Das and Teng, 2000; Kellermanns et al., 2016). Accordingly, an extended RBV provides a notion of firms being able to link to other firms in value-chains and utilise a wide range of external resources through their relations (Mathews, 2003). In that sense, resources generated from the interplay between firms in their business environment provide them with the competitive advantage that can contribute to their growth over time (Clarysse et al., 2011).

Considering a (extended) RBV, the resource base (internal and external) of NTBFs will impact their early development both in terms of how founders decide to set up their businesses by using

their experiences and knowledge as well as how they will perform initially depending on their relationship with other firms.

2.3 Internal resources of NTBFs

In the early stage of development, NTBFs are resource constrained (e.g., Yli-Renko et al., 2001a; Kollmer and Dowling, 2004; Aspelund et al., 2005), and extant research has studied how these firms can overcome this obstacle. Small firms, including NTBFs, possess some bundles of resources in the early development of which those related to the founder are most apparent, and these resources, such as human and social capital, help founders to exploit opportunities in the market (e.g., Alvarez and Busenitz, 2001). Especially, studies show that the founders play a central role in the development and structuring of the new firm's trajectory (e.g., Edelman and Yli-Renko, 2010). Human capital involves prior knowledge and experiences related to previous work, education, and start-up experiences (Colombo and Grilli, 2005; Brinckmann et al., 2011), and such knowledge and experiences can enhance founders' abilities to perceive opportunities (Ardichvili et al., 2003; Davidsson and Honig, 2003; Camisón-Haba et al., 2019). This because the cognitive abilities would increase with higher human capital, which can help firms to adapt to new situations and, in turn, prove to be critical for firm performance (Weick, 1996).

As an internal resource dimension of NTBFs, founders' previous business experiences have been demonstrated to have effect on firm development (e.g., Colombo and Grilli, 2005; Ejermo and Xiao, 2014; Löfsten, 2016a). Clarysse et al. (2011) demonstrated that firms with higher levels of human capital (know-how and entrepreneurial experiences) have more profitable and organic growth paths. Founders or founding teams with higher levels of formal business education and business experiences (work experience in the same industry) also exhibit better performance in terms of employment growth (Ganotakis et al., 2012). The 'right' competences and an enhanced business experience can further help founders to recognise opportunities in the market and attract financial capital, which is often lacking but necessary to enhance NTBFs' growth (e.g., Colombo and Grilli, 2010; Brinckmann et al., 2011). However, owing to hurdles in attracting financial capital in the early development, NTBFs are not often growth-oriented (Autio and Yli-Renko, 1998; Autere and Autio, 2000). Nevertheless, Aaboen et al. (2006) found that the founders' motivation to grow can help them raise funding. Additionally, they showed that NTBFs that seek higher growth are more likely to be successful. Saemundsson (2003) studied growth intention and found that NTBFs' growth-orientation can change as a result of a

change in firm ownership. Studies have also demonstrated that prior experiences increase the possibilities of founders to attract financial capital essential for their firms' performance and thus development (Colombo and Grilli, 2005, 2010; Brinckmann et al., 2011). This is because prior experiences signal entrepreneurial quality (Hsu, 2007). Neill et al. (2017) further demonstrated that founders (entrepreneurs) with more prior experience perceive opportunities in their environment as more exogenous compared to less-experienced founders. This can help them limit the external cues and explore unfamiliar areas that might have been overlooked by others. Aaboen et al. (2006), however, found that few founders of NTBFs possess prior experience in finance and business preparation, and a lack of this experience can pose financing hurdles in the early development stage.

Although there are some contradictory results regarding the relationship between human capital and NTBFs' performance, several studies have shown that previous experience, managerial and start-up experiences, and education exerts, to some extent, positive effects on early performance and survival of new firms (e.g., Gimeno et al., 1997; Davidsson and Honig, 2003).

Social capital involves skills and abilities required for interaction and building relationships, and also refers to the ability required to extract benefits from these relationships and networks (Davidsson and Honig, 2003; Baron, 2007). Especially, social capital can contribute towards building trust among actors in an external network to provide and gain access to resources that they do not possess (Yli-Renko et al., 2001a). The social networks, including business networks, significantly contribute towards creating competitive advantage by providing essential information and resources to NTBFs competing against established firms; they can also facilitate opportunity recognition and the exploitation of new concepts (Birley, 1985; Davidsson and Honig, 2003; Hoang and Antoncic 2003). These networks consist of both informal and formal relationships (Birley, 1985), which are important for NTBFs in their early stage (Elfring and Hulsink, 2003). However, since informal networks consist of stronger personal relationships, these may be more commonly used for resource acquisition in the initial years of the firm (Birley, 1985; Hite and Hesterly, 2001; Jack et al., 2010). Furthermore, social and business networks, especially strong ties, can enhance the firm's reputation in the market, and thereby facilitate resource acquisition and first sales (Baron, 2007).

2.4 External resources of NTBFs

Being new in the market, NTBFs lack legitimacy and face difficulties attracting financial capital, which can be attributed to the risk and uncertainty associated with a new technology

(Lindström and Olofsson, 2001). At the same time, financing is critical to the formation and early development of NTBFs (e.g., Murray and Lott, 1995; Norrman, 2008). Venture capital firms that provide important means to NTBFs to raise financial capital in their early stage of development, often exhibit bias against investing during the early (seed and start-up) stages of technology development (Murray and Lott, 1995; Lockett et al., 2002; Wright et al., 2004). Thus, self-financing often tends to be the main financing mode of firms in the early stage (Lindelöf and Löfsten, 2002; Löfsten and Lindelöf, 2003; Brinckmann et al., 2011). However, self-financing falls short of meeting the survival needs of the firm since technology development (e.g., product or service) and innovation are long-term endeavours (e.g., Penrose, 1959; Storey and Tether, 1998), they need long-term financial support, which cannot be met only through self-financing. Information asymmetry, not sharing the same knowledge and information about relevant factors, is often a reason founders of new firms fail to obtain financing from investors. For example, investors perceive founders to be overoptimistic or overconfident when they fail to estimate their full potential (Shane and Cable, 2002). Additionally, founders who are overoptimistic about their environment (Åstebro, 2003; Fourati and Attitalah, 2018) can hinder their prospects for investment.

One way of supporting NTBFs in their development, including attracting financial capital, is policy support enabling establishment of support organisations (i.e., science parks and business incubators) to support and stimulate NTBFs' formation and development through R&D and technology transfer (e.g., Löfsten and Lindelöf, 2003; Siegel et al., 2003). These organisations also provide firms with access to information and networks important for their progress and performance (Ferguson and Olofsson, 2004; Löfsten and Lindelöf, 2002, 2005; Ramírez-Alesón and Fernández-Olmos, 2018). From a system level, public venture support, including science parks and incubators, should help NTBFs to acquire external resources needed for their development (Norrman, 2008). However, research has demonstrated differences in these support organisations' abilities to enhance NTBFs' performance. Lindelöf and Löfsten (2002) found that firms located in science parks grow faster and record higher growth (sales and employment turnover) than firms not located on-park. Ferguson and Olofsson (2004) further found that on-park firms have higher survival rates than off-park firms. Science parks have also been argued to provide NTBFs with favourable locations for their different stages of development. Particularly, they provide proximity to and cooperation with universities, which can enhance firms' ability to overcome liability of newness (Ferguson and Olofsson, 2004; Lindelöf and Löfsten, 2004; Dettwiler et al., 2006). Siegel et al. (2003) however, found no

evidence of a difference in the performance (growth) between on-park firms and off-park firms. Based on a study on incubators, Colombo and Delmastro (2002) found little difference between on- and off-incubator firms, and the only differences were that on-incubator firms had superior human capital (education and previous work experience), recorded higher growth, and had easier to obtain public subsidies than the off-incubator firms. It has also been demonstrated by previous research that science parks and incubators attract more motivated founders and high-tech potential NTBFs (Löfsten and Lindelöf, 2003; Ramírez-Alesón and Fernández-Olmos, 2018). Often, on-park firms are more likely to be associated with a local university than off-park firms (Löfsten and Lindelöf, 2002, 2005), which can explain their superior human capital. However, Löfsten and Lindelöf (2002) state that *'It is also "clear" that, in terms of NTBF performance, whether or not a firm is in the high technology sector is maybe of greater importance than whether or not it is located in a science park.'* (p.863). Moreover, NTBFs located on-park do not necessarily exhibit superior performance, in terms of innovation, than off-park firms. However, an on-park location can still enhance NTBFs' innovation performance through collaboration and access to resources (Ramírez-Alesón and Fernández-Olmos, 2018). If founders of NTBFs engage in collaboration with universities and incubators, then it can strengthen their absorptive capacity and business model and have consequences for their development (e.g., Patton, 2014). However, research demonstrates contrasting results in this aspect.

One issue is that founders often fail to use incubator resources to develop their firm's missing resources, which can be attributed to their lack of awareness of their resource gaps and short-term orientedness (van Weele et al., 2017). Poor absorptive capacity of NTBFs can negatively affect firms' innovation performance in terms of cooperation and proximity to universities (Börjesson and Löfsten, 2012). Nevertheless, research networks will continue to play an important role in facilitating knowledge transfer, information processing, procurement of R&D equipment, and identifying opportunities (ibid).

Proximity to universities, science parks, and business incubators can enhance technology and knowledge transfer among NTBFs that are often technology-based university spin offs (e.g., Autio and Yli-Renko, 1998; Löfsten and Lindelöf, 2002, 2005) and rely on these institutions' equipment for their development. Studies showed that research institutes also enhance the innovation performance of NTBFs (Camisón-Haba et al., 2019). Nevertheless, these networks and the dynamism of the specific environment can influence founders' behaviour, perceptions, and, ultimately, their actions in the early development (Edelman and Yli-Renko, 2010). It can

promote learning among firms and help them to strive towards, for example, internationalisation (Bengtsson, 2004). However, perceived resource needs can further limit the ability of other actors, such as business coaches and advisors, to assist NTBFs, and founders may perceive the support insufficient (van Weele et al., 2017). How the founders perceive resources available as well as their situation can be influenced by previous experiences providing the founders with knowledge about starting a firm or about the industry in which they operate (Neill et al., 2017). From this perspective, human capital and established network relationships can influence the founders' strategic posture, such as their growth orientation (to strive for high growth and internationalisation in the early stage). This can increase their optimism in the initial years and, eventually, lead to over optimism; in this scenario, the founder may exhibit a tendency to anticipate positive outcomes (Busenitz and Barney, 1997; Baron, 2007).

Moreover, science parks and incubators can provide NTBFs with opportunity to access and build networks that are important for the firms to gain access to resources that they do not possess in the initial years. However, Löfsten (2010) found an insignificant relationship between firm performance (sales and employment) and business networks, in terms of networks internal (business incubator support) and external (banks, lawyers, patent offices) to the incubators. Based on an examination of the effect on NTBFs' innovation performance, Börjesson and Löfsten (2012) found that R&D- and business networks strongly contribute to NTBFs' performance (patents). Closeness and proximity of firms to business networks and regions that provide access vital resources, which cannot be developed internally, can positively affect NTBFs' growth (Maine et al., 2010). However, it may depend on the industry sector that the NTBF is operating in (ibid).

In relation to business networks, extant research has highlighted NTBFs' relationships with customers and other partners (Yli-Renko et al., 2001a, 2001b; Clarysse et al., 2011) and the influence of this relationship on firms' growth (e.g., Birley, 1985; Hite and Hesterly, 2001). Both formal and informal networks (Birley, 1985) are important for NTBFs, although informal contacts are used more often in the initial years to access resources (Birley, 1985; Aaboen et al., 2006). Aaboen et al. (2006), for example, found that NTBFs most often relied on banks or family when attracting financial capital in the early stage of development. Thus, close relationships can help firms obtain funds when they have low legitimacy levels in the market. Yli-Renko et al. (2001a) also showed that close social and informal relationships with customers as well as connections to customers' networks positively affect firms' knowledge acquisition, influencing their technology distinctiveness and performance. However, close

proximity may only have positive effects in the early stages of development or when firms are engaged in less radical innovation (see e.g., Freel, 2003; Letaifa and Rabeau, 2013). Building an extensive network of business partners can also enhance NTBFs' ability to gain legitimacy in the market and, in turn, facilitate their development and performance (Clarysse et al., 2011). However, young and small firms find it difficult to manage numerous relationships, and hence they often become dependent on a few relationships (Yli-Renko et al., 2001b). Founders also face problems signalling quality of their technological achievements in the early stage of development, and this aspect may restrain the establishment of business networks and alliances (Colombo et al., 2006). In the initial years of the firm, patent development plays a critical role in signalling technology achievements, forming alliances, and gaining access to partners resources (Colombo et al., 2006), and thus is critical for NTBFs' survival (Löfsten, 2016b). Particularly, patents can reduce financial constraints when the information asymmetries are high (as most often is the case in early stage of development) (Conti et al., 2013; Hottenrott et al., 2016).

The business environment can limit the scope of founders to perform business in a certain manner, but it can also drive the founder to a certain direction (e.g., Boeker, 1988). For example, with a focus of accelerating development, business coaches and advisors at science parks, incubators, or venture capitalists (financial partners) can push NTBFs to strive pursue high growth (e.g., Reymen et al., 2015). Moreover, environmental constraints in the industry in which the firms operate can influence business decisions in the initial years and how the business model of the firm is developed and designed (Amit and Zott, 2015). Additionally, as collaborators for technology commercialisation, suppliers and customers can provide inputs that influences founders to make certain decisions (Reymen et al., 2017).

2.5 Early development of NTBFs

Research has focused on the performance and factors affecting the performance of the NTBFs in their early development stage. Research has primarily emphasised sales or employment growth as measures of business performance, and thus provided an approach for understanding the early development.

In relation to growth, firms' (and founders') orientation towards growth has been suggested as an indicator of sales and employment growth or even internationalisation and profitability (Yli-Renko et al., 2002; Isaksson et al., 2013). These suggestions are based on the fact that NTBFs are expected to exhibit strategic behaviour oriented towards high-growth and accelerate

introduction of technology to the market, thereby facilitating sales. Nevertheless, research has shown contradicting results regarding NTBFs' growth orientation; as per these studies, NTBFs tend to be less growth-oriented (Autere and Autio, 2000; Rydehell et al., 2019).

Moreover, during the early development stage of NTBFs, growth and profitability may not serve as relevant measures of firm performance as legitimisation of firms, commercialisation of the technology, and technology (product or service) sales entail a significant amount. At the same time, in their early stage of development, firms often lack information to measure sales and employment growth (see e.g., Zott and Amit, 2007). Therefore, other measures might be more effective for measuring NTBFs' early performance.

Survival reveals a firm's ability to stay in the market; however, less research has been conducted on this aspect by considering firms' early stage of development (Rannikko et al., 2019). Additionally, survival may not serve as most suitable measure of performance of NTBFs in their early stage of development as this measure does not explain specific influences on development, and it can only be measured over time (retrospectively).

Business performance can also be measured as perceived performance or performance satisfaction rather than realised performance (Cooper and Artz, 1995). Perceived (business) performance, such as time-to-market, early sales and employment growth, can facilitate understanding of founders' perceptions of their firms' performance, which can have long-lasting consequences for the businesses (e.g., Autere and Autio, 2000; Rydehell et al., 2019). At the same time, founders' previous experiences as well as their understanding of the business environments (industry and market) can form their perceptions of their firms' early performance as such experiences can make founders more or less optimistic (Fourati and Attitalah, 2018), which may or may not constrain, for example, growth.

Furthermore, NTBFs are characterised as innovative firms (Colombo et al., 2006; Löfsten, 2015; Löfsten, 2016b), and as such, technological innovation is considered important for their early development and performance. Therefore, innovation performance is considered a relevant measure for NTBFs. The meaning of innovation performance may differ depending on research discipline. However, concerning the research on NTBFs, innovation performance often includes measures such as patents, licences, R&D intensity, R&D expenditures, and introduction and change in the number of new products (e.g., Colombo and Delmastro, 2002; Börjesson and Löfsten, 2012; D'Ambrosio et al., 2017; Ramírez-Alesón and Fernández-Olmos, 2018; Fudickar and Hottenrott, 2019).

Product differentiation is also used as to measure the newness of the firm's offering (product or service) in relation to other offerings in the market (Soto-Acosta et al., 2017; Ramírez-Alesón and Fernández-Olmos, 2018; Rydehell et al., 2019). Especially, today, an increasing number of NTBFs are based on technology, which is not offered as a product in itself (e.g., ICT and IT sectors).

Related to product differentiation is the firm's novelty orientation of their value proposition (see e.g., Rydehell et al., 2018) as this aspect reflects the novelty of the product or service offering to customers. The value proposition is part of the firm's overall business model⁵, which has been highlighted for its relationship with firm performance (Zott and Amit, 2007). The business model is important to understand the young firm's development as it describes how firms 'do business' and, more specifically, how they create and capture value (Magretta, 2002; Chesbrough and Rosenbloom, 2002; Teece, 2010).

In relation to the definition of 'early development' in this thesis, it is argued that NTBFs must reach a stage in their early development wherein they can establish a way of doing business, and hence have one viable business model. Particularly, a business model plays a crucial role in enabling NTBFs to commercialise their technology (Dmitriev et al., 2014; Reymen et al., 2017). At the same time, the business model can function as a communication tool that firms can use to demonstrate their feasibility to venture capitalists and other stakeholders (Doganova and Eyquem-Renault, 2009).

Moreover, since these firms are dependent on external resources, their business model will develop and evolve in interaction with customers, venture capitalists, and other stakeholders (Amit and Zott, 2015; Rydehell and Isaksson, 2016). Margiono et al. (2018) studied resource dependence of new firms and found that business models develop through arrangements between the new, young firm and external organisations, and that these arrangements enable firms to cope with resource dependences. In this sense, the business model indicates that the way a firm operates to realise development can be understood from the manner in which founders choose different ways of structuring businesses.

⁵ A concept similar to a business platform model is mentioned in Chapter 1. In the thesis, business model as a concept is used to describe the early development, because NTBFs are required to establish a viable model to perform (see, e.g., Andries and Debackere, 2007). Thus, the business model concept is used instead of the business platform to describe the culmination of the process of early development.

2.6 Research questions

To analyse the early development of NTBFs based on dimensions inside and outside the firms' boundaries, we must understand how internal- (e.g., founders' experiences and education) or external resource dimensions (e.g., industry and business networks) impact the development and how these dimensions together contribute toward this development. Particularly, NTBFs interact with others to gain access to vital resources needed for their development and the commercialisation of technology. Starting with such interrelation for firm development, we need to understand how the founders (as part of a NTBF's internal resource dimension) interact with their business environment (external resource dimension) to find ways of structuring business activities in order to create and capture value. The founders are the ones in charge of developing the firms' businesses. By understanding the development of, for example, the business model, it would be possible to shed light on how these founders choose to structure their firms to 'do business'. This development necessitates interaction with, for example, customers and other external stakeholders. Accordingly, the first research question is proposed:

RQ1: How do internal and external resource dimensions interact to structure NTBFs' businesses?

Besides structuring the way of doing business, the early development emphasises how the NTBFs perform to sustain their development. The early performance (i.e., development) would be influenced by both internal and external resource dimensions, such as founder and business environments.

Although both the founder and the environment have clear influences on a NTBF's development, the final decisions that reflect this development depend on the founder's perceptions, beliefs, and attitudes. Furthermore, in the initial years, NTBFs and their founder(s) lack in established, accepted rules and procedures, unlike established firms, and need access to resources for their development. To this end, they utilise the resources they possess. Thus, the (internal) resources that exist in NTBFs must be considered for understanding how the firm will be able to develop. Further, the founder of the firm possesses certain resources and perceptions that influence the founder's intentions of how to develop the firm. This will also have some imprinting effects on the firm's development, irrespective of the influences from the environment and business network. Therefore, it is important to understand how these internal resource dimensions impact NTBFs and their performance (as one way of understanding the early development). Therefore, the second research question is proposed:

RQ2: How do internal resource dimensions impact NTBFs' early development?

Furthermore, research has demonstrated that decisions for development are based on founders' experiences and perceptions; however, these decisions may be imprinted by the external context. Thus, despite the founders' final decisions, the external business environment (such as industry sector) and the external resource dimensions will impact the NTBFs. Therefore, comprising certain rules, resources, and relationships, a business environment that influences a firm would also contribute towards its early development. This early development is determined by stakeholders in the NTBFs' business networks and the barriers that exist in the business environment. To provide a full picture of the early development of NTBFs, the external resource dimensions must be considered. Accordingly, the third research question is proposed:

RQ3: How do external resource dimensions impact NTBFs' early development?

3 Research methodology

This chapter is organised as follows. First, the section presents the research design based on the aforementioned research questions and the appended papers. Subsequently, it presents a reflection on the research process that leads to this thesis, including the process undertaken for conducting the empirical studies and the outcomes of the studies. Subsequently, the empirical studies are described in detail, followed by a discussion on research quality, and limitation of the chosen methods.

3.1 Research design and overview

The research method and design should reflect the research project's purpose and research questions (Maxwell, 2013). This thesis aims to explore the early development of NTBFs and focuses on how different resource dimensions structure and impact this development. To achieve this objective, the choice of method has been mixed, using both qualitative and quantitative approaches. These approaches contribute towards addressing the gaps in the extant literature on firm structuring in early stage and examining the effects on the firms' early development. The former relates to research question 1 that asks how internal and external resource dimensions (founders and business environment) interact to structure how NTBFs' do business. To explore how such interaction takes place and how and why the different resource dimensions influence the structuring of the NTBFs during their early development, a qualitative approach was chosen. Such an approach provides the possibility to gain a deeper understanding (Flick, 2009; Bryman and Bell, 2011), and is considered appropriate when the topic and context is complex, such as NTBFs and their early development (Rizzo et al., 2013). To address such complexity for this specific research question, multiple case study is selected (Eisenhardt, 1989) as well as a longitudinal case study (Pettigrew, 1997). In the initial stage of the research process, a multiple case study provided an opportunity to gain an in-depth understanding of NTBFs by studying these firms in different industry sectors and examining how the founders of the firms and these sectors structure business activities early on. Subsequently, a longitudinal case study tracked firms' early development to understand how the interaction between founder and its business environment influences the structuring of the firms. These case studies led to empirical studies 1 and 2.

Empirical study 1 was a multiple case study focusing on eight NTBFs, and empirical study 2 was a longitudinal case study that followed two of these eight firms for 2 years. For these studies, the unit of analysis was meant to be the firm (and more specifically the firms' business

models) as the early development is analysed on a firm-level. However, in the early stage of development, the founder and the firm can be seen as interchangeable; thus, to understand the early development of the NTBFs, the unit of analysis was set at an individual-level (founder-level).

Moreover, to obtain a general overview of NTBFs, their early development, and the impacts of external and internal resource dimensions on NTBFs, and to connect this overview with research questions 2 and 3, a quantitative approach was chosen. This allowed for examining impacts of business environment, networks, and founders' human capital and attitudes towards growth on NTBFs' early development, including an examination of different performance measures. Hence, empirical study 3 was conducted, which involved a survey study as research design to examine how and to what extent external and internal resource dimensions impact NTBFs during their early development (between 1 and 3 years as previously mentioned). This survey study focused on the firm-level (the NTBFs) to study impacts on early development and, specifically, the early performance.

The three studies conducted resulted in the five appended papers in this thesis, which provided insights that can answer the research questions proposed. Table 1 describes the relationships between the three research questions, three studies, and the five appended papers.

Table 1. Relationship between research questions, studies, and papers

Research question	Empirical study	Paper
RQ1: How do internal and external resource dimensions interact to structure NTBFs' businesses?	Multiple case study	Paper 1
	Longitudinal case study	Paper 5
RQ2: How do internal resource dimensions impact NTBFs' early development?	Survey study	Paper 2
		Paper 3
RQ3: How do external resource dimensions impact NTBFs' early development?		Paper 4

3.2 The research process

The research journey has not been a linear process; it has been a learning process. The focus of the research changed several times, and an iteration comprising own learnings, reflections, meetings and discussions with respondents and researchers, and outcomes from data collections led to this dissertation on NTBFs' early development along with five appended papers on the topic.

The journey started with a focus on initial business models for NTBFs wherein the business model *per se* was the phenomenon of interest, and thus initially one of my key concepts. Research on this topic discussed the relationship between business models and firm performance, but less was known about the initial business models for NTBFs. Thus, my research project started with a focus on understanding founders' perceptions and thoughts about their business models. At the same time, the underlying idea was to operationalise the business model concept in order to examine the effects of the initial business models of NTBFs on the firms' performance, which also was the aim of another research project that we conducted with researchers from Finland and France. Therefore, understanding founders' perceptions and exploring ways to discuss their business models seemed an important topic for a future survey. This research need enabled me and the co-author of Paper 1 to develop a semi-structured interview guide, which included a timeline for mapping early business development. In addition to this interview guide, I developed activity cards based on the business model canvas to help founders to and analyse their contributions within their businesses. This led to the empirical study 1, wherein I interviewed nine founders of eight NTBFs in different industry sectors during February and March 2015. This interview guide and the timeline mapping and activity cards were used by two bachelor thesis groups that I supervised during the spring semester 2015. Two conference papers were written based on my interviews with the eight NTBFs and my interviews and those conducted by 20 interviewers from the bachelor thesis groups. These papers were presented at two conferences during autumn 2015, and the former was rewritten after it was invited for submission in a peer-reviewed journal (i.e., *Journal of Business Models*). It was accepted for publication in June 2016. Both these papers focused on the perceptions of initial business models; however, they revealed that stakeholders within the firms' business networks played a crucial role in influencing founders' views and opinions about the business and market. Hence, the development of the business model could also be a way of understanding the early development. The insights from these papers further resulted in

empirical study 2, which was a longitudinal study on two of the firms interviewed during empirical study 1, and it started after the first interview in 2015 and lasted until June 2017.

Simultaneous to the empirical study 1, a literature review was conducted in collaboration with a PhD student in France to identify characteristics of business models and their measurable dimensions in literature, and thereby provide a deeper understanding of the business model in academia. This study specifically aimed to identify measures to support future quantitative research on business models. It resulted in a conference paper presented in November 2015, which was rewritten and updated for journal submission during 2016. Unfortunately, it did not add much to the survey study that was planned from the joint project's perspective, because the results revealed a general measurement that was difficult to apply to new, small firms. The timeline of the survey project further did not match the time taken to conduct the extensive literature review. Furthermore, the conference paper did not meet the scope of this thesis, and hence it is not included as one of the appended papers, although it has been included as one of the additional papers and publications.

During May 2015, the parallel process of developing a survey for examining business models of NTBFs was initiated and it continued until March 2016. The survey process included developing questions; translating questions to Swedish, Finnish, and French; and pilot-testing the questionnaire with NTBFs. Subsequently, the data was collected in March-April 2016.

Accordingly, the empirical study 1 ended in 2016; however, the work on Paper 1 continued, and focus was given to survey development, the literature review study, and empirical study 2. It was also the year when I wrote my licentiate thesis focusing on initial business models for NTBFs, which was defended in September 2016. As mentioned, the empirical study 1 provided insights into the role of stakeholders in the process of business model development, and thus questions on business networks were added to the part of the survey that focused on the Swedish sample (see 3.5 for more detail). The final survey study (empirical study 3) and the data obtained from this survey revealed the complexities of measuring business models. However, we emphasised examination of the impacts of business networks and internal (founder-related) resource dimensions on the early development of NTBFs. The insights gained from (partly) empirical study 1 made it one of the most interesting dimensions to examine. Empirical study 3 led to three papers that investigated the impacts on different performance measures (including novelty-orientation) of NTBFs (Paper 2, 3, and 4 in the thesis). These papers were written, submitted to journals, and revised in parallel from 2016, along with Paper 5 that resulted from the empirical study 2, which is presented in Figure 1 (that presents an overview of my research

journey). Paper 5 was initiated as a conference paper in 2016. In this period, some data from empirical study 2 were collected for testing an idea that emerged from a brief data analysis, which focused on the roles of different external stakeholders in the development of two NTBFs' business models, and thus their role in structuring the businesses in their early stage of development. This examination led to a second conference paper in 2017, which involved extensive data collection and extensive rewriting for a journal paper. This exercise led to the current version that is found in the appended papers.

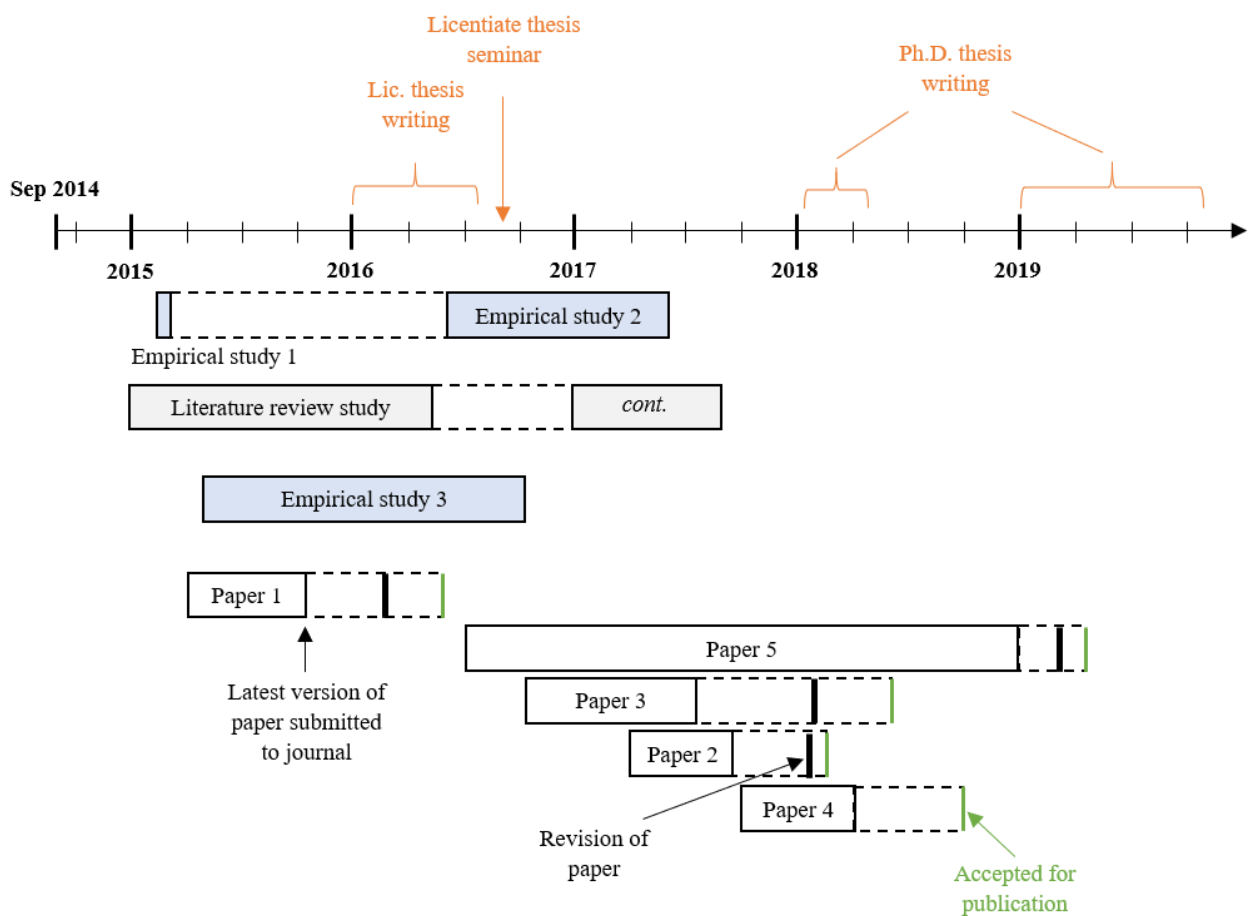


Figure 1. Research journey including studies and process of appended papers

It should be noted that all the empirical studies initially focused on business models. However, the learnings emerging from the study showed that the business model development reflected the early development of the sampled NTBFs. Thus, the business model served only as a concept of analysing that development, and it became a key concept after my licentiate thesis regarding the overall dissertation. The results from the empirical study 3 led to a change in the study's focus, and after empirical study 1 and during data collection in empirical study 2, I gained new insights for the future study. Consequently, the research journey concluded as an

investigation of the early development of NTBFs with focus on both founders and external resource dimensions impact on it. In this case, the business model served as a way of understanding how the influence of these dimensions led to the structuring of the businesses.

3.3 The research setting

This thesis focuses on the context of NTBFs in Sweden. The choice was based on the convenience of accessing data as the authors were based in Sweden and owing to the access to information on all the firms in Sweden (i.e., Retriever Business database). Moreover, NTBFs add to the competitiveness of a small country like Sweden in the context of economic globalisation. Sweden has been popular for fostering innovation, especially in the manufacturing industry (Business Sweden, 2015); this innovativeness can be seen across product segments, such as machinery, equipment, vehicles, chemical products, and pharmaceutical products. Over the past decades, the emergence of new growth industries, such as ICT, e-commerce, biotechnology, and services have increased the focus on NTBFs outside the traditional manufacturing industry. In Sweden, the digital trend has led to the start-up and growth of other new firms. As one of the top countries in Europe for product innovation (in the total number of enterprises) (Eurostat, 2019), Sweden has become a centre for technology-based firms. According to Forbes (Forbes, 2016), in 2017, Sweden was considered the best country for doing business. Considering number of billion-dollar tech firms produced per capita (so-called ‘unicorns’) Sweden ranks as the first and second most innovative country in Europe and the world, respectively (Bloomberg, 2018). Accordingly, Sweden seems to have a good business environment for the commencement of NTBFs to start and grow, and thus, provides a good starting point for studying their development.

The research setting was based on NTBFs in different industry sectors classified as *high-technology manufacturing*, *medium high-technology manufacturing*, and *knowledge-intensive high-technology services*. This classification is based on Statistical Classification of Economic Activities in the European Community (*Nomenclature generale des Activites economiques dans les Communautés europeennes*, or otherwise known as NACE) codes⁶ within Europe. Regarding

⁶ NACE code classification (Eurostat, 2016): Eurostat is the European Union’s statistical office and provider of comparable information at a European level (Eurostat, n.d.). The NACE codes represent the classifications of industries provided by Organisation for Economic Co-operation and Development (OECD). The high-tech manufacturing industry and knowledge-intensive high-tech services are based on a technological intensity that can be identified using sectoral or product approaches. The first approach is based on a collection of manufacturing industries and their R&D expenditures, whereas the second complementary approach includes high-tech trade data (Eurostat, 2016).

the different industry sectors of NTBFs, most of the population is concentrated in knowledge-intensive high-technology services. This category includes information and telecommunication (ICT), programming, and scientific research and development. A smaller fraction of Swedish NTBFs are involved in high-technology and medium high-technology manufacturing. These categories include the manufacturing of different products, such as pharmaceutical products, computers and electronics, air and spacecraft, chemical products, and transport equipment. The significant difference in the number of NTBFs in these categories, wherein the first category has extensively more firms, can be explained to some extent by the lower barriers of entry compared to traditional manufacturing firms.

Furthermore, since the 1990s, the Swedish government has implemented corporate tax regulations and deregulations in industries to promote the growth of entrepreneurial firms (Andersson et al., 2016). However, the tax system still has disadvantages considering innovation and entrepreneurship with regard to firms financed with equity (Braunerhjelm and Henrekson, 2016). However, different incentives for public support programmes and other support organisations have been in place to support NTBFs (and other new firms) with finance and networking support. Examples are ALMI, Vinnova (Swedish Agency for Innovation Systems), Tillväxtverket (Swedish Agency for Economic and Regional Growth, former NUTEK), Industrifonden, Innovationsbron, and Sweden Innovation Center (SIC). The latter two organisations do not longer exist, but parts of these organisations have been inherited by ALMI.

Investments in national incubator programmes to support NTBFs has resulted in 65 business incubators and science parks across the country (SISP, n.d.). Most of the incubators are also connected to universities, and these university-related innovative environments support NTBFs in various ways, such as by introducing the firms to investors, providing networking support, and facilitating knowledge exchange.

Although NTBFs are supported in multiple ways one resisting issue for these firms is financing in early stage. Financial support is usually available to firms in the form of loans or against equity shares; however, they are often unavailable as early seed capital. For NTBFs, this means that financial support from public support programmes is limited. Although universities and science park incubators can provide access to funding in the early stage, it is conditional on the selection process of the incubator. Besides public support, private venture capital (VC firms) and business angels can provide seed funding. The latter has been demonstrated to be limited in Sweden, although a recent report has shown an increase in seed and start-up investments

since 2015 (at a time when investments in seed and start-up were decreasing). In 2017, 9% and 24% (23,8%) of the total VC investments were in seed and start-up, respectively (Tillväxtanalys, 2018). Additionally, for public financing, the investments have increased for seed financing. Additionally, compared to other fund categories, government funds are invested more in seed phase (ibid.).⁷

3.4 Qualitative research approach

For answering research question 1 and to gain in-depth understanding of the early development of NTBFs and for examining how the interaction between founders and their business environment structure the businesses, case studies were chosen, as explained in section 3.1. For the empirical study 1, which was an initial study to explore founders' perceptions of their business (model) development, a multiple case study method was used to study the firms and their founders at the time when the firms were still in the early stage of development. Subsequently, for the empirical study 2, a longitudinal case study approach was chosen to study the early development over time that focused on stakeholder roles and stakeholder interaction. The business model in these studies served as a concept to explore the structuring of the firms during their early stage of development. It also helped examine founders' perceptions of how to structure businesses and how this perception developed in interaction with external influences.

3.4.1 Case selections

For both the empirical studies 1 and 2, the initial criteria for selecting cases were based on how to operationalise the definition of NTBFs, as explained in Chapter 1. This operationalisation is based on the following two criteria: (1) the firm must be new, and (2) the firm must be technology-based (Almus and Nerlinger, 1999; Yli-Renko et al., 2001a). For the first criterion, new firms were considered based on the years of operation from registration (year of founding). Based on this criterion, the firms were supposed to structure their business activities (and develop their business models). Firms in these studies were categorised as 'new' if they were younger than 5 years⁸. This was based on previous research studying the early (business model)

⁷ However, it should be mentioned that regional opportunities concerning funding and other support functions differ in Sweden and thus provide different means for NTBFs to develop and grow in different regions. However, this thesis does not study these differences between regions.

⁸ As shown in Table 2, the firms selected for the studies were between 2 and 5 years old, which is older than the same selected for the quantitative (survey) study. However, concerning the business structure, including the business model development, NTBFs aged 5 years are considered to be in their early stage, compared to the majority of previous research studying these firms.

development of technology-based firms (e.g. Clarysse and Moray, 2004; Andries and Debackere, 2007).

Classifications of technology- and knowledge-intensiveness degrees (as a subset of technology-based) were used for the second criterion, such as high-technology and medium-technology manufacturing industries (e.g. Almus and Nerlinger, 1999). Classifications of *high-tech manufacturing*, *medium high-tech manufacturing*, and *knowledge-intensive high-tech services* were used to study NTBFs, based on codes from the Statistical Classification of Economic Activities in the European Community (NACE) (Eurostat, 2016). This classification has been previously used by researchers studying NTBFs (e.g. Clarysse et al., 2011; Xiao, 2015). The NACE codes can be found in the translated version of Sweden's Standard Industrial Classification codes, which enabled the use of the Retriever Business database to obtain information on Swedish NTBFs.

Firms that met the two criteria could be identified using the Retriever Business database. Subsequently, the final sample for study 1 was chosen based on access to the specific cases (Eisenhardt and Graebner, 2007). Thus, cases were ultimately selected based on convenience sampling, that is, firms that agreed to participate in the study were chosen. The final sample included eight cases, which are displayed in Table 2.

Table 2. Description of selected cases for empirical study 1

Cases	Description of NACE code	# Founders interviewed	Year of founding	Business idea
A	Engineering, Technical Testing and Analysis	1	2012	Dental disposable product for saliva absorption under the tongue
B	Computer Programming	2	2013	Developed software to streamline production; software can manage production planning
C	Information Services	1	2010	Software that will enable companies to take advantage of online products, in the area of 'Internet of things'
D	Video and Television Program Production	1	2011	Films, broadcasts, live performances, and concerts in theatres
E	Computer Programming	1	2012	IT service to facilitate photography improvements
F	Video and Television Program Production	1	2012	Providing services and technology for post-production, including films
G	Engineering, Technical Testing and Analysis	1	2011	Data-based simulator for the training and maintenance of intubation skills
H	Advertising and Market Research	1	2013	Terminal to easily collect customer feedback; it assists service industry to enhance customer satisfaction and customer service

For the empirical study 2, investigation on cases A and G was continued since these firms were operating in similar industry contexts and possessed similar features (of founders), and this aspect could allow for cross-case analysis (Eisenhardt and Graebner, 2007) and facilitate the identification of patterns associated with their early development.

3.4.2 Data collection and analysis

For both study 1 and 2, semi-structured interviews were used as primary data sources. For empirical study 1, timeline mapping and activity cards based on the Business Model Canvas (Osterwalder and Pigneur, 2010) were used in combination with the interview questions. This approach aimed to capture activities during the first years of development (after founding and registered the firm), focus areas, and actors and their purpose of involvement. This allowed for capturing the founders' perception of the early business (model) development. The timeline and activity cards also facilitated capturing of the founders' thought and perceptions about their businesses and business models in several ways.

Data were collected for the empirical study 1 in spring 2015. For the empirical study 2, I used the data collected from two cases investigated in 2015 and added to the follow-up interviews and email conversations conducted during 2016 and 2017, which focused on the development of the businesses and their business models as well as stakeholder involvement in the development. Archival data, press releases, and annual reports were used for triangulation purpose.

The interviews conducted during the two studies were recorded and transcribed for analysis. The timelines used during interviews were collected and activity card positions were photographed and added to the transcriptions to support the interview data. In the first-round, transcription of interview data closely followed the interview to ensure that the interactive and retrospective parts were not forgotten or misunderstood.

Furthermore, to analyse the data, each transcript was first analysed individually. For study 1, the eight transcripts were analysed individually and thematically based on business model components (e.g., from Morris et al., 2005; Osterwalder and Pigneur, 2010) and on seemingly important themes that emerged during the within-case analysis. The new themes were verified against literature. Overall, the coding was driven by the research question (Braun and Clarke, 2006) of that study, as thematic coding is useful for comparing people's experiences and perceptions (Flick, 2009). After individual analysis of the cases, the cases were compared to identify patterns within the themes.

For the empirical study 2, data analysis was conducted in a similar manner. This involved the individual analysis of cases, adding additional insights to these cases over a period. Moreover, two cases were compared to identify patterns in, for example, stakeholder roles and their involvement during early business development.

3.5 Quantitative research approach

Concerning research questions 2 and 3, a survey study approach was chosen to study influences of different resource dimensions related to the founder (internal) and the business environment (external) on the early development of NTBFs, as described in section 3.1. This approach enabled measuring the intensity and level of impact of certain resources on NTBFs (specifically on their performance in the early development) in one point in time when these firms were in the early stage of their development.

The overall survey was conducted within a project that collected data about NTBFs from Sweden, Finland, and France; the survey consisted of three parts. The first part related to NTBFs' business models aimed to measure how the firms do business. The second part captured background information of the firms, such as the number of founders, financing of the firm, and founders' previous business experiences. These two parts of the survey were identical for all three countries. However, since researchers from the three countries had different research interests, the third part was country-specific. The Swedish part was related to the interest in this thesis, and hence it comprised questions on founders' attitudes (i.e., growth orientation) and external dimensions (i.e., business networks and business localisation). For the papers appended in this thesis, the Swedish part was mainly used. Some of the questions in the first two parts were used only for the Swedish sample in different papers.

3.5.1 Sample

The criteria for NTBFs in the sample was same as that for the qualitative case studies (e.g., being new and technology-based). The NACE codes (Eurostat, 2016) were used for selecting all firms operating in any industry sector acknowledged as technology-intensive, which refers to firms within *high-tech* and *medium high-tech manufacturing*, and *knowledge-intensive high-technology* industry sectors. All firms within these sectors founded between 2013 and 2015 (which were a bit younger than some of the firms in empirical study 1 and 2) were selected using Retriever Business database for the Swedish sample. For the study, inactive firms (e.g., not deregistered, liquidated) were filtered and removed from the sample. Furthermore, during data collection, 130 firms were removed from the population as they were recognised as inactive. The final sample consisted of 2329 NTBFs. It was divided over the 3 years as follows: 1230 firms were founded in year 2013, 812 were founded in year 2014, and 287 were founded in year 2015. Within this population, the largest category was represented by firms in *knowledge-intensive high-technology services* (90 percent). This can be explained by an increase in the number for service-related firms, such as firms within information and communication sectors. High- and medium high-technology manufacturing represented 2.8 percent and 7.2 percent of the population, respectively.

3.5.2 Data collection and analysis

The questionnaire for empirical study 3 was developed and included the three parts previously mentioned. Initiated in May 2015, the questionnaire development process continued until March 2016. It involved several rounds of discussion on the number and formulation of

questions, translation of the questionnaire from English to Swedish (for the collection of data from Sweden), and pre-testing of the questionnaire with founders of NTBFs (six firms in total) to identify any uncertainties in the formulation of the questions and to avoid misunderstandings.

The majority of the measures in first and third (Swedish) part of the questionnaire were measured using a five-point Likert-type scale to capture founders' opinions about, for example, the differentiation they offered. However, in the second part, a binary scale (yes=1 and no=0) was primarily used as these questions mainly collected background information, for example, they asked if founders had received any external financing or not.

The final survey was developed for data collection over telephone and as such could not exceed 15 minutes for asking and answering the questions. The time limit was a recommendation from the National Institute for Consumer Research (TNS-Sifo), which is one of Sweden's largest and most respected marketing research companies. TNS-Sifo was also used for collecting the data during March–April 2016.

We received valid responses from 401 NTBFs (a response rate of 17.2 percent). Additionally, an analysis of non-respondents based on founding year, sales, employment, and profitability did not show any large differences between responding firms and non-responding firms. Hence, the sample was considered representative.

Based on the survey, papers 2, 3, and 4 examine the impacts of independent variables on one dependent variable. Since nearly all measures were based on a five-point Likert-type scale, analysis started with principle component analysis (PCA) to shed light on the latent variables. This approach aimed to examine if the independent variables were important for the dependent variable. By applying PCA, it was possible to convert correlated variables into linearly uncorrelated variables (principle components).

Subsequently, data was analysed using a correlation analysis to identify the statistically significant measures (latent and control variables), and multiple regression analysis was conducted for testing the link between the dependent variables and independent latent variables.

3.6 Research quality

The research conducted for this thesis has taken different approaches to understand early development of NTBFs. The empirical studies 1 and 2 are based on qualitative research; hence, the quality can be evaluated based on criteria other than that of validity and reliability (Tracy, 2010; Bryman and Bell, 2011). For instance, this evaluation can be conducted using the concept

of trustworthiness, which parallel the criteria for quantitative research. For the empirical study 3, which is a survey study, the quality criteria of validity and reliability can be discussed.

3.6.1 Trustworthiness

The concept of trustworthiness has the following four criteria: credibility, transferability, dependability, and confirmability (Bryman and Bell, 2011).

The credibility criterion parallels internal validity and refers to how believable the findings are. To ensure that the research employed good practices and was controlled by respondents to reduce misinterpretations (e.g., Bryman and Bell, 2011), results from transcribed interviews were confirmed with respondents in the empirical study 1. The use of timelines and activity cards further provided an opportunity to ensure an accurate understanding of founders' perceptions, since it provided several ways for the founders to express themselves. In the empirical study 2, discussions over time ensured that misinterpretations from previous interviews were not apparent. In addition, respondents were given opportunity to read case descriptions about their development.

The transferability criterion parallels external validity—it verified whether the findings can be applied to contexts similar to those studied (Flyvbjerg, 2006; Bryman and Bell, 2011). The applicability may have been constrained due to a limited number of firms studied in the empirical studies 1 and 2'. However, for both studies, transferability can be enhanced by detailed descriptions of the case contexts and interview proceedings (see e.g., Gibbert et al., 2008; Tracy, 2010). Moreover, the use of multiple cases (and different industries in empirical study 1) further enhanced chances of analytical generalization (Gibbert et al., 2008).

Related to reliability, dependability refers to the degree of transparency and the extent to which the study can be replicated; thus, it verifies the likely application of the findings at other times (Gibbert et al., 2008; Bryman and Bell, 2011). For the empirical studies 1 and 2, dependability was ensured by interview guide, records and transcriptions that provide detailed and rich descriptions of the studies.

Finally, confirmability criterion refers to the issue of objectivity and ensures that research findings are not influenced by researcher bias (Bryman and Bell, 2011). It is difficult to achieve complete objectivity in the case of a research based on, for example, semi-structured interviews. Nevertheless, for the empirical studies 1 and 2, confirmability was achieved through an ongoing

discussion with interviewees. They were allowed to examine the transcriptions to address misunderstandings and to confirm the accuracy of the research's interpretations.

3.6.2 *Validity and reliability*

Validity and reliability are fundamental cornerstones of scientific method and are important to ensure the research quality. Validity concerns accuracy of measurements and sample representativeness; thus, if you actually are measuring what you want to measure (Bryman and Bell, 2011). For the empirical study 3, validity was ensured by using the expertise of a marketing research company (TNS-Sifo) to validate the questionnaire and reassessed it to ensure clarity in communication and understanding. The comprehensibility of questions was further ensured through a pre-test involving founders of NTBFs. For the data collection, validity was increased using TNS-Sifo as external service for collecting data by telephone.

Moreover, reliability is concerned with the consistency of measurements: if the findings are replicable (Bryman and Bell, 2011). For the empirical study 3, reliability was increased by using TNS-Sifo, which has experienced professional callers. They randomly select callers for calling the firms and monitor and record the interview process. The monitoring further ensures resolution of problems areas in a manuscript. Firms that did not answer were called again and the reasons behind non-participation were noted.

Since firms in the sample were founded between 2013 and 2015, independent sample T-tests were conducted to compare means between two unrelated groups on the same variable. This ensured that no significant differences existed between the firms founded in different years.

Concerning validity and reliability of questionnaires, such as the one in empirical study 3, there is a likelihood of common method variance (or bias) that may emerge when the same person answers the questionnaire (Podsakoff et al., 2003). This is the case with small firms (i.e., NTBFs), wherein one person generally serves in managerial position. In the empirical study 3, the risk of common method bias was minimized by using different sections to separate independent and dependent variables (Podsakoff et al., 2012). Moreover, by using well-established self-reported measures and pre-testing, the questionnaire helped to minimize the ambiguity of items, and thus common method bias.

3.6.3 *Reflections of the research quality*

Regarding the research quality of the methodological approaches adopted for the thesis, the strengths have been that the two approaches have enabled studying the early development of

NTBFs, and thus facilitated answers to questions of ‘how’ and ‘why’ (qualitative approach) and questions on ‘how much’ or ‘to what extent’ (quantitative approach). This facilitated an in-depth examination of how the development proceeds and what and why certain resource dimensions interact or provide opportunity for the firm to develop. It also allowed generalisability of the findings about the impacts of these resource dimensions and how they affect the NTBFs and their performance.

At the same time, the use of two different methodological approaches led to complexities pertaining to, for example, results that are more generalisable than others. However, when comparing results from the quantitative survey study, the qualitative case studies provide situated knowledge, which aimed to generalise within the cases and not between cases (see e.g., Tracy, 2010). Furthermore, although the representativeness of a sample can be ensured when using a quantitative approach, it cannot be ensured in the case selection in the qualitative approach. Hence, some results from the latter studies may not be applicable to all the NTBFs in the other study. However, these results still provided explanations for how NTBFs develop in early stage.

3.7 Limitations of data

As with all research, the empirical studies in this thesis did not come without limitations. First, to study the early development of NTBFs, the unit of analysis was changed between firm-level and individual-level (the founder). To understand how the business is configured, the business model of the NTBFs have been used as a unit of analysis, because it gives a better understanding of how founders think and perceive their businesses and facilitates an analysis of NTBFs’ development. Using a different unit of analysis may have limited the results of the early development, because it may have led to the omission of some important dimensions related to either the founder or the firm. However, as the founder and the firm are often interchangeable in the early stage of development, it is difficult to analyse the firm development without analysing the founder and his/her perceptions and choices.

Second, each of the research designs of the empirical studies on NTBFs’ early development come with their own limitations. To start with the qualitative case studies, they are restricted to certain industry sectors; particularly, empirical study 2 is restricted to only one industry. This restricted context creates limitations in the possibility to generalise the findings to other contexts of NTBFs. It should also be noted that the firms in the qualitative case studies are a bit older than the NTBFs in the survey study, which may create some contradictions in the findings.

However, the case studies provided the opportunity to collect both background information about the founders at the time of firm registration and retrospective data on external influences of the stakeholders. This provided knowledge about how resources internal and external to the firm enabled (or constrained) the early development structuring of the businesses.

Furthermore, the survey study (empirical study 3) has several limitations concerning measurements, because it initially aimed to examine NTBFs' business models; however, it was used to study different internal and external resource dimensions' impact on early performance. This limited the analysis of all internal and external resource dimensions that might be relevant to the study on the early performance (early development). However, the measures included in the survey captured a variety of these dimensions. Moreover, the data are based on a single point in time, but the early development evolves over time.

In addition to the limitations mentioned above, the thesis context is based on the Swedish NTBFs only. This has limited the findings to this context and makes it difficult to ascertain if the same conditions apply to NTBFs in other countries. However, some findings are in line with research conducted on NTBFs in other countries such as Italy, Germany, and the UK. Hence, the above findings offer promising avenues for future research.

4 Summary of appended papers

The chapter briefly summarises the five appended papers included in this thesis. The full versions of the papers appear at the end of the thesis. Each section provides a brief history of the paper and the authors' contribution, followed by a summary of the papers' research purposes, major findings, and contributions.

4.1 Paper 1

Rydehell, H., and Isaksson, A. (2016). Initial configurations and business models in new technology-based firms. *Journal of Business Models*, 4(1), 63–83. doi.org/10.5278/ojs.jbm.v4i1.1241

4.1.1 Background of Paper 1

The idea behind the paper developed after the first initial interviews in the empirical study 1, which emphasised the importance of understanding the founders' perceptions of their NTBFs' business models, because they reflect on their models when configuring and structuring their business activities. From the idea, the paper was developed by both authors. They also contributed to its conceptualisation and to the development of the interview guide for study 1. The major data collection was conducted by Rydehell, who also analysed the data and assumed a leading role in writing the paper, which was first written as a conference paper for the NFF conference 2015. This conference paper developed into a journal paper after it was invited for submission in the journal, wherein it was later published.

4.1.2 Summary of Paper 1

The paper explores and analyses founders' perceptions of initial configurations and business models in NTBFs. It explores how NTBFs' founders view their business models and what they emphasise within the business model when configuring and structuring their businesses, focusing on the business models as mental models of the founders.

The paper includes eight cases and describes how to study business models in an entrepreneurial setting without using 'business model' as a starting point. The results reveal that business models' configurations and adjustments are influenced by the founders' cognition. The paper reveals that external organisations, such as science parks and venture capitalists, influenced founders' definition and perceptions of a business model. Moreover, it was concluded that a business model's elements, and different activities within these, were differently perceived and

emphasised by founders. However, the identification and development of customer relationships was expressed as the main focus by a majority of founders. For example, concerning these differences, a majority of partners were referred to as ‘investors’ and were seen as resources to access financial capital. These partners and access to financial capital was further mentioned as important for survival, but it did not form the focus during the first years of development. Most founders did not find these ‘partners’ as important to attend to. However, a majority of the founders interviewed mentioned distributors and customers as important for the creation and delivery of value, and thus referred to them as partners within a value chain context.

The paper concludes that dividing the business models’ elements and internal activities into different areas would allow respondents to express their focus more clearly, reducing misunderstandings. Such elements and activities include identifying key resources and partners in the value chain. These two aspects were treated differently, for example, if referring to financial resources and investors, or human capital and distributors, suppliers and/or customers. Hence, in accordance with research arguing that the business model is a model in the minds of the founders, the paper demonstrates that NTBFs’ initial business models are configured based on founders’ perceptions.

4.2 Paper 2

Rydehell, H., Isaksson, A., and Löfsten, H. (2019). Effects of internal and external resource dimensions on the business performance of new technology-based firms. *International Journal of Innovation Management*, 23(1), 1–29. doi.org/10.1142/S1363919619500014

4.2.1 Background of Paper 2

The overall idea behind the paper was developed in discussion among the three authors of the paper. This idea was developed into a paper that was later submitted to a journal as an idea for a final paper on a course in which Rydehell participated. Thus, Rydehell took a prominent role in writing the paper; the author prepared the manuscript for journal submission and later rewrote and prepared the final version of the manuscript after the revision of the paper.

4.2.2 Summary of Paper 2

To develop and perform in initial years, NTBFs must utilise resources that their founder(s) possess internally as well as position themselves suitably to gain access to resources they do not possess. There is ambiguity on how such resource dimensions influence NTBFs’ business

performance in the early development. Therefore, the paper aims to examine the effects of NTBFs' internal and external resources on their early business performance.

Based on a survey study of 401 newly started NTBFs, the findings show that founders' business experience and NTBFs' proximity to other firms, as internal and external resource dimensions, respectively, positively affect the firms' early business performance. Growth orientation can be regarded as an attitude of founders, and thus it is also connected to the firms' internal resource dimensions. However, it is negatively related to business performance. This can be due to the presence of a certain level of over optimism among the founders who seek rapid growth.

Due to a limited understanding of which resource significantly contributes towards the performance of NTBFs during their early development, this paper contributes to the NTBF literature by demonstrating the benefits of utilising both human capital and external relationships. Further, it highlights that founders' attitudes towards growth is less obvious in the early stage of the development; however, founders anticipating early business performance may witness the negative consequences of their over optimism. Thus, NTBFs should consider their expectations in the light of growth prospects.

4.3 Paper 3

Rydehell, H., Isaksson, A., and Löfsten, H. (2018). Business networks and localization effects for new Swedish technology-based firms' innovation performance. *The Journal of Technology Transfer* 44(5), 1547–1576. doi.org/10.1007/s10961-018-9668-2.

4.3.1 Background of Paper 3

This paper is a result of a long journey. It started with Rydehell's idea to examine the effects of business networks and localisation on NTBFs in Sweden; the author came across this idea during the survey study. Thus, the paper, in its first version, was initiated by Rydehell who also took a more prominent role in writing the paper and in preparing it for journal submission. After reviewing comments, the paper was rewritten. The initial idea was rejected, and hence it was changed. A renewed emphasis was put on examining the effect on innovation performance (initially only on patents). Rydehell had a prominent role in revising the manuscript, after journal revision provided suggestions for improving the paper (including other variables to measure innovation performance).

4.3.2 Summary of Paper 3

For NTBFs, technological innovation provides them competitive advantage, in addition they to that they are required to differentiate their offerings in the market. Thus, innovation performance is important in the early stage of development. However, this indicates the need to access resources to develop their technology and to perform initially. Due to resource scarcity, it also implies that the firms must access several resources from the external business environment, including business networks and business localisation. The paper examines the business networks and localisation effects for NTBFs in the context of innovation performance (the number of patents and product differentiation).

The findings from a survey study with 401 Swedish NTBFs show that the latent variable of business networks—professional network services—that is, formal networks, is a significant factor for NTBFs' innovation performance. Innovation performance, in turn, may enhance the firms' abilities to gain access to external financing, which is important initially, through these formal networks. From the perspective of business localisation of the young firms, industrial and regional areas have a positive relationship with the firms' product differentiation. However, proximity to other firms has a negative relationship with innovation performance. The paper concludes that, in order to enhance innovation performance, these firms must consider their external relationships in the early stage of development. The firms should access vital resources at this stage instead of waiting for later. By studying the early stage of development of NTBFs, the paper contributes to research on these firms, suggesting that business networks and localisation significantly impact the innovation performance of NTBFs. This paper also clarifies what resource networks and localisation provide to NTBFs.

4.4 Paper 4

Rydehell, H., Löfsten, H., and Isaksson, A. (2018). Novelty-oriented value propositions for new technology-based firms: Impact of business networks and growth orientation. *Journal of High Technology Management Research*, 29(2), 161–171. doi.org/10.1016/j.hitech.2018.09.001

4.4.1 Background of Paper 4

This paper has a shorter history than the earlier paper. It was initiated by the first two authors after discussing the idea of examining the effects on the strategic orientation of NTBFs. Rydehell took a leading role in writing the paper and it was submitted and later accepted in the journal, wherein it is now published.

4.4.2 Summary of Paper 4

This paper analyses business networks and growth orientation effects on the novelty-orientation of NTBFs' value proposition. Value proposition is important for NTBFs in their early development as it enables them to connect business idea to customer market and differentiates them from competitors. Thus, a novelty-oriented value proposition is important for early firm performance.

From the strategic perspective of the firm, we argue within this paper that the tendency to be more novelty-oriented can depend on founders' attitudes towards growth as well as external influences from the firms' business networks. To develop a suitable value proposition, firms need to interact with the target customer. Additionally, the findings of the study show that interaction with stakeholders in the business network leads to technological distinctiveness and hence novelty-orientation of the firm's offering. Nevertheless, decisions pertaining to firm's strategic orientation depends on the attitudes and strategic behaviour of founders. Growth orientation and ambitions to seek fast growth have been argued as characteristics of entrepreneurial firms such as NTBFs, and these characteristics are considered to foster innovation. Hence, these characteristics can influence the novelty-orientation of the firm's value proposition.

Survey data from 401 Swedish NTBFs, show that firms' informal (management) networks and the founders' growth orientation are positively related to the development of novelty-oriented value propositions. Consequently, the paper concludes that if novelty-orientation is favoured for NTBFs' performance, such business networks and attitudes of founders should be considered and supported early on.

This paper adds to the literature on NTBFs and strategic orientation (value proposition) by highlighting effects of stakeholder interaction and founders' growth attitudes on firms' positioning of their value proposition. This value proposition may distinguish them from competitors and enhance early performance.

4.5 Paper 5

Rydehell, H. (2019) Stakeholder roles in business model development in new technology-based firms. *International Journal of Innovation Management*.doi.org/10.1142/S1363919620500310.

4.5.1 Background of Paper 5

The idea behind this paper originated from the empirical study 1 (as mentioned earlier), and it was developed further during data collection and analysis of the empirical study 2. The initial idea was only to explore the different roles that stakeholders external to the NTBFs played in the development of the firms' business models. It focussed only on the stakeholders who frequently interacted with the founders. This first idea for this paper was presented at the RENT conference in 2016, and subsequently, initial feedback led to the development of this idea. It was also complemented by additional data collection and analysis, and it was presented for the second time at the GIKA conference in 2017. It was submitted to a journal in 2017, wherein it was rejected. With the comments from and discussion with colleagues in the department's annual PhD workshop as well as with colleagues in my division, the data was reanalysed, and the paper was rewritten. After a revision, based on the comments of the reviewers, the paper was accepted for journal publication.

4.5.2 Summary of Paper 5

Business model development is important for NTBFs to obtain competitive advantage with their technology—for the firm to create and capture value. However, this development does not happen in isolation. The founders need to interact with stakeholders in their business networks during the early business development in order to gain access to vital resources, gain legitimacy, and to find a suitable value proposition for their offering to the target segment. Thus, stakeholder interaction may shape founders' perceptions of how to do business (i.e., their business model). Hence, stakeholders play important roles in the young businesses' development; however, there is a lack of clarity on these roles.

This paper examines the roles of external stakeholders in the business model development of NTBFs, from the perspective of the founders. Using a qualitative approach, it is based on a longitudinal study of two NTBFs in Sweden. Data was collected over a period of 2 years (from 2015-2017), and also included retrospective data from the first years of the founding. The study revealed that stakeholder roles are based on the position that they assume through their relationship with the founders and the tasks they perform in relation to the firms' resource

needs. However, the latter has more noteworthy consequences for business model development through shaping founders' perceptions. Nevertheless, such influence reduces over time as the founders gain schemas⁹ (such as the business model itself) to support their decision-making.

The paper contributes to research on the NTBFs and their early development, with a focus on the business model, by providing insights on the roles that external stakeholders in the firm's business networks play in the business development (and for the founder) as well as why these roles become important at different development stages. The paper further adds to our understanding of how both founders' perceptions and external stakeholders influence the business model development, highlighting the development as both endogenous and exogenous.

⁹ Schemas refer to cognitive frameworks (mental models) that consist of cognitive (accumulated knowledge) or knowledge structures, acquired from experiences that help people to interpret information (e.g., Baron, 2007; Martins et al., 2015).

5 Discussion

In this chapter each of the three research questions will be discussed. Each section will conclude with a short presentation of the main findings on each of the research questions. The chapter will end by discussing the research findings in relation to the purpose of the thesis.

5.1 How do internal and external resource dimensions interact to structure NTBFs' businesses?

The first research question asks how internal and external resource dimensions of NTBFs interact to structure the firms' businesses. These internal and external resource dimensions are related to founder of the firm, with his/her experiences and knowledge, and the firm's surrounding business environment, which includes business networks and external stakeholders.

As the ones making the final decisions about how the firms will develop, founders rely on their experiences and education. Additionally, the business environment and relationships formed within this environment influences founders' perceptions of how to do business (e.g., Edelman and Yli-Renko, 2010; Gartner, 2010). Interaction with the surrounding environment is further needed for NTBFs to gain access to external resources and for the founders to test and verify their technology and business model (Paper 5). Thus, on the basis of different resource dimensions, early development (e.g., business model development) results from an interplay between the founder (firm) and the external business environment.

Founders' interaction with the business environment often emerges from his or her relationships within the business networks, especially informal networks that founders have to rely on in the early stage of development (e.g., Birley, 1985; Hite and Hesterly, 2001; Jack et al., 2010). Informal business networks and close interactions with stakeholders within these networks have positive consequences in terms of increasing the novelty-oriented value proposition of the firm (Paper 4). Furthermore, business networks and stakeholder within these networks also influence by shaping founders' perceptions of how to do business. These networks and stakeholders provide an understanding of how business is usually done within a certain industry sector or how they might expect the firm to deliver their product/service (Papers 1 and 5). Customers, for example, play a vital role in providing input to the founders on what they perceive as valuable and what and how they would like to pay for the firms' offerings, thus supporting development of the firms' value propositions and even the business models (Reymen et al., 2017; Paper 1 and 5). Founders' closely interact with these stakeholders than with others during

the development of the technology (product) (Paper 5). These relationships will have a greater influence on structuring the business model development, and even help founders to focus on this in the early stage of development (e.g., Paper 1). Accordingly, business networks help structure the early development of NTBFs through their impacts on the founders. However, they also set boundaries in order to ensure that the NTBFs conform to the boundaries of a certain industry sector (i.e., how business is supposed to be done). This is because a new and young firm might need to adapt to certain standards in order to even sell its products/services. This is explained by one founder in the following lines:

It was just to ask [the customers (end-users)], 'how do you want to buy such a product'? Then they told me "we want to buy it through distributors". [...] When you ask [the customers], they say 'we do not want to buy from a lot of different [companies], but we want to buy from our distributor who supplies everything'. Then I have to relate to that. (Founder of Alpha in the empirical study 2)

Other external stakeholders, such as investors (venture capital firms), can create opportunities and conditions through financial sources. They can also create barriers by pushing firms in a certain direction (Reymen et al., 2015; Paper 1). Several founders (in the empirical studies 1 and 2) also expressed the problems of receiving financing from investors in the early stage of development.

The hardest part is getting investors to invest in this. I believe that fundraising has been the most difficult part. (Founder of Firm E in the empirical study 1)

This is in line with previous research arguing that NTBFs have issues attracting financing in early stage (e.g., Lindström and Olofsson, 2001; Colombo and Grilli, 2010). One way of for these firms to attract financing could be through patents, which signal the quality of the technology and novelty (e.g., Conti et al., 2013). Additionally, in the case of NTBFs, there is a correlation between having patents and receiving external financing (Paper 3). However, in the early stage of development, patents may be too costly for the young firms. Additionally, the firms that are in the process of developing their technology (product or service), and businesses find it difficult to apply for patents

(A patent was) sought and withdrawn. [...] I am not going to apply for a patent for this. [...] At this stage, there are numerous changes, which would make the patent obsolete. I do not think that a patent application would be of any help to me. (Founder of Beta in the empirical study 2).

Despite difficulties attracting and receiving financing in the early development, external stakeholders and the tasks they perform in interaction with the founders and in relation to NTBFs' resource needs (e.g., being a co-developer), significantly influence the business structure and the business's development (Paper 5).

Moreover, although closer interaction with external stakeholders in the business environment (the business networks) can provide strongly influence founders' perceptions of how to do business early on (e.g., Paper 5), founders' experiences and attitudes, for example, towards growth, can also influence their perceptions and decisions (e.g., Edelman and Yli-Renko, 2010; Paper 4; Paper 5). Founders' growth orientation influences them to increase their firm's novelty-oriented value proposition (Paper 4), and thus their business model. Attitudes related to prior business experiences further shape their mental schemas and with increased experiences, this continues over time, which have consequences for the business model development (Paper 5) and hence, the development of the business itself. Hence, the founders seem to rely more on such schemas over time, and these schemas may restrict the impacts of the external stakeholder (the business environment) on the early business development. This has also been discussed by extant research arguing that business environment influences the early development. However, this external influence benefits only to a certain extent, depending on founders' own schemas and perceptions (e.g., Gavetti and Levinthal, 2000; Edelman and Yli-Renko, 2010).

To sum up, founders interact with their business environment to gain access and utilise resources needed to enhance their NTBFs' early development, such as technology commercialisation and first sales. Interaction with the business environment, especially, close interaction, further enables founders to fit their idea with the market and the customers' needs. Moreover, interaction between the founder(s) and the business environment provides the founder with knowledge of how to orient the firm strategically. This is because interaction (externally) impacts and shapes schemas and perceptions of 'what is possible'. For example, close relations with customers can support commercialisation and sales as they can help founders understand their needs. They can also reveal how the firm's technology can contribute and support them. In addition, the business environment may also set boundaries for how business can be or should be done within a certain industry sector, thus influencing the firm's business model development. However, over time, founders' gain experiences and these experiences shape and structure schemas for decision-making. Hence, these schemas provide

founders with ways of how they may want to do business and lead to the creation of firm procedures that founders can rely on for future decisions.

I thought that I can start a little differently this time. I can use my experience from the previous model and lessons to do the right thing or to do things differently.

(Founder of Beta in the empirical study 2 about previous mistakes)

From the above, it can be concluded that internal and external resource dimensions (specifically the interaction between the founder and external stakeholders in the business environment) shape and structure the NTBFs in the early stage of development, and that these influences emerge from informal relationships and/or close interactions. These interactions provide resources to the founder such as financing and market awareness. This adds to research emphasising close relationships for innovativeness (e.g., Yli-Renko et al., 2001a), especially the use of close and informal relationships in the early development stage (Birley, 1985; Hite and Hesterly, 2001; Letaifa and Rabeau, 2013). This can be explained by the fact that informal relationships can easily support the founders and their NTBFs with, for example, financial capital (as explained by previous research, e.g., Colombo and Grilli, 2010; Brinckmann et al., 2011), which is otherwise difficult to attract due to lack of signalling quality of technology achievements (e.g., Hsu, 2007). However, it can be concluded from the above findings that it is not always a matter of formality (i.e., informal and formal relationships) in the case of such interactions. The distance (closeness) is revealed to be more important for the interaction critical to the structuring of the businesses.

Moreover, it can be concluded that, during the early development, either the internal or external resource dimensions will have more influence on the structuring of the businesses of NTBFs. The industry may set rules of how the firm may be able to sell or how external stakeholders (e.g., customers) may drive the firm to make changes in their value proposition (product or service offering) or even business model. However, it can be concluded that a significant influence is exerted by founders' experiences and knowledge and their ability to sort out what is useful and important from the opinions and recommendations provided by others and from the external business environment. This aspect makes internal resource dimensions more dominant over time. In some way, decisions of the founders seem to be a mixture of conscious choices and unconscious choices. The latter is evident when the founders have little or no previous experience and they are required to depend on external stakeholders.

5.2 How do internal resource dimensions impact NTBFs' early development?

From an RBV, founders' human capital (e.g., experiences) provide means for their firms' competitive advantage. Founders' perceptions based on previous education, business experience, or influences from others, impact the development and performance of these young firms (e.g., Neill et al., 2017). Accordingly, the second research question focuses on the impacts of internal resource dimensions on NTBFs' early development.

Extant research has demonstrated different effects of founders' human capital (e.g., business experience) on firm performance (e.g., Davidsson and Honig, 2003; Colombo and Grilli, 2005; Brinckmann et al., 2011), although much of the focus is on the positive effects on NTBFs. Concerning NTBFs early development and performance, founders' business experience has been found to positively influence their firms' business performance in the early stage of development (Paper 2); particularly, it focuses on founders' perceived satisfaction from the early commercialisation of the developed technology (product or service) and firm growth. This supports extant research that demonstrates that managerial experience impact firm performance (e.g., Colombo and Grilli, 2005). Moreover, as founders' business experience provide them with knowledge about the industry and market, it can enhance their abilities to attract employees and initiate sales. This can explain how they perform and develop their firms initially, and thereby influence their firms' business performance.

Moreover, business experience can increase founders' relationships within the industry sector (business environment), which can contribute towards the firm's early development (Paper 5). For example, business networks (and relationships within these) can support the young firms in finding a product that meets customers' needs, and they can also enable firms to differentiate themselves in the market (Morris et al., 2005; Reymen et al., 2017). Both formal and informal business networks related to founders' social relationships positively impact the firms' early development as these networks enable firms to differentiate their offering (Papers 3 and 4). Thus, these networks enhance firms' innovation performance in the early development phase.

Accordingly, founders' relationships within the business networks (and business environment) may support the firm during its early development. In this regard, both founders' human capital and relationships can be argued to affect the firms' early development and performance, however, for different reasons. Although founders' relationships can strengthen the firms' abilities to differentiate themselves—enhancing the innovativeness of the firms' offerings by providing access to valuable resources (Yli-Renko et al., 2001a; Elfring and Hulsink, 2003;

Löfsten, 2015; Paper 3)—founders’ experiences can make them perceive growth (development) differently compared to those with less prior experience (Paper 2). This, in turn, may affect founders’ attitudes towards growth. In other words, founders with more prior business experience may exhibit a tendency to be over optimistic in the early stage of their firms’ development, affecting their early business performance negatively (Paper 2). Nevertheless, such orientation towards growth (even if it is less common for NTBFs in early stage of development) can drive the founders to focus more on being novelty-oriented (Paper 4) and to differentiate their firms against competitors, which can prove to be crucial to firm’s development in the long-run (e.g., Edelman and Yli-Renko, 2010). This is because NTBFs must distinguish their technology (and business model) to create competitive advantage and perform over time.

From the above, it can be concluded that internal resource dimensions, such as founders’ business experiences and their social relationships, seem to support the firms’ early development related to business performance (e.g., satisfaction with marketing technology and first sales) as well as contribute towards differentiating their offering.

Moreover, founders’ attitude towards growth (in those cases where it exists) can impact his or her decision to be more novelty-oriented and to differentiate the firm against competitors. It can also make founders’ over-optimistic in the early stage, which can affect their satisfaction of early business performance negatively if they do not perform as expected.

The aforementioned finding leads to the conclusion that founders’ previous business experience significantly influences NTBFs’ development, especially their innovation performance (patents). It also influences their potential for future growth by attracting employees and financial capital. This finding is in line with the research demonstrating that previous experiences, education (human capital), and relationships help firms to overcome information asymmetry (Hsu, 2007) However, it can be concluded that more experiences can lead founders to having higher expectations from their performance during early development, which can lead to over-optimism (see also e.g., Busenitz and Barney, 1997; Baron, 2007; Fourati and Attitalah, 2018).

5.3 How do external resource dimensions impact NTBFs' early development?

External resource dimensions comprise the firm's business environment—their business network and relationships—and has long been recognised as a determinant for how the firm will develop due to their imprinting effects (e.g., Boeker, 1988, 1989; Mathias et al., 2015). The industry sector that also constitutes a part of the business environment might set rules and principles of how to do business that can constrain the way founders want to do business as well as what they may perceive as the right way of doing business (Edelman and Yli-Renko, 2010). Concerning the early development of NTBFs, previous research has shown different, and sometimes contradictory, results regarding how the business environment (e.g., business networks, industry, and science parks) impacts the young firms' performance and how they do business (see e.g., Siegel et al., 2003; Ferguson and Olofsson, 2004; Löfsten, 2010). However, the possible imprinting effect of the business environment on the NTBFs' early development is of importance to explain founders' decisions about their firms, and thus their performance in the end.

In this thesis, the third research question asks how external resource dimensions impact the early development of NTBFs. One aspect related to the firms' early development is their ability to differentiate themselves in the market and gain competitive advantage. To develop their technology (and differentiate it from other technologies) as well as their firms' businesses, NTBFs are often required to gain access to resources that they do not possess internally, such as R&D equipment and facilities. Studies showed that the firms' business networks and the relationships within these networks provide such accessibility (e.g., Yli-Renko et al., 2001a; Löfsten and Lindelöf, 2003). Business networks can be divided into formal and informal relationships (Birley, 1985). However, in the early stage of development, it is more common that firms depend on informal relationships as they lack legitimacy and other connections (Birley, 1985; Hite and Hesterly, 2001; Jack et al., 2010). Accordingly, informal networks may provide the firm with valuable resources to start their business; however, formal networks have often been emphasised as providing inputs for innovation (Löfsten, 2015; D'Ambrosio et al., 2017). Papers 3 and 4 provide robust insights that both formal and informal business networks are important for NTBFs in their early development phase (see e.g., previous research by Elfring and Hulsink, 2003). Both types of business networks positively impact the early development of NTBFs in terms of differentiating the firms' offerings (Paper 3 and 4). Thus, they play a significant role in enhancing firms' ability to be innovative, which is important for NTBFs that are technology-intensive and are based on the development and commercialisation

of technology (Bollinger et al., 1983; Colombo et al., 2006; Löfsten, 2016b). Accordingly, NTBFs' business networks impact founders' strategic orientation towards being more novelty-oriented (Paper 4).

Besides the business networks, extant research showed that localisation of the firm is an important aspect to consider in relation to the firms' business environment, such the location of the firms on or off science parks, the role of incubators (Löfsten and Lindelöf, 2002, 2003), or the positioning of the firm in a region that can provide necessary resources (Maine et al., 2010). Regarding this, Paper 3 provides insights that certain regions have positive consequences and effects for NTBFs' early development when it comes to innovation performance, such as providing technology (product or service) differentiation. These regions consist of industrial areas that can provide local or regional advantages, such as enhanced communication, better recruitment opportunities, lower facility costs, and proximity to universities. Studies have showed that universities and research institutes significantly impact NTBFs' technology development and hence their businesses development (Autio and Yli-Renko, 1998; Fergusson and Olofsson, 2004; Lindelöf and Löfsten, 2004; Löfsten and Lindelöf, 2005; Dettwiler et al., 2006; Camisón-Haba et al., 2019).

Although localisation close to universities and industrial areas has a positive impact on NTBFs' early development, proximity to other stakeholders within the business environment can have other consequences for the firms. Proximity to customers have been highlighted as important for supporting such firm's development of the technology (and the product or service) that fits with the market's needs, and thus it can help them to find a suitable value proposition (Reymen et al., 2017). Customers and other external stakeholders can enhance the NTBFs' chances to gain access to vital resources as and gain legitimacy needed in the early stage of development (Yli-Renko et al., 2001a; Clarysse et al., 2011). For NTBFs' early development and performance, proximity can enhance the firms' business performance as it might help firms to commercialise and sell their technology with ease (product or service) (Paper 2). Hence, in order to gain satisfaction from early business performance (e.g., time-to-market, sales growth), it is beneficial for the founders to establish their firms close to other similar firms, competitors, and customers during the early stage of development. Close interaction, which is facilitated by proximity, can influence the decisions made by the founders on how to do business, since the impact of closer interaction (and relationships) on the founder is higher compared to distant relationships. It can direct founders' attention towards certain business activities (as part of the

business model) (Paper 5) in certain environmental context, and thus, the configuration of the firm in its early stage of development.

Moreover, besides the role of resource accessibility in developing the technology (or e.g., the product and service) for NTBFs, proximity has been demonstrated to have certain positive effects on the level of innovation achieved by a technology, but only in the early development stage (Letaifa and Rabeau, 2013). This shows that the reliance of a firm's product differentiation on proximity would reduce over time. However, proximity does not always support firms' differentiation in the early stage of their development, but it can also influence their early innovation performance negatively (Paper 3). Accordingly, the proximity dimension in the business environment seems to have both positive and negative effects on NTBFs' performance in their early stage of development.

According to the discussion, it can be concluded that the external resource dimensions, such as business networks and firm localisation within the business environment, both positively and negatively impact the NTBFs' innovation performance during their early development. On the positive side, business networks and proximity to industrial regions and universities enhance firms' possibility to differentiate their product or service offering and hence their innovation performance. Although proximity to, for example, customers can support first sales and the firms' business performance, close interaction resulting from proximity can impact the founders' decisions on how to do business, and these decisions may not always support firms' innovativeness in their initial years.

From this, it can be concluded that external resources related to the business environment (industry and the business networks) and how the NTBFs establish their firms close to others (e.g., universities) have an important impact on the firms' abilities to develop their product or service and their businesses in novel ways. Thus, this thesis adds to the extant research that discusses the environmental impact on growth paths of NTBFs (e.g., Clarysse et al., 2011). This finding adds the aspect of NTBFs' differentiation and innovation performance (adding to research on patents, e.g., Börjesson and Löfsten, 2012; Ramírez-Alesón and Fernández-Olmos, 2018). It can further be concluded that NTBFs need to consider the reason different external stakeholders maintain close relationships with the firm and its founders, especially in terms of the former's impact on the latter's innovation performance.

5.4 Early development of NTBFs

The extant research on NTBFs, on which this thesis is built, is conducted stage wise. In other words, the research is conducted several years after the firms are funded. This leaves a gap for understanding these firms' initial conditions for future development, performance, and survival. Particularly, there is a gap concerning the resources that impact and structure the initial conditions in the early development stage and how the development progresses through an interaction between the resources—both internal and external to the firms—with a specific focus on the founders of the firms. Thus, broadening the understanding of NTBFs' early development includes exploring the resources internal and external to the firms. The research presented in this thesis reveals that impacts from internal resource dimensions connected to the founders and, specifically, previous experiences from the industry and the market (i.e., human capital) provide a basis for NTBFs' business and innovation performance in their initial years. This is because the perceptions of first sales, time-to-market, and product differentiation or patents are related to the founders' decisions and attitudes about their firms and their relationships, which support and enhance, for example, innovation performance and sales. Both experiences and relationships can provide knowledge about the industry and how the firm can differentiate itself from others. Additionally, relationships create market awareness, which is otherwise emphasised as lacking in the case of NTBFs (see e.g., the summary of constraints of NTBFs by Storey and Tether, 1998). Previous research on NTBFs has further argued that experiences and informal relationships are important as they can support in reducing information asymmetry between founders and external stakeholders (e.g., investors) and provide a basis for initial financing (Hsu, 2007). Additionally, studies have shown that patent development during the early stage of NTBFs' development provides competitive advantage and reduce the barriers to funding initially (Conti et al., 2013; Hottenrott et al., 2016). Patent development can attract investors' attention, however, the research in this thesis concludes that in the early stage NTBFs seldom have patents. Additionally, as demonstrated in Paper 3 (as well as in the empirical study 1 and 2), most NTBFs do not apply for patents, but focus more on the differentiation of their technology in the early stage. This can be explained by the fact that the majority of NTBFs operates in industry sectors characterised as knowledge-intensive high-technology services wherein patenting is not as common as that in the high-technology manufacturing industry sectors.

Furthermore, relationships with external stakeholders and business networks in the business environment may be facilitated by proximity. Overall, the research demonstrates that proximity

in terms of business localisation is an important external resource dimension as it enables NTBFs to, for example, take advantage of knowledge spillover from universities. Thus, such locations and relationships provide important means for the early development of NTBFs. Previous research demonstrates the same result for relatively older firms in their later stages of development (Audretsch and Lehmann, 2005; Audretsch et al., 2005; Fudickar and Hottenrott, 2019). Additionally, business networks (both informal and formal) enhance innovation performance, but closeness to external stakeholders exerts varying impacts on the early development of these firms in relation to founders' perceived satisfaction about their business performance or development in case of structuring the business (model). Accordingly, impacts from the business environment (external resource dimensions) can emerge from their interaction with the founders of the NTBFs. This is because the specific impacts would be non-existent without founders' decision to acknowledge and act upon the influences from others. Hence, this thesis highlights founders as the main influencers of the firms' early development (in line with other scholars, e.g., Edelman and Yli-Renko, 2010). However, founders' previous experiences seem to influence the extent to which external stakeholders and the business environment impact the firm structure and how the firms will do business (i.e., business model). Thus, the maturity of the founders enhances their ability to sort out and addresses important issues (for better or worse) and enables them to pursue firm performance in its early development stage. This is related to previous research on new firms that shows that founders use heuristics to make decisions in cases of uncertainty (Busenitz and Barney, 1997; Sarasvathy, 2001), as is the case of NTBFs in their early stage of development.

Finally, the research on NTBFs' early development demonstrates the usefulness of the business model concept in reflecting the decisions and the structuring of the NTBFs' business activities. This concept provides a valuable basis for understanding how internal and external resource dimensions impact and structure the early development, especially emphasising the shifting attitudes of the founders over time.

6 Conclusions and implications

The research presented in this thesis provides several contributions and implications for both the research and practice associated with NTBFs. This final chapter presents a short summary of the main conclusions, followed by contributions and implications for research and practice. It concludes with suggestions for potential future research on these firms.

6.1 Conclusions

As stated in the introduction, the overall purpose of this thesis has been to explore how internal and external resource dimensions impact and structure the early development of NTBFs. From an RBV, these dimensions would form a basis for the firms' development as NTBFs rely on their founders' experiences and relationships to gain competitive advantage. Additionally, in their early years, NTBFs are resource scarce and need to interact with their business environment to create conditions for development. This leads to the question of how founders with their experiences, attitudes, relationships, and business environment influence how NTBFs develop, how business will be done, and how they will perform?

The research reveals that both resource dimensions (internally and externally) impact and structure the early development in terms of providing knowledge to the founders of NTBFs, influencing their perceptions of how to do business, and affecting the development in terms of performance. These findings lead to the conclusion that the impacts from both internal and external resource dimensions contribute towards NTBFs' early development by enhancing their innovation performance and enabling them to differentiate their technology (product or service) for gaining competitive advantage.

The interaction between the founder and the business environment further reveals that founders' experience over time, in terms of maturity, provides important insights in explaining the early development as external influences become easier to sort. Thus, it can be concluded that, in the case of the early development of NTBFs', internal or external influences seem to be more dominant depending on how much founders rely on their own ideas and experiences.

Moreover, according to the discussion on the external dimensions and how they interact with the founders to influence and structure the early development of NTBFs, it can be concluded that business model as a concept is valuable to understand how the early development progresses. This is reflected through the development of the firm structure and, in particular, the structuring around the offering (value proposition).

6.2 Contribution to research and practice

The thesis contributes to research on NTBFs and their early development, adding knowledge about the impact of the internal (founder) and external (business environmental) resource dimensions on this development. This section presents the main contribution of the thesis to research on NTBFs; it is followed by this research's contributions and its implications. These elements are outlined in relation to each research question about interaction; they are also presented in terms of the impact from resources on early development of NTBFs.

6.2.1 Main contribution to research on early development of NTBFs

Davis and Parker (1997) present four types of contributions of a dissertation: (1) new or improved evidence, (2) new or improved methodology, (3) new or improved analysis, and (4) new or improved concepts or theories. Contribution of a dissertation can be based on more than one of these and this thesis, in particular, contributes to research about NTBFs in terms of improved evidence and a new, improved methodology. In short, the contributions to research on NTBFs' can be summarised as follows:

- Improving evidence by adding and broadening the knowledge on the early development of NTBFs
- Improving evidence and methodology by adding the concept of business model to the research on NTBFs' early development

Regarding the former of these two, the thesis contributes to research by improving evidence and adding to the understanding on NTBFs' early development. It studies the firms in their early stage of development (first years after founding), in contrast to most research on NTBFs that have studied them after some years of founding (see e.g., Löfsten and Lindelöf, 2002; Kolmer and Dowling, 2004; Gao et al., 2010; Ganotakis, 2012; Fudickar and Hottenrott, 2019). By studying the firms in the years after founding, the thesis provides improved insights to their early development, and hence clarifies how different resources enable firms to perform in their early years of development and impact and structure the way they will do business (i.e., their business models). By studying both internal and external resource dimensions together, rather than separately, the thesis further adds improved evidence to how the founder and the business environment influence the early development. This adds to previous research on new firm development, with a focus on NTBFs (e.g., Klofsten, 1994; 2005; Billström, 2018).

Furthermore, the second contribution concerns with new improved evidence and methodology regarding NTBFs' early development. New improved evidence is provided by highlighting how NTBFs' develop (as analysed through their business model development) in interaction with external stakeholders (within the business environment) and when the influence of the business environment reduces as a result of founders' perceptions and decisions on how to do business. Research on business model development has demonstrated and highlighted the importance of stakeholder interaction for developing a viable business model (e.g., Amit and Zott, 2015; Reymen et al. 2017; Margiono et al., 2018). This thesis provides new empirical evidence on how NTBFs' early development, (partly) analysed from the perspective of business model development, is influenced by interactions with others and how the extent of impact exerted by different stakeholders may depend on founders' mental schemas.

New, improved methodology is provided for exploring new ways of studying initial business models—how the firms do business as a way of understanding their development—and to obtain data about firms' early business models (new procedure for data collection about firms' business models), which can be read more in detail in Papers 1 and 5.

6.2.2 Implications coupled to structuring of NTBFs' businesses

Interaction between the founder and the firms' external business environment, including external stakeholders, is inevitable for NTBFs (as for other firms new or not) to develop and to perform in the long-run (Bamford et al., 2000; Edelman and Yli-Renko, 2010; De Massis et al., 2018). Within this thesis, such interaction in regard to resources internal and external to the NTBFs contribute to a nuanced view of these firms' early development. This especially concerns how the concept of business models enhance our way of studying early development of NTBFs and how external stakeholders, such as customers, interact and influence the founders to make decisions about their technology and the structuring of businesses. Starting internally with founders' experiences and relationships, the founders' ideas about the business are starting points to develop the NTBFs. The more experienced the founder, the more they can sort out to the focus areas when structuring their business activities and developing their product or service. This is important in relation to considering influences and pressures from external stakeholders during the early stage of firms' development. At this stage, the firm has lesser established structures, which can be easily changed. Therefore, the founder and resources connected to his or her must be considered when studying the early development of NTBFs. However, the founder has previously been left out in most research on NTBFs. An exception is

Klofsten (1994, 2005); this thesis adds to such research and emphasises that research on NTBFs' early development must consider the internal resource dimensions and the founder to understand NTBFs' development, performance, and survival over time.

For founders of NTBFs, the first years of development involves struggles pertaining to the development of the offering, identification of a suitable revenue model to commercialise and sell the product or service, and establishment of relationships to gain access to necessary resources for this development (Klofsten, 1994; Reymen et al., 2017). Founders face time constraints when they attempt to develop and build their firms, commercialise their technology, and compete with others, and their situation is very uncertain. It might be useful to develop awareness of the impacts that the business environment can have on the firm development and to understand that much iteration and interaction with others will be needed to develop and structure the business. However, some industries are more reluctant to changes or new ways of doing businesses and have higher barriers to entry for NTBFs, and these factors further have consequences for time to establish the firm. This thesis provides contributions concerning that less (business) experienced founders tend to change their way of doing business more, which has implications for the development (and performance) of the firms. Thus, practitioners (e.g., founders and business coaches) need to recognise the external influence on the firm related to both time and financing, based on the previous experiences of the founders. Accordingly, supporters of NTBFs (e.g., policymakers and incubation management) need to consider how to design support systems. If these firms are to be supported for technology development that is important for, for example, large established companies in high-tech sectors, then certain dimensions of the firms related to both the founders' previous experiences and the industry in which they are operating should be considered to support their development. Incubator management can, for example, consider the type of network relationships for which they can extend support and how to encourage firm growth for supporting the firms' novelty-orientation. Moreover, they should be aware of the early development stage of the founder in order to adapt their support.

6.2.3 Implications coupled to the impact of resources internal to NTBFs

Based on the previous section on the importance of putting the founder at the centre of NTBFs' early development, resources internal to the firms exert certain impacts on the development per se (as shown both in this thesis and by previous researchers) (e.g., Colombo and Grilli, 2005; Clarysse et al., 2011; Brinckmann et al., 2011). The contributions related to the internal impact

on NTBFs and their early development improved evidence on how previous experiences of founders' impact innovation performance and business performance, with a focus on the ambitions of the firms (and their founders). This would imply that NTBFs' abilities to develop in novel ways, their innovativeness, depend on previous experiences of the founders and their ambitions. It is also related to how the founders perceive their performance (development) and whether they are satisfied with it, which can have consequences in the future (as demonstrated by Cooper and Artz, 1995; Edelman and Yli-Renko, 2010). Accordingly, in relation to previous research on NTBFs, the contributions in this thesis add to our knowledge about the impact of internal resources (e.g., human capital) on other dimensions than on growth and survival (see e.g., Almus and Nerlinger, 1999; Lindström and Olofsson, 2001; Brinckmann et al., 2011; Ejermo and Xiao, 2014; Löfsten, 2016a; Rannikko et al., 2019).

In the case of practitioners (e.g., founders of NTBFs), they could consider the experiences and knowledge that the founder or founding team have and accordingly determine what can be developed or acquired (such as hiring new employees). This will enable them to positively impact and develop their firms in the early stage.

6.2.4 Implications coupled to the impact of resources external to NTBFs

Contributions in relation to the resources external to NTBFs, within the business environment, deal with how the business networks and the localisation of the firms, including the proximity to external stakeholders, impact the early development. Similar to impacts of resources internal to the NTBFs, the thesis contributes to previous research on these firms by focusing on how resources impact firms' ability to be innovative, rather than examining their growth and survival in the early stage of development. Especially, contributions are added by demonstrating how both informal and formal business networks are important for NTBFs' differentiation and innovation performance. However, proximity does not seem to always support such performance in the early stage, contradicting some earlier findings (see e.g., Yli-Renko et al., 2001a, Maine et al., 2010). Nevertheless, the thesis also adds to the research by highlighting the positive impact of firms' proximity to industrial regions and universities on NTBFs' early development.

These contributions can apply to practitioners as well as researchers. The empirical evidence provides implications for founders (and managers) of NTBFs by suggesting the founders to consider localisation of their firms in addition to business networks to enhance their firms' ability to be innovative. For agencies supporting the founders of NTBFs and policymakers, such

as incubator management, business coaches at science parks, and business incubators, the thesis provides improved evidence on the complexity of NTBFs' early development. External resources are needed for NTBFs to develop; and if these firms are going to be supported for technology development and innovation (as mentioned previously), the support organisations need to assess their contribution towards enhancing such development (e.g., provide access to both informal and formal networks).

6.3 Future research

NTBFs are important for any industry's technology development and innovation. Based on the emphasis by policymakers and researchers, support organisations (i.e., science parks and business incubators) have been receiving financial support to assist new firms in their growth. A future research on NTBFs' early development can provide insights on how to further support these firms and hence their technology (product or service) development.

This thesis shed light on how internal and external resource dimensions influence the early development of NTBFs; however, this development is complex and future research is needed to understand these effects over time.

This thesis not only examined NTBFs in their initial stage, but it also conducted a longitudinal study on two firms in the same industry sector. NTBFs operate in several high-tech industries. In this context, to better understand their early development, such as the development of mental schemas and influences from external environment, more industry sectors must be included. Moreover, it may also be of interest to follow-up and study the relationship between business performance (perceived satisfaction) and actual performance (e.g., ROA, ROE) over time, which will provide an understanding of how internal and external resources influence NTBFs' performance. In addition, survival of NTBFs could be examined more to understand why some firms remain while other do not, especially since previous research has been contradicting regarding results and measurements. A clearer understanding of NTBFs' development and their survival can be gained by examining the financing aspects of these firms. Early stage financing would, for example, be of interest as many of these firms experience difficulties in developing due to funding issues. Not only do NTBFs still to some extent apply for patents only to later withdraw them after establishing contacts with investors (thus much time spent on patent application rather than on developing their technology and businesses), but a substantial amount

of funding is provided at a later stage of their development, according to founders¹⁰; they express that public funding is not designed to meet their needs.

Furthermore, this thesis has only studied NTBFs in a stage when the managerial responsibilities lie with one founder or two persons. During the firm development, new people might join, for example, because new knowledge and expertise are needed. For example, investors may join when the firm tries to expand and needs new financial capital, or a new CEO may be appointed to take the firm to new markets. To study future developments of NTBFs related to changes in internal or external resource dimensions, a longitudinal case study over several years might be required. This will enhance our understanding of how to further support these firms in their development.

Finally, the empirical studies in this thesis reveals insight on early business development (and business model development) of NTBFs and external stakeholders' (business environment) influence on this development. However, there are several examples wherein new business models from technology-based firms have made old ones (commonly used in one industry) obsolete (e.g., Chesbrough, 2007; Sosna et al., 2010). Regarding this, it would be interesting to conduct studies on how NTBFs' business models influence the business environment and how and why they might change the existing (dominant) ones. There may also be the case wherein business models may develop within entrepreneurial ecosystems; however, this phenomenon remains to be studied. In relation to entrepreneurial ecosystems, possible directions for future would include an examination on how NTBFs develop in different settings (different entrepreneurial ecosystems). How some regions are more successful in supporting and enhancing emergence of NTBFs? What elements are causing and influencing emergence, development, and survival of NTBFs, and how can such systems be designed? Future research on NTBFs can explore these aspects to provide an increased understanding of their development.

¹⁰ This was expressed during interviews with founders in empirical studies 1 and 2, although not specifically included in the appended papers of this thesis.

References

- Aaboen, L., Lindelöf, P., von Koch, C., and Löfsten, H. (2006). Corporate governance and performance of small high-tech firms in Sweden. *Technovation*, 26(8), 955–968.
- Almus, N., and Nerlinger, E.A. (1999). Growth of new technology-based firms: Which factors matter? *Small Business Economics*, 13(2), 141–154.
- Alvarez, S.A., and Busenitz, L.W. (2001). The entrepreneurship of resource-based theory. *Journal of Management*, 27(6), 755–775.
- Amit, R., and Zott, C. (2015). Crafting business architecture: The antecedents of business model design. *Strategic Entrepreneurship Journal*, 9(4), 331–350.
- Andersson, F., Heyman, F., Norbäck, P.-J., and Persson, L. (2016). Has the Swedish business sector become more entrepreneurial than the U.S. business sector?. Working Paper Series No. 1147, Research Institute of Industrial Economics, revised 19 Nov 2018.
- Andries, P., and Debackere, K. (2007). Adaptation and performance in new businesses: Understanding the moderating effects of independence and industry. *Small Business Economics*, 29(1-2), 81–99.
- Arantes, F.P., Caetano, M., de Paula, V.A.F., and Freitag, M.S.B. (2019). New independent technology-based firms: differences from other NTBFs and future research agenda for technology innovation management. *International Journal of Entrepreneurship and Innovation Management*, 23(1), 46–71.
- Ardichvili, A., Cardozo, R., and Ray, S. (2003). A theory of entrepreneurial opportunity identification and development. *Journal of Business Venturing*, 18(1), 105–123.
- Arya, B., and Lin, Z. (2007). Understanding collaboration outcomes from an extended resource-based view perspective: The roles of organizational characteristics, partner attributes, and network structures. *Journal of Management*, 33(5), 697–723.
- Aspelund, A., Berg-Utby, T., and Skjævdal, R. (2005). Initial resources' influence on new venture survival: a longitudinal study of new technology-based firms. *Technovation*, 25(11), 1337–1347.
- Audretsch, D.B., and Lehmann, E.E. (2005). Does the knowledge spillover theory of entrepreneurship hold for regions? *Research Policy*, 34(8), 1191–1202.

- Audretsch, D.B., Lehmann, E.E., and Warning, S. (2005). University spillovers and new firm location. *Research Policy*, 34(7), 1113–1122.
- Autere, J., and Autio, E. (2000). Is entrepreneurship learned? Influence of mental models on growth motivation, strategy, and growth. In Academy of Management Conference.
- Autio, E., and Yli-Renko, H. (1998). New, technology-based firms in small open economies – An analysis based on the Finnish experience. *Research Policy*, 26(9), 973–987.
- Bamford, C.W., Thomas, J.D., and McDougall, P.P. (2000). An examination of the impact of initial founding conditions and decisions upon the performance of new bank start-ups. *Journal of Business Venturing*, 15(3), 253–277.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Baron, R.A. (2007). Behavioral and cognitive factors in entrepreneurship: Entrepreneurs as the active element in new venture creation. *Strategic Entrepreneurship Journal*, 1(1–2), 167–182.
- Bengtsson, L. (2004). Explaining born globals: An organizational learning perspective on the internationalization process. *International Journal of Globalization and Small Business*, 1(1), 28–41.
- Bertoni, F., Colombo, M.G., and Grilli, L. (2011). Venture capital financing and the growth of high-tech start-ups: Disentangling treatment from selection effects. *Research Policy*, 40(7), 1028–1043.
- Bhave, M.P. (1994). A process model of entrepreneurial venture creation. *Journal of Business Venturing*, 9(3), 223–242.
- Bhide, A.V. (2000). *The Origin and Evolution of New Businesses*. Oxford University Press, New York.
- Billström, A. (2018). *Human capital, social networks and new firm formation - The role of academic and external entrepreneurs in university spin-offs*. Doctoral dissertation, Chalmers University of Technology, Gothenburg, Sweden.
- Birley, S. (1985). The role of networks in the entrepreneurial process. *Journal of Business Venturing*, 1(1), 107–117.

- Bloomberg (2018, January 23). The U.S. drops out of the top 10 in innovation ranking. Retrieved from <https://www.bloomberg.com/news/articles/2018-01-22/south-korea-tops-global-innovation-ranking-again-as-u-s-falls>.
- Boeker, W. (1988). Organizational origins – Entrepreneurial and environmental imprinting at the time of founding. In Carroll, G.R. (ed.). *Ecological models of organizations*. Ballinger Publishing Company, Cambridge, MA, 33–51.
- Boeker, W. (1989). Strategic change: The effects of founding and history. *The Academy of Management Journal*, 32(3), 489–515.
- Bollinger, L., Hope, K., and Utterback, J.M. (1983). A review of literature and hypotheses on new technology-based firms. *Research Policy*, 12(1), 1–14.
- Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77–101.
- Braunerhjelm, P., and Henrekson, M. (2016). Från utbildning, forskning och innovation till växande företag och stigande välstånd. In McKelvey, M., and Zaring, O. (1st ed.) *Sveriges entreprenöriella ekosystem: Företag, akademi, politik*. ESBRI, Stockholm, Sweden, 302–315.
- Brinckmann, J., and Hoegl, M. (2011). Effects of initial teamwork capability and initial relational capability on the development of new technology-based firms. *Strategic Entrepreneurship Journal*, 5(1), 37–57.
- Brinckmann, J., Salomo, S., and Gemuenden, H.G. (2011). Financial management competence of founding teams and growth of new technology-based firms. *Entrepreneurship Theory and Practice*, 35(2), 217–243.
- Bryman, A., and Bell, E. (2011). *Business Research Methods*. Oxford University Press, New York, USA.
- Busenitz, L.W., and Barney, J.B. (1997). Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing*, 12(1), 9–30.
- Business Sweden (2015). Därför tillverkar vi i Sverige – Drivkrafter och förutsättningar för tillverkningsindustrin i Sverige 2015. Vitt Grafiska Produktion AB, <https://www.business-sweden.se/contentassets/3ddf7f59c6194c5280dd03463cfe350a/darfor-tillverkar-vi-i-sverige---business-sweden-2015.pdf>

- Börjesson, S., and Löfsten, H. (2012). Capabilities for innovation in small firms – A study of 131 high-tech firms and their relation to performance. *International Journal of Business Innovation and Research*, 6(2), 149–176.
- Camisón-Haba, S., Clemente-Almendros, J.A., and Gonzalez-Cruz, T. (2019). How technology-based firms become also highly innovative firms? The role of knowledge, technological and managerial capabilities, and entrepreneurs' background. *Journal of Innovation & Knowledge*, 4(3), 162–170.
- Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. *Strategy & Leadership*, 35(6), 12–17.
- Chesbrough, H., and Rosenbloom, R.S. (2002). The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change*, 11(3), 529–555.
- Clarysse, B., and Moray, N. (2004). A process study of entrepreneurial team formation: the case of a research-based spin-off. *Journal of Business Venturing*, 19(1), 55–79.
- Clarysse, B., Bruneel, J., and Wright, M. (2011). Explaining growth paths of young technology-based firms: structuring resource portfolios in different competitive environments. *Strategic Entrepreneurship Journal*, 5(2), 137–157.
- Colombo, M.G., and Delmastro, M. (2001). Technology-based entrepreneurs: Does internet make a difference? *Small Business Economics*, 16(3), 177–190.
- Colombo, M.G., and Delmastro, M. (2002). How effective are technology incubators? Evidence from Italy. *Research Policy*, 31(7), 1103–1122.
- Colombo, M.G., and Grilli, L. (2005). Founders' human capital and the growth of new technology-based firms: a competence-based view. *Research Policy*, 34(6), 795–816.
- Colombo, M.G., and Grilli, L. (2010). On growth drivers of high-tech start-ups: Exploring the role of founders' human capital and venture capital. *Journal of Business Venturing*, 25(6), 610–626.
- Colombo, M.G., Grilli, L., and Piva, E. (2006). In search of complementary assets: The determinants of alliance formation of high-tech start-ups. *Research Policy*, 35(8), 1166–1199.

- Conti, A., Thursby, J., and Thursby, M. (2013). Patents as signals for startup financing. *The Journal of Industrial Economics*, 61(3), 592–622
- Cooper, A.C., and Artz, K.W. (1995). Determinants of satisfaction for entrepreneurs. *Journal of Business Venturing*, 10(6), 439–457.
- Cooper, A.C., and Bruno, A.V. (1977). Success among high-technology firms. *Business Horizons*, 20(2), 16–22.
- Cyert, R.M., and March, J.G. (1963). *A behavioral theory of the firm*. Prentice-Hall, Englewood Cliffs, NJ.
- D'Ambrosio, A., Gabriele, R., Schiavone, F., and Villasalero, M. (2017). The role of openness in explaining innovation performance in a regional context. *The Journal of Technology Transfer*, 42(2), 389–408.
- Das, T.K., and Teng, B.S. (2000). A resource-based theory of strategic alliances. *Journal of Management*, 26(1), 31–61.
- Davidsson, P., and Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, 18(3), 301–331.
- Davis, G.B., and Parker, C.A. (1997). *Writing the doctoral dissertation: A systematic approach* (2nd ed.). Barron's Educational Series, Hauppauge, New York.
- De Massis, A., Kotlar, J., Wright, M., and Kellermanns, F.W. (2018). Sector-based entrepreneurial capabilities and the promise of sector studies in entrepreneurship. *Entrepreneurship Theory and Practice*, 42(1), 3–23.
- Dettwiler, P., Lindelöf, P., and Löfsten, H. (2006). Utility of location: A comparative survey between small new technology-based firms located on and off Science Parks—Implications for facilities management. *Technovation*, 26(4), 506–517.
- Dmitriev, V., Simmons, G., Truong, Y., Palmer, M., and Schneckenberg, D. (2014). An exploration of business model development in the commercialization of technology innovations. *R&D Management*, 44(3), 306–321.
- Doganova, L., and Eyquem-Renault, M. (2009). What do business models do?: Innovation devices in technology entrepreneurship. *Research Policy*, 38(10), 1559–1570.

- Dyer, J.H., and Singh, H. (1998). The relational view: Cooperative strategy and source of interorganizational competitive advantage. *The Academy of Management Review*, 23(4), 660–679.
- Edelman, L., and Yli-Renko, H. (2010). The impact of environment and entrepreneurial perceptions on venture-creation efforts: Bridging the discovery and creation views of entrepreneurship. *Entrepreneurship Theory and Practice*, 34(5), 833–856.
- Eisenhardt, K.M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Eisenhardt, K.M., and Graebner, M.E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25–32.
- Eisenhardt, K.M., and Schoonhoven, C.B. (1990). Organizational growth: Linking founding team, strategy, environment, and growth among U.S. semiconductor ventures, 1978-1988. *Administrative Science Quarterly*, 35(3), 504–529.
- Ejermo, O., and Xiao, J. (2014). Entrepreneurship and survival over the business cycle: How do new technology-based firms differ? *Small Business Economics*, 43(2), 411–426.
- Elfring, T., and Hulsink, W. (2003). Networks in entrepreneurship: the case of high-technology firms. *Small Business Economics*, 21(4), 409–422.
- Eurostat. (n.d.). Eurostat – Your key to European statistics. Retrieved from <http://ec.europa.eu/eurostat>
- Eurostat. (2016, April 1). High-tech industry and knowledge-intensive services (htec). Retrieved from http://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm
- Eurostat (2019, April 1). Innovation statistics. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php/Innovation_statistics
- Feeser, H.R., and Willard, G.E. (1990). Founding strategy and performance: A comparison of high and low growth high tech firms. *Strategic Management Journal*, 11(2), 87–98.
- Ferguson R., and Olofsson C. (2004). Science parks and the development of NTBFs: Location, survival and growth. *The Journal of Technology Transfer* 29(1), 5–17.
- Flick, U. (2009). *An Introduction to Qualitative Research* (4th ed.). Sage Publications Ltd, London, England.

- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245.
- Forbes (2016, December 21). Sweden heads the best countries for business for 2017. Retrieved from <https://www.forbes.com/sites/kurtbadenhausen/2016/12/21/sweden-heads-the-best-countries-for-business-for-2017/#724a0e737ecd>
- Fourati, H., and Attitalah, R.B. (2018). Entrepreneurial optimism, the nature of entrepreneurial experience and debt decision for business start-up. *International Journal of Innovation Management*, 22(3), 1850024.
- Freel, M.S. (2003). Sectoral patterns of small firm innovation, networking and proximity. *Research Policy*, 32(5), 751–770.
- Fudickar, R., and Hottenrott, H.J. (2019). Public research and the innovation performance of new technology based firms. *The Journal of Technology Transfer*, 44(2), 326–358.
- Ganotakis, P. (2012). Founders' human capital and the performance of UK new technology based firms. *Small Business Economics*, 39(2), 495–515.
- Gao, J., Li, J., Cheng, Y., and Shi, S. (2010). Impact of initial conditions on new venture success: A longitudinal study of new technology-based firms. *International Journal of Innovation Management*, 14(1), 41–56.
- Gartner, W.G. (1985). A conceptual framework for describing the phenomenon of new venture creation. *The Academy of Management Review*, 10(4), 696–706.
- Gartner, W.B., Carter, N.M., and Reynolds, P.D. (2010). Entrepreneurial behavior: Firm organizing processes. In Acs, Z.J., and Audretsch, D.B. (eds.) *Handbook of entrepreneurship research*. Springer, New York, N.Y., 99–127.
- Gavetti, G., and Levinthal, D. (2000). Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45(1), 113–137.
- Geroski, P.A., Mata, J., and Portugal, P. (2010). Founding conditions and the survival of new firms. *Strategic Management Journal*, 31(5), 510–529.
- Gibbert, M., Ruigrok, W., and Wicki, B. (2008). What passes as a rigorous case study?. *Strategic Management Journal*, 29(13), 1465–1474.

- Gimeno, J., Folta, T., Cooper, A., and Woo, C. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly*, 42(6), 750–783.
- Gulati, R. (1999). Network location and learning: The influence of network and firm capabilities on alliance formation. *Strategic Management Journal*, 20(5), 397–420.
- Heydebreck, P., Klofsten, M., and Maier, J.C. (2000). Innovation support for new technology-based firms: the Swedish Teknopol approach. *R&D Management* 30(1), 89–100.
- Hite, J.M., and Hesterly, W.S. (2001). The evolution of firm networks: From emergence to early growth of the firm. *Strategic Management Journal*, 22(3), 275–286.
- Hoang, H., and Antoncic, B. (2003). Network-based research in entrepreneurship: a critical review. *Journal of Business Venturing*, 18(2), 165–187.
- Hottenrott, H., Hall, B.H., and Czarnitzki, D. (2016). Patents as quality signals? The implications for financing constraints on R&D. *Economics of Innovation and New Technology*, 25(3), 197–217.
- Hsu, D.H. (2007). Experienced entrepreneurial founders, organizational capital, and venture capital funding. *Research Policy*, 36(5), 722–741.
- Isaksson, A., Vanyushyn, V., and Hultén, P. (2013). The impact of managers' attitudes on SMEs' growth in northern Sweden. *International Journal of Entrepreneurship and Small Business*, 18(3), 298–312.
- Jack, S., Moults, S., Anderson, A.R., and Dodd, S. (2010). An entrepreneurial network evolving: Patterns of change. *International Small Business Journal*, 28(4), 315–337.
- Jones-Evans, D. (1995). A typology of technology-based entrepreneurs: A model based on previous occupational background. *International Journal of Entrepreneurial Behavior & Research*, 1(1), 26–47
- Jones-Evans, D., and Klofsten, M. (1997). Universities and local economic development: The case of Linköping. *European Planning Studies*, 5(1), 77–93.
- Kazanjian, R.K. (1988). Relation of dominant problems to stages of growth in technology-based new ventures. *Academy of Management Journal*, 31(2), 257–279.

- Kellermanns, F.W., Walter, J., Crook, R., Kemmerer, B., and Narayanan, V.K. (2016). Resource-based theory in entrepreneurship: A content-analytical comparison of researchers' and entrepreneurs' views. *Journal of Small Business Management*, 54(1), 26–48.
- Kirkley, W.W. (2016). Creating ventures: decision factors in new venture creation. *Asia Pacific Journal of Innovation and Entrepreneurship*, 10(1), 151–167.
- Klofsten, M. (1994). Technology-based firms: Critical aspects of their early development. *Journal of Enterprising Culture*, 2(1), 535–557.
- Klofsten, M. (1997). Management of the early development process in technology-based firms. In Jones-Evans, D., and Klofsten, M. (eds.), *Technology, innovation and enterprise: The European Experience* (1 ed.). Macmillan Press LTD. Chippenham, Wiltshire, 148–178.
- Klofsten, M. (2005). New venture ideas: An analysis of their origin and early development. *Technology Analysis & Strategic Management*, 17(1), 105–119.
- Klofsten, M. (2010). *The Business Platform – Entrepreneurship and management in the early stage of a firm's development*. (3rd edition), European Commission, TII, Luxembourg.
- Klofsten, M., and Jones-Evans, D. (2000). Comparing academic entrepreneurship in Europe – The case of Sweden and Ireland. *Small Business Economics*, 14(4), 299–309.
- Kollmer, H., and Dowling, M. (2004). Licensing as a commercialisation strategy for new technology-based firms. *Research Policy*, 33(8), 1141–1151.
- Letaifa, S.B., and Rabeau, Y. (2013). Too close to collaborate? How geographic proximity could impede entrepreneurship and innovation. *Journal of Business Research*, 66(10), 2071–2078.
- Lindelöf, P., and Löfsten, H. (2002). Growth, management and financing of new technology-based firms – Assessing value-added contributions of firms located on and off Science Parks. *Omega*, 30(3), 143–154.
- Lindelöf, P., and Löfsten, H. (2004). Proximity as a resource base for competitive advantage: University–industry links for technology transfer. *The Journal of Technology Transfer*, 29(3–4), 311–326.
- Lindholm-Dahlstrand, Å. (1997). Growth and inventiveness in technology-based spin-off firms. *Research Policy*, 26(3), 331–344.

- Lindström, G., and Olofsson, C. (2001). Early stage financing of NTBFs: An analysis of contributions from support actors. *Venture Capital*, 3(2), 151–168.
- Little, A.D. (1979). *New Technology-Based Firms in UK and Federal Republic of Germany*. Wilton House Publications, London, UK.
- Lockett, A., Murray, G., and Wright, M. (2002). Do UK venture capitalists still have a bias against investment in new technology firms. *Research Policy*, 31(6), 1009–1030.
- Löfsten, H. (2010). Critical incubator dimensions for small firm performance – a study of new technology-based firms localised in 16 incubators. *International Journal of Business Innovation and Research*, 4(3), 256–279.
- Löfsten, H. (2015). Critical resource dimensions for development of patents – an analysis of 131 new technology-based firms in incubators. *International Journal of Innovation Management*, 19(1), 1550006.
- Löfsten, H. (2016a). Organisational capabilities and the long-term survival of new technology-based firms. *European Business Review*, 28(3), 312–332.
- Löfsten, H. (2016b). Business and innovation resources: Determinants for the survival of new technology-based firms. *Management Decision*, 54(1), 88–106.
- Löfsten, H., and Lindelöf, P. (2002). Science Parks and the growth of new technology-based firms – academic-industry links, innovation and markets. *Research Policy*, 31(6), 859–876.
- Löfsten, H., and Lindelöf, P. (2003). Determinants for an entrepreneurial milieu: Science Parks and business policy in growing firms. *Technovation*, 23(1), 51–64.
- Löfsten, H., and Lindelöf, P. (2005). R&D networks and product innovation patterns – academic and non-academic new technology-based firms on Science Parks. *Technovation*, 25(9), 1025–1037.
- Löwegren, M. and Bengtsson, L. (2010). University spin-offs in Sweden: A longitudinal study. *Industry and Higher Education*, 24(3), 219–225.
- Magretta, J. (2002). Why business models matter. *Harvard Business Review*, 80(5), 86–92.
- Maine, E.M., Shapiro, D.M., and Vining, A.R. (2010). The role of clustering in the growth of new technology-based firms. *Small Business Economics*, 34(2), 127–146.

- Margiono, A., Zolin, R., and Chang, A. (2018). A typology of social venture business model configurations. *International Journal of Entrepreneurial Behavior & Research*, 24(3), 626–650.
- Martins, L.L., Rindova, V.P., and Greenbaum, B.E. (2015). Unlocking the hidden value of concepts: a cognitive approach to business model innovation. *Strategic Entrepreneurship Journal*, 9(1), 99–117.
- Mathews, J.A. (2003). Competitive dynamics and economic learning: An extended resource-based view. *Industrial and Corporate Change*, 12(1), 115–145.
- Mathias, B.D., Williams, D.W., and Smith, A.R. (2015). Entrepreneurial inception: The role of imprinting in entrepreneurial action. *Journal of Business Venturing*, 30(1), 11–28.
- Mathisen, M.T., and Rasmussen, E.J. (2019). The development, growth, and performance of university spin-offs: a critical review. *The Journal of Technology Transfer*, doi.org/10.1007/s10961-018-09714-9.
- Maxwell, J.A. (2013). *Qualitative research design: An interactive approach* (3rd ed.). Sage Publications, USA.
- Morris, M., Schindehutte, M., and Allen, J. (2005). The entrepreneur's business model: Toward a unified perspective. *Journal of Business Research*, 58(6), 726–735.
- Murray, G.C., and Lott, J. (1995). Have UK venture capitalists a bias against investment in new technology-based firms? *Research Policy*, 24(2), 283–299.
- Neill, S., Metcalf, L.E., and York, J.L. (2017). Distinguishing entrepreneurial approaches to opportunity perception. *International Journal of Entrepreneurial Behavior & Research*, 23(2), 296–316.
- Norrman, C. (2008). *Entrepreneurship Policy Public Support for Technology-Based Ventures*. Doctoral dissertation, Linköping University, Linköping.
- O'Shea, R., Allen, T.J., O'Gorman, C., and Roche, F. (2004). Universities and technology transfer: A review of academic entrepreneurship literature. *Irish Journal of Management*, 25(2), 11–29.
- Osterwalder, A., and Pigneur, Y. (2010). *Business Model Generation*. John Wiley and Sons, New Jersey, USA.

- Patton, D. (2014). Realising potential: The impact of business incubation on the absorptive capacity of new technology-based firms. *International Small Business Journal*, 32(8), 897–917.
- Penrose, E.T. (1959). *The theory of the growth of the firm* (3rd ed.). Oxford University Press, Oxford, UK.
- Peteraf, M.A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 171–191.
- Pettigrew, A.M. (1997). What is a processual analysis?. *Scandinavian Journal of Management*, 13(4), 337–348.
- Podsakoff, P.M., MacKenzie, S.B., Lee J-Y., and Podsakoff, N.P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903.
- Podsakoff, P.M., MacKenzie, S.B., and Podsakoff, N.P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63, 539–569.
- Ramírez-Alesón, M., and Fernández-Olmos, M. (2018). Unravelling the effects of science parks on the innovation performance of NTBFs. *The Journal of Technology Transfer*, 43(2), 482–505.
- Rannikko, H., Tornikoski, E.T., Isaksson, A., and Löfsten, H. (2019). Survival and growth patterns among new technology-based firms: Empirical study of cohort 2006 in Sweden. *Journal of Small Business Management*, 57(2), 640–657.
- Reymen, I., Andries, P., Berends, H., Mauer, R., Stephan, U., and van Burg, E. (2015). Understanding dynamics of strategic decision making in venture creation: A process study of effectuation and causation. *Strategic Entrepreneurship Journal*, 9(4), 351–379.
- Reymen, I., Berends, H., Oudehand, R., and Stultiëns, R. (2017). Decision making for business model development: A process study of effectuation and causation in new technology-based ventures. *R&D Management*, 47(4), 595–606.
- Rickne, A., and Jacobsson, S. (1999). New technology-based firms in Sweden - A study of their direct impact on industrial renewal. *Economics of Innovation and New Technology*, 8(3), 197–223.

- Rizzo, U., Nicolli, F., and Laura Ramaciotti, L. (2013). The development process of new technology-based firms. *International Journal of Entrepreneurship and Innovation Management*, 17(4/5/6), 352–369.
- Rothaermel, F.T., Agung, S.D., and Jiang, L. (2007). University entrepreneurship: a taxonomy of the literature. *Industrial and Corporate Change*, 16(4), 691–791.
- Rydehell, H. (2019). Stakeholder roles in business model development in new technology-based firms. *International Journal of Innovation Management*, doi.org/10.1142/S1363919620500310.
- Rydehell, H., and Isaksson, A. (2016). Initial configurations and business models in new technology-based firms. *Journal of Business Models*, 4(1), 63–83.
- Rydehell, H., Isaksson, A., and Löfsten, H. (2019). Business networks and localization effects for new Swedish technology-based firms' innovation performance. *The Journal of Technology Transfer*, 44(5), 1547–1576.
- Rydehell, H., Löfsten, H., and Isaksson, A. (2018). Novelty-oriented value propositions for new technology-based firms: Impact of business networks and growth orientation. *Journal of High Technology Management Research*, 29(2), 161–171.
- Rydehell, H., Isaksson, A., and Löfsten, H. (2019). Effects of internal and external resource dimensions on the business performance of new technology-based firms. *International Journal of Innovation Management*, 23(1), 1–29.
- Saemundsson, R.J. (2003). The interaction between growth intentions, access to resources and growth in new technology-based firms. *The International Journal of Entrepreneurship and Innovation*, 4(2), 85–95.
- Saemundsson, R.J., and Candi, M. (2014). Antecedents of innovation strategies in new technology-based firms: Interactions between the environment and founder team composition. *Journal of Product Innovation Management*, 31(5), 939–955.
- Saemundsson, R.J., and Candi, M. (2017). Absorptive capacity and the identification of opportunities in new technology-based firms. *Technovation*, 64-65, 43–49.
- Sarasvathy, S.D. (2001). Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*, 26(2), 243–263.

- Sarasvathy, S.D. (2009). *Effectuation: Elements of Entrepreneurial Expertise*, Edward Elgar Publishing, Northampton, MA.
- Shane, S., and Cable, D. (2002). Network ties, reputation, and the financing of new ventures. *Management Science*, 48(3), 364–381.
- Siegel, D.S., Westhead, P., and Wright, M. (2003). Science parks and the performance of new technology-based firms: A review of recent U.K. evidence and an agenda for future research. *Small Business Economics*, 20(2), 177–184.
- Simsek, Z., Curtis Fox, B., and Heavey, C. (2015). “What’s past is prologue”: A framework, review, and future directions for organizational research on imprinting. *Journal of Management*, 41(1), 288–317.
- SISP (n.d.). About Swedish incubators and science parks. Retrieved from <https://www.sisp.se/about-swedish-incubators-science-parks>
- Sosna, M., Trevinyo-Rodríguez, R.N., and Velamuri, S.R. (2010). Business model innovation through trial-and-error learning: The Naturhouse case. *Long Range Planning*, 43(2), 383–407.
- Soto-Acosta, P., Popa, S., and Palacios-Marqués, D. (2017). Social web knowledge sharing and innovation performance in knowledge-intensive manufacturing SMEs. *The Journal of Technology Transfer*, 42(2), 425–440.
- Spencer, A., and Kirchoff, B. (2006). Schumpeter and new technology based firms: Towards a framework for how NTBFs cause creative destruction. *International Entrepreneurship and Management Journal*, 2(2), 145–156.
- Stinchcombe, A. (1965). Social structure and organizations. In March, J.G. (Ed.), *Handbook of organizations*. Rand McNally & Company, New York, 142–193.
- Storey, D.J., and Tether, B.S. (1998). New technology-based firms in the European union: An introduction. *Research Policy*, 26(9), 933–946.
- Teece, D.J. (2010). Business models, business strategy and innovation. *Long Range Planning*, 43(2–3), 172–194.
- Tillväxtanalys (2018). *Risikkapitalstatistik 2017 – venture capital*. Myndigheten för tillväxtpolitiska utvärderingar och analyser, Östersund. Retrieved from

https://www.tillvaxtanalys.se/download/18.347b5cf7166740f99f19263b/1543417564562/statistik_2018_05_Riskkapitalstatistik%202017.pdf

- Torrecilla García, J.A., Skotnicka, A.G., and Maeso-González, E. (2015). The role of the entrepreneur in the new technology-based firm (NTBF). In Cortés P., Maeso-González E., Escudero-Santana A. (eds). *Enhancing Synergies in a Collaborative Environment. Lecture Notes in Management and Industrial Engineering*. Springer, Cham, Switzerland, 225–232.
- Tracy, S.J. (2010). Qualitative quality: Eight “big-tent” criteria for excellent qualitative research. *Qualitative Inquiry*, 16(10), 837–851.
- Virasa, T. (2007). A gap-analysis model for identifying effective government support for new technology-based firms (NTBFs) in Thailand. *International Journal of Technoentrepreneurship*, 1(2), 165–182.
- van Weele, M., van Rijnsoever, F.J., and Nauta, F. (2017). You can't always get what you want: How entrepreneur's perceived resource needs affect the incubator's assertiveness. *Technovation*, 59, 18–33.
- Weick, K. (1996). Drop your tools: An allegory for organizational studies. *Administrative Science Quarterly*, 41(2), 301–313.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180.
- West, G., and Noel, T. (2009). The impact of knowledge resources on new venture performance. *Journal of Small Business Management*, 47(1), 1–22.
- Westhead, P., and Storey, D.J. (1997). Financial constraints on the growth of high technology small firms in the United Kingdom. *Applied Financial Economics*, 7(2), 197–201.
- Williams Middleton, K. (2010). *Developing entrepreneurial behavior: Facilitating nascent entrepreneurship at the university*. Doctoral dissertation, Chalmers University of Technology, Gothenburg, Sweden..
- Wright, M., Vohora, A., and Lockett, A. (2004). The formation of high-tech university spinouts: The role of joint ventures and venture capital investors. *The Journal of Technology Transfer*, 29(3–4), 287–310.
- Xiao, J. (2014). *Entrepreneurial Dynamics and Acquisitions of New Technology-Based Firms*. PhD dissertation. Lund University, Lund, Sweden.

- Xiao, J. (2015). The effects of acquisition on the growth of new technology-based firms: Do different types of acquirers matter? *Small Business Economics*, 45(3), 487–504.
- Yli-Renko, H., Autio, E., and Sapienza, H.J. (2001a). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, 22(6-7), 587–613.
- Yli-Renko, H., Sapienza, H.J., and Hay, M. (2001b). The role of contractual governance flexibility in realizing the outcomes of key customer relationships. *Journal of Business Venturing*, 16(6), 529–555.
- Yli-Renko, H., Autio, E., and Tontti, V. (2002). Social capital, knowledge, and the international growth of technology-based new firms. *International Business Review*, 11(3), 279–304.
- Zott, C., and Amit, R. (2007). Business model design and the performance of entrepreneurial firms. *Organization Science*, 18(2), 181–199.
- Åstebro, T. (2003). The return to independent invention: Evidence of unrealistic optimism, risk seeking or skewness loving? *The Economic Journal*, 113(484), 226–239.