Taking Scientific Inventions to Market in the Stockholm Entrepreneurial Ecosystem

A Qualitative Study on the Influence of Entrepreneurial Ecosystems on the Commercialization of Early-Stage Life Science Firms

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ABSTRACT

This study examines the commercialization process of early-stage life science firms in Stockholm, a process critical to these firms' survival and the overall economy of the region, but which poses unique challenges within this industry. To address the lack of research explaining the activities of entrepreneurial agents involved in this process, this study adopts an Entrepreneurial Ecosystem perspective and focuses on how actors and factors in the Stockholm Entrepreneurial Ecosystem influence the Dynamic Capabilities of early-stage firms in the commercialization process. By doing so, we also address a fundamental gap in the Entrepreneurial Ecosystem literature on the linkages through which Entrepreneurial Ecosystem components influence entrepreneurial activities and abilities. The study employs a qualitative cross-sectional method which seeks to explore the experiences of early-stage firms and how they perceive the Entrepreneurial Ecosystem regarding its effects on their capabilities. This study includes a sample of 24 different early-stage life science firms across the biotech, medtech and healthtech industries. Using a theoretical framework illustrating the relationship between Entrepreneurial Ecosystem attributes and the Dynamic Capabilities of early-stage firms, we find that specific Entrepreneurial Ecosystem elements shape the Dynamic Capabilities of the firms in this study, both through supporting and constraining manners. From the findings, Support services and facilities, Networks, Investment capital and Policy and governance were identified as the most central elements in this relationship. Given the newness of the phenomenon under investigation, this study represents the initial efforts bridging literature on the structure of Entrepreneurial Ecosystems with the Dynamic Capabilities of its actors. Furthermore, this study yields implications for regional stakeholders and policymakers seeking to foster the support for early-stage firms and their entrepreneurial activities.

Keywords: Life Science Industry, Entrepreneurial Ecosystems, Dynamic Capabilities

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ABBREVIATIONS

EE	Entrepreneurial Ecosystem
LS	Life science
DC	Dynamic capability
KI	Karolinska Institute
KTH	Royal Institute of Technology
IP	Intellectual property
QMS	Quality management system
Biotech	Biotechnology
Medtech	Medical Technology
Healthtech	Health Technology

GLOSSARY

Life science companies

Companies operating in biomedicine, bioengineering, medical engineering, and pharmaceutical development and manufacturing. This category also involves companies engaged in the development of diagnostics and treatment methods, along with those developing products and services related to e-health (Swelife, 2023).

Life science industry

The Life science industry encompasses companies, higher education institutions, and public stakeholders at municipal, regional, and national levels that contribute to advancing human health through various activities. This sector involves research, higher education, innovation, the development of pharmaceuticals, medical technology products and treatments, as well as activities related to prevention, implementation, and follow-up (Swelife, 2023).

Commercialization (in life science)

This process encompasses strategic and tactical planning, along with marketing activities related to product or concept launch and interactive engagement with potential buyers and other relevant players (Aarikka-Stenroos et al., 2024). The specific commercialization of life science innovations refers to the process of transforming an invention into a new product, service, concept, or technology that obtains regulatory approval and can be sold on commercial markets, both domestically and internationally (Fitchel, 2024).

Early-stage firm

Early-stage firms are defined by their maturity, delimited to those with less than 10 years of age (Marion & Meyer, 2011).

Clinical study

Clinical studies are conducted on humans to study medical or health-related issues. It may involve studying and/or developing medicines, treatment methods or medical technology products with the aim of developing healthcare (Vetenskapsrådet, 2022).

TABLE OF CONTENTS

1. Introduction **7**

1.1 Background 7

1.2 Research problem 8

1.3 Purpose & Research question 9

2. Literature review and theoretical framework **10**

2.1 Entrepreneurial Ecosystems 10

2.1.1 Defining the entrepreneurial ecosystem concept 10

2.1.2 Origins and evolution of the the entrepreneurial ecosystems perspective 11

2.1.3 Entrepreneurial Ecosystem elements 12

2.1.3.1 Cultural attributes 13

2.1.3.2 Social attributes 14

2.1.3.3 Material attributes 15

2.2 Dynamic Capabilities 16

2.2.1 The roots of dynamic capabilities 16

2.2.2 Dynamic capabilities in entrepreneurship 17

2.2.3 Dynamic capabilities in commercialization 18

2.2.3.1 Sensing 19

2.2.3.2 Seizing 20

2.2.3.3 Reconfiguring 20

2.3 Entrepreneurial Ecosystems and Dynamic Capabilities 20

3. Methodology **22**

3.1 Introduction to the research setting (Stockholm as an Entrepreneurial Ecosystem) 22

3.2 Methodological Fit 23

3.3 Design of study 24

3.4 Data Collection 24

3.4.1 Pre-study 25

3.4.2 Interview Sample 25

3.4.3 Interview Design 26

3.5 Data Analysis 27

3.6 Trustworthiness Criteria 27

3.6.1 Credibility 28

3.6.2 Transferability 28

3.6.3 Dependability 28

3.6.4 Confirmability 28

3.7 Ethical considerations 29

3.8 Methodological limitations 29

4. Empirics & Analysis **30**

4.1 The Influence of Entrepreneurial Ecosystems on Dynamic Capabilities 31
4.1.1 Sensing capabilities 31
4.1.1.1 Learning how to identify opportunities 31
4.1.1.2 Scanning for opportunities 33
4.1.2 Seizing capabilities 37
4.1.2.1 Understanding what makes a viable business 37
4.1.2.2 Building the business 39
4.1.3 Reconfiguring capabilities 44
4.1.3.1 Problem solving 44
5. Discussion **46**
5.1 The influence of Entrepreneurial Ecosystems on Dynamic Capabilities 46
5.2 Early-stage firms approaching Dynamic Capabilities 51
6. Conclusion **54**
6.1 Adapted theoretical framework 54
6.2 Theoretical Contributions 55
6.3 Managerial/Practical Implications 56
6.4 Limitations 56
6.5 Suggested Future Research 57
7. List of References **58**
8. Appendixes **73**

1. Introduction

1.1 Background

Life science is a crucial industry in Sweden overall and Stockholm, in particular. The life science industry contributes significantly to Swedish exports (BioStock, 2022), plays a vital role in regional development, contributing to economic growth and creating employment opportunities, and positions Sweden as an attractive hub for investment and collaboration (Stockholms Handelskammare, 2023; Vinnova, 2023). Stockholm houses Sweden's largest and most qualified life science cluster and, as the city's third-largest industry, the life science sector also significantly contributes to Stockholm's economy (Stockholm Science City, 2024; Stockholms Handelskammare, 2023).

Life science companies engage in research, innovation, the development of medicines, medical technology products and treatments, as well as prevention, implementation, and follow-up. They operate in various fields, including pharmaceutical development and manufacturing, biomedicine, bioengineering, medical engineering, diagnostics and e-health services (Proclinical, 2024; Swelife, 2023). Many life science companies build on and translate scientific research with industrial applications into practical solutions that can create value and benefit society through new therapies and clinical protocols (Lane & Flagg, 2010). Typically, this involves turning novel knowledge and "discoveries" about living organisms and biological systems into innovations in a process of further exploration, application, and viability testing, that leads to their implementation in functional devices, services, therapies, or drugs, that can be scaled up for mass production and distribution, and introduction into the market (Gartner, 1985; Lane & Flagg, 2010).

While Sweden is internationally recognized for its world-class scientific quality and dynamic knowledge clusters, commercializing scientific discoveries and academic research within life science in Sweden has proven difficult (Olausson, 2014). The industry faces undercapitalization and partial commercial underdevelopment, exemplified by the fact that only two percent of European investments in biotechnology are directed towards Sweden (Stockholms Handelskammare, 2023). This has resulted in the limited growth of small companies and a decline in Sweden's production of new global life science entities, which represents a departure from its historical prominence (Göransson, 2023).

Given the significance of life science for Sweden, positioning the nation as a leader in the field of life science stands as a strategic priority for the Swedish Government (Regeringskansliet, 2019). As part of this initiative, there is a strategic vision in place to propel the Stockholm-Uppsala life science cluster specifically into one of the top life science regions globally by 2025. Key focus areas include

fostering interdisciplinary collaboration, particularly between life science and technology/artificial intelligence; strengthening cooperation among academia, healthcare, and industry; and cultivating a more appealing environment for life science companies in the region (Stockholms Handelskammare, 2023).

1.2 Research problem

This study focuses on the commercialization process of early-stage life science firms in Stockholm. Commercialization, which refers to the process of strategic and tactical planning, along with marketing activities related to product or concept launch and interactive engagement with potential buyers and other relevant players (Aarikka-Stenroos et al., 2024), is an important stage of all innovation processes and particularly challenging in the life science industry. Specifically in the context of life science innovations, commercialization refers to the process of transforming an invention into a new product, service, concept, or technology that obtains regulatory approval and can be sold on commercial markets, both domestically and internationally (Fitchel, 2024). The potential of life science inventions to address global health and societal challenges (Business Sweden, 2024; Bhide, 2000; Scholten et al., 2004), as well as the success of life science firms depends on their ability to bring innovations to market (Kastelle et al., 2018; Chiesa & Frattini, 2011; Di Benedetto, 1999). However, the commercialization process in life science is a long process, inherently risky, involving multiple stakeholders with diverse objectives spanning organizational boundaries and high R&D investment without guaranteed returns (Batiz-Lazo & Holland 2004; Brännback et al. 2009).

This thesis defines early-stage firms based on their maturity, specifically delimited to those with less than 10 years of age (Marion & Meyer, 2011). These firms constitute a major part of the life science ecosystem in Stockholm and play an important role in driving societal innovations and industrial renewal (Acs & Audretsch 2005; Schoonhoven & Eisenhardt, 2012). Because they are small and newly established, early-stage life science firms face specific challenges in the commercialization process. This includes resource constraints, establishing legitimacy, navigating new markets, alongside dealing with immature technologies and shifts in policies and regulatory landscapes (Petersen & Ahmad, 2007; Stinchcombe 1965; Shepherd et al. 2000; Aaboen et al. 2006; Nagy & Lohrke 2010). Additionally, as they operate in a dynamic environment marked by rapid technological changes, they face pressures to innovate quickly (Flatten et al. 2015).

Although the commercialization of science holds significant importance and constitutes an inherently risky process, there is a lack of studies explaining the activities of entrepreneurial agents involved in this process. Studies in the life science field predominantly focus on large, publicly traded companies, leaving smaller privately held firms, which often lack financial resources, experienced management, and a clear market, relatively overlooked (Alvedalen, 2021).

To study the commercialization process of early-stage life science firms in Stockholm, we adopt an Entrepreneurial ecosystem (EE) perspective and focus on how the EE participants and attributes influence the dynamic capabilities (DCs) of early-stage firms (Roundy & Fayard, 2018). The EE concept adopts a holistic and systemic view of entrepreneurship (Cavallo et al., 2019), emphasizing that the success of entrepreneurship does not only depend on firm-specific attributes but is also contingent on the context within which they develop and operate (Brown & Mason, 2017; Balawi & Ayoub, 2022). The life science industry is an ideal setting to examine through a systemic framework such as the EE perspective. It is characterized by numerous interconnected actors and institutions (Pucci et al., 2020) and the nonlinear journey from scientific research to product commercialization necessitates the engagement of numerous stakeholders throughout the process (Toth, 2013; Wadman & Hütt, 2004).

DCs play a critical role in the commercialization process for early-stage firms, as this process involves identifying and pursuing market opportunities in an unexplored area (Zahra et al., 2006). DCs refer to the firm's capacity to integrate, build, and reconfigure internal and external competencies to respond to a rapidly changing environment (Teece et al., p. 516, 1997). Faced with an uncertain and evolving landscape and suffering the liabilities of newness, new ventures should therefore leverage flexible dynamic processes and routines, which constitute distinctive DCs. These capabilities enable them to effectively build, utilize and adapt their resources and competencies in response to external environmental factors and internal organizational pressures (Hällerstrand et al., 2023; Felin et al., 2012; Lavie, 2006).

While the literature emphasizes that the success of entrepreneurship is contingent on the EE context (Brown & Mason, 2017; Balawi & Ayoub, 2022), the linkages through which EE components influence entrepreneurial activities, abilities and the functioning of early-stage ventures lack clarity. In particular, the literature acknowledges a theoretical gap in how to bridge research on the structure of EEs with the DCs of its actors (Roundy & Fayard, 2018; Wurth et al., 2021). Therefore, a study that investigates how EE components relate to the DCs of early-stage firms seems warranted.

1.3 Purpose & Research question

The purpose of this study is to explore how EE actors and factors influence the DCs of early-stage life science firms. Specifically, this paper will examine the influence of the Stockholm EE as an illustrative example to understand how EEs, in general, impact the DCs of early-stage life science firms turning novel knowledge and discoveries about living organisms and biological systems into functional and scalable devices, services, therapies, or drugs, and taking them to market.

We investigate the following research question:
How does an entrepreneurial ecosystem influence the dynamic capabilities of early-stage firms when commercializing life science inventions?

Through our study, we hope to provide valuable empirical insights into how EEs relate to the DCs of entrepreneurial actors, namely early-stage firms, within the ecosystem that can inform further research. Given the importance of commercializing science, our study also holds significant relevance for practitioners and policymakers. The paper aims to add to knowledge on how EEs can best support entrepreneurial actors and how ecosystem attributes are linked to entrepreneurs' abilities. The intended result of this study, therefore, is to bridge research on the structure of EEs with DCs of its actors.

2. Literature review and theoretical framework

2.1 Entrepreneurial Ecosystems

2.1.1 Defining the entrepreneurial ecosystem concept

Cohen (2006) was the pioneer in introducing the concept of EE and defined it as *"an interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures."* Since then, the notion of EE has gained increasing attention in recent years, particularly attributed to the works of Feld (2012) and Isenberg (2010). Their contributions popularized the view among policymakers and entrepreneurial leaders that the community and culture of a location can greatly influence the entrepreneurial process.

The literature on EEs is continuously evolving, and therefore also the definition. Over time, scholars have offered different definitions of the EE, and there is no consensus about a single-agreed upon definition (Malecki, 2018; Stam & Van De Van., 2021). However, what they share is that they adopt a systemic approach to studying entrepreneurship and highlight that the interplay of different elements shape entrepreneurship (Autio et al., 2014; Welter, 2011; Wurth et al., 2021). EE definitions focus on the localized sets of interconnected actors and factors that enable or constrain entrepreneurial innovation and growth (Stam, 2015; Stam & Van de Ven, 2021), underscoring that entrepreneurs do not identify or develop opportunities independently (Ramachandran & Ray, 2006; Roundy et al., 2017). All EE definitions are also delimited in terms of geographic boundaries (Alvedalen, 2021). In terms of the differences between definitions, some focus clearly on productive entrepreneurship, while others are more open and less normative in that they do not presuppose a

desired outcome (see, for example, Isenberg, 2010; Qian et al., 2013; Brown & Mason, 2014; Audretsch & Belitski, 2017; Stam, 2015).

In this study, we follow Spigel's (2017) definition and define EEs as *"the union of localized cultural outlooks, social networks, investment capital, universities, and active economic policies that create environments supportive of innovation-based ventures."* This view of EEs emphasizes the nature of EEs rather than their performance effects, and aligns well with our interest in studying how EE elements influence firm capabilities.

Despite the insights produced by EE research and its broad description of the benefits EEs create for entrepreneurs (Roundy & Fayard, 2018; Wurth et al., 2021), the EE concept does not provide a clear analytical framework that demonstrates what elements cause what effects (Alvedalen & Boschma, 2017). Lists of elements and factors believed to foster entrepreneurship have been presented without establishing their order of impact and importance. This thesis will attempt to address this limitation by exploring the influence of different ecosystem components on entrepreneurial activity.

2.1.2 Origins and evolution of the the entrepreneurial ecosystems perspective

The "entrepreneurial" component to the EE-term refers to entrepreneurship, which is considered essential for economic development through various means, such as innovation (Acs and Audretsc, 1988), job creation (Blanchflower, 2000; Shane, 2003; Parker, 2009), and the technology and knowledge transfer and from research to industry (Acs et al. 2009; Grimaldi et al. 2011; Terjesen & Wang 2013; Plummer & Acs 2014)

The literature on entrepreneurship has yielded important insights into facilitating new firm formation and its impacts on economic development (Acs 2006). In order to explain entrepreneurship, scholars have mostly focused on behavioral qualities and characteristics of firms or individuals (Shane, 2003; Shane & Venkataraman, 2003). However, a number of issues had been debated in the entrepreneurship literature for some time, including the need to further study and understand entrepreneurship in a broader setting (Autio et al., 2014; Colombelli et al., 2019; Zahra & Wright, 2011; Spilling, 1996), as well as studying the interconnectedness of actors and factors that influence entrepreneurship (Audretsch 2003; Gustafsson & Autio 2011; Qian et al. 2013; Acs et al., 2014).

As a result, in slightly more than a decade, scholars have developed a new concept of EEs that has surged in popularity recently. The literature on EEs adopts a holistic and systemic view of entrepreneurship (Cavallo et al., 2019), emphasizing that the success of entrepreneurship does not

only depend on firm-specific attributes but is also contingent on the context within which they develop and operate (Brown & Mason, 2017; Balawi & Ayoub, 2022).

The roots to the EE concept can be found across a number of interconnected fields of literature, mainly centered on the contextual aspects of entrepreneurship (Audretsch & Belitski, 2017; Cavallo et al., 2019; Erina et al., 2017; Yun et al., 2017). Marshall's (1920) research on factors stimulating business growth in industrial districts laid early groundwork for the evolution of the concept of EEs. Subsequent scholars have built upon Marshall's work, from the early work on national systems of innovation (Freeman, 1995; Lundvall, 1992), learning regions (Keeble et al., 1999; Malmberg & Maskell, 2002), the Triple Helix model (Leydesdorff & Etzkowitz, 1996) to regional clusters (Delgado et al., 2016; Porter, 1998) and regional innovation systems (Cooke et al., 1997; Cooke, 2001).

The strategy literature also antecedes EE research (Acs et al., 2017a, b), including concepts such as the business ecosystem introduced by Moore (1993). Business ecosystems represent the environment where firms create and capture value through complementary products and services (Moore, 1993; Iansiti & Levien, 2004; Acs et al., 2017a, b). This spawned the rise of other types of ecosystem ideas, including innovation ecosystems, characterized by Autio and Thomas (2014) as a network of interconnected organizations, centered around a focal firm or platform, dedicated to the development of new value through innovation.

While the above-mentioned concepts vary in their goals and view of how the economy works, they are united by the common belief that external factors beyond the boundaries of the firm significantly influences and contributes to the competitiveness of firms and new ventures (Spigel & Harrison, 2018; Spigel, 2017). In contrast to these affiliated approaches, however, the EE places the entrepreneur and the startup at the focal point. The central focus of EEs lies in the creation of new ventures (Stam, 2015), emphasizing the role of the social, cultural and economic context surrounding the entrepreneurial process (O'Connor et al., 2018).

Having evolved rapidly in recent years, the EE literature has offered important insights regarding favorable conditions that promote entrepreneurship, especially at the early stages of new venture development. The concept has gained significant attention from both researchers, practitioners and policy makers (Alvedalen & Boschma 2017).

2.1.3 Entrepreneurial Ecosystem elements

The entrepreneurial process is shaped by several elements within EEs (Brown & Mason, 2017; Jones & Ratten, 2021). Scholars and practitioners have subsequently elaborated and expanded on

these elements and proposed a variety of theories to identify the key influential components in EEs (Ehst et al., 2018).

In general, scholars underscore three primary regional resources that foster entrepreneurship and growth. Firstly, shared cultural norms and institutional environments facilitate interfirm collaboration and normalize knowledge exchange. Secondly, regional social networks establish channels for knowledge diffusion between universities and firms, help distribute information about entrepreneurial opportunities and connect entrepreneurs with investors. Finally, government policies and universities can bolster these cultures and networks by eliminating institutional barriers for entrepreneurs, training entrepreneurs and skilled workers, as well as providing funding for support services, such as startup incubators and networking events (Spigel, 2017).

In this study, we adopt the EE framework proposed by Spigel (2017), which focuses on the three main attributes above that create supportive environments for entrepreneurial activity and play significant roles in the early development of new ventures. These attributes consist of (1) Material attributes (government policies, universities, infrastructure, open markets and support services), (2) Social attributes (networks, mentors and role models, worker talents, and investment capital), and (3) Cultural attributes (supportive culture and history of entrepreneurship). The chosen framework emphasizes the inputs that support entrepreneurial activity, rather than the outcomes of ecosystems, such as rates of entrepreneurship or the prevalence of high-growth firms that some researchers concentrate on. This aligns well with this study's objective of studying ecosystem functionality and firm interactions with them.

According to Spigel (2017), while not all of these elements are essential for a flourishing ecosystem, they should be regarded as key factors that contribute to a supportive environment for entrepreneurial initiatives and that offer external resources necessary for the competitiveness of new ventures.

2.1.3.1 Cultural attributes

Supportive culture
According to Spigel (2017), cultural beliefs that normalize perceptions of entrepreneurship, portraying it as a conventional career choice, help build an environment that fosters venture creation and encourages individuals to support risky entrepreneurial initiatives. Isenberg (2010) further argues that society must communicate entrepreneurship as a social priority to stimulate individuals to become entrepreneurs and promote tolerance of failure. This can be accomplished through media events, publicized awards, speeches and interviews.

Histories of entrepreneurship

Prominent entrepreneurial success stories are another important part shaping the cultural outlooks within a region. Local entrepreneurs who founded startups that eventually evolved into global market leaders can inspire aspiring entrepreneurs to follow (Spigel, 2017; Isenberg, 2010). So-called blockbuster enterprises: *"young successful entrepreneurial firms that have grown exceptionally in size and wealth",* provide major effects to the broader EE, including demonstration effects and experiential learning for spin-offs, as well as fostering serial entrepreneurship opportunities (Brown & Mason, 2017).

2.1.3.2 Social attributes

Networks

Social networks support entrepreneurs in acquiring new information about technologies and opportunities, market knowledge, access to finance, customers and suppliers, as well as improve entrepreneurs' vision and abilities (Spigel, 2017). These advantages can be realized when there are previous connections and trust among entrepreneurs and other actors in the EE (Kwon et al., 2013). Vibrant EEs tend to have strong informal and formal networks that facilitate tacit knowledge sharing and help reduce resource deficiencies in new ventures, including a variety of networking forums, such as business clubs, mentoring programs, and startup networks (Brown & Mason, 2017), and planned events, including pitch competitions and entrepreneurship meet-ups (Case & Harris, 2012; Roundy, 2017).

Worker talent

A key resource for new ventures are skilled employees familiar with the demands of working at a small company, including both experienced managers and technical workers. Building on the significance of dense social networks within a region, both workers and entrepreneurs leverage these networks to identify suitable matches (Spigel, 2017).

Mentors and role models

Drori and Wright (2018) define mentoring as the learning and coaching processes led by experts, providing startups with relevant knowledge and experience, advice on overcoming obstacles and exposure to their networks. Experienced business people and successful local entrepreneurs can provide guidance to new entrepreneurs, supporting them in developing new business skills, building their localized social capital (Spigel, 2017), and assisting entrepreneurs in utilizing their resources more effectively (Lux et al., 2020).

Investment capital

Investment capital and guidance from investors are necessary to catalyze the growth of startups and can be acquired from institutional investors such as venture capitalists, angel investors, or the

entrepreneur's own network of family and friends. Local investors within a region with strong ties to the local entrepreneurial community play a vital role in stimulating venture growth (Spigel, 2017). Brown & Mason (2017) emphasizes that entrepreneurs who have divested or are no longer active in their businesses often become business angels, re-investing in local, promising new ventures while providing them advice. Moreover, the majority of risk capital invested in startups flows through the social networks of investors, which help them identify new firms to invest in and reduce the information asymmetry between the firm and the investor (Spigel, 2017).

2.1.3.3 Material attributes

Policy and governance
The role of the government is to nurture the ecosystem (Stam, 2015), facilitating the pre-conditions necessary for entrepreneurship to thrive (Isenberg, 2011; Brown & Mason, 2014), primarily through bureaucratic, legal and regulatory reforms (Cohen, 2006; Isenberg, 2010). It falls under the government's responsibility to mitigate excessive barriers to entrepreneurship (Isenberg, 2010), with policies that may include reducing legal barriers to venture creation, allocating public funds to entrepreneurship support, networking or incubation programs and creating beneficial tax regimes (Spigel, 2017).

Universities
Universities engage in the development of new technologies, generating entrepreneurial opportunities that academic entrepreneurs can either commercialize or that may spill over into existing startups. Moreover, entrepreneurs can leverage university knowledge by hiring university graduates. Universities play a crucial role in not only developing the human capital of a region, but also in promoting entrepreneurial mindsets among its students, motivating them to create new ventures or to work for them (Spigel, 2017).

Open markets
The presence of strong local markets characterized by local customers with specialized needs, provide opportunities for new ventures within EEs. By having close interaction with local customers, entrepreneurs can spot opportunities within the local market and easily test new offerings with them. Acting as a catalyst for EE development, such markets also enable entrepreneurs to further expand their ventures in the future (Spigel, 2017).

Support services and facilities
Support services and facilities offer specialized support for startups, such as patent lawyers, accountants and human resource providers tailored to the needs of early-stage firms, thus enabling entrepreneurs to access capabilities that they lack internally (Spigel, 2017). Additionally, incubators, accelerators, and co-working facilities play a vital role in providing office space for

startups, as well as offering business learning through coaching or professional consulting services; and facilitating networking events to help startups connect to resources providers such as financiers (Bruneel et al., 2012; Hansen et al., 2000; Lalkaka, 2002; Eveleens et al., 2017; Spigel, 2017). Furthermore, mentorship and advice from experts with relevant knowledge and experience that benefit startups are one of the most important functions of business accelerators (Bliemel, Flores, De Klerk, & Miles, 2018).

2.2 Dynamic Capabilities

2.2.1 The roots of dynamic capabilities

Building on the resource-based view (Barney, 1991; Peteraf, 1993;Wernerfelt, 1984), DCs focus on the ability of firms to respond, manage and adjust to external changes and uncertainty, important for long-run growth and firm survival. Since its emergence, the literature on DCs has received increasing attention in the field of strategic management research (Zheng et al.,, 2011; Foss et al., 2011).

DCs are defined as "*the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments*" (Teece et al, p. 516, 1997). The concept of DCs has been further developed into a strategic management framework, consisting of the following microfoundations: "*(1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets"* (Teece, 2007). Following this definition, literature suggests that DCs are multifaceted, meaning that firms may not necessarily be strong in all types (Teece, 2018).

DCs highlight the concept of 'opportunity,' wherein the performance of a firm is linked to its abilities to identify and pursue opportunities (Eisenhardt & Martin, 2000). These capabilities enable firms to sense and seize opportunities through the acquisition and rearrangement of resources, achieved by refining existing competencies or establishing new ones (Harreld et al., 2007). The change of allocation and utilization of resources is a critical part of DCs, as a response to new opportunities or the need for change. These changes can take many forms, including the transformation of organizational processes and operations, and may involve resources such as human capital, technological capital, knowledge-based capital, and tangible-asset-based capital, among others (Easterby-Smith et al., 2009).

Developed with an explicit focus on conventional, large, and well-established companies with established products, customer bases, employees, and organizational structures (e.g., Eisenhardt & Martin, 2000; Helfat & Peteraf, 2009; Peteraf et al., 2013), the DCs framework emphasizes the

importance of the entrepreneurial management function, involving assessing opportunities and diagnosing threats, allocating resources strategically, and possibly reshaping structures and systems to address technological opportunities (Teece, 2012). Literature demonstrates that established companies benefit from possessing DCs as it enhances organizational agility and improves market responsiveness (Zahra & George, 2002). They are proven useful for effectively introducing newly developed technologies from research and development departments to the market (Marsh & Stock, 2003).

2.2.2 Dynamic capabilities in entrepreneurship

DCs are necessary for both large and small enterprises to establish and sustain superior financial performance (Teece, 2012; Teece, 2007). Despite the lack of empirical development of DCs in early-stage firms (Boccardelli & Magnusson, 2006; Zahra et al., 2006; McKelvie & Davidsson, 2009), the importance of DCs for new firms is recognized in existing literature (Jones et al., 2013; Newbert, 2005; Zahra et al., 2006). Given the highly uncertain, volatile, and high-competitive environment faced by new firms (Hoffman & Radojevich-Kelley, 2012; Trimi & Berbegal-Mirabent, 2012; Garbellano & Da Veiga, 2019; Hassani & Mosconi, 2022), it is essential for these firms to display DCs that facilitate the enhancement and reconfiguration of their resources as needed (Eisenhardt & Martin, 2000; Teece et al., 1997), allowing them to sense and respond to changing market conditions and operational or strategic crises (Jones et al., 2013).

Moreover, DCs are important for the process of new venture creation (Newbert, 2005), which involves capturing and transforming opportunities into market offers using resources controlled by an entrepreneur (Łobacz & Głodek, 2015). They allow new firms to identify and exploit market opportunities, as well as acquire, reconfigure and integrate resources to meet the perceived market needs (Łobacz & Głodek, 2015). As new firms tend to struggle to accurately predict opportunities or how to tackle them, this new firm formation process is iterative, requiring firms to adapt and modify their approach over time (Sommer et al., 2008). DCs play a crucial role within this process, enabling entrepreneurs to implement necessary changes (Jones et al., 2013) and evolve (Schilke & Helfat, 2018; Teece, 2007).

The DCs of new firms differ further from those in established firms. While DCs prove especially valuable for new ventures when facing opportunities in unexplored areas and major changes in demands, established companies often utilize them in response to changes in the competitive landscape or after repeated execution failures. Trial and error, improvisation and imitation tend to serve as primary methods for discovering and developing DCs in early-stage firms, in contrast to the reliance on learning from experience and planned changes in established companies. Moreover, DCs of early-stage firms are typically fewer, more focused and evolve more rapidly compared to

those of established firms. Also, for early-stage firms, they primarily aim to tackle significant gaps in the firm's existing capability portfolio to explore opportunities for organic growth, while established firms focus on developing DCs that leverage both their current competencies and extend them further (Zahra et al., 2006)**.**

All in all, early-stage firms who demonstrate DCs will maximize their goals (Zahra et al., 2006) and enhance their chances of survival and sustained growth (Telussa et al., 2006; Teixeira et al., 2021; Foss et al., 2011; Adam et al., 2018). Despite literature establishing the relevance of DCs in early-stage firms, limited attention has been paid to new firms and the role of DCs in their development and survival (Soluk et al., 2023; Iakovleva et al., 2015). Although it is known that DCs may be learnt (Eisenhardt & Martin, 2000; Teece et al., 1997; Zahra et al., 2006) and created and developed over time by organizational processes internalized by early-stage ventures (Corner & Wu, 2011; Teece et al., 1997), research lacks a thorough understanding of the process through which DCs emerge, develop and evolve in these firms, considering their limited resources, knowledge bases, and expertise in building and integrating diverse capabilities (Boccardelli & Magnusson, 2006; Zahra et al., 2006; McKelvie & Davidsson, 2009).

The existing DC framework has been criticized for not capturing the unique challenges and opportunities facing early-stage ventures. Differences in strategic processes between established firms and entrepreneurial start-ups have been articulated by various scholars, including Bhide (2000), who argues that experimentation is vital in the early stages of company development. This deviates from the focus on analysis, continuity and routines commonly seen in large, established firms, suggesting that the DCs utilized in entrepreneurial settings are not adequately addressed in the works of scholars such as Teece et al. (1997) and Eisenhardt and Martin (2000), who predominantly concentrate on organizational processes as routines. Instead, the DCs crucial in the early phases of company development often lie within individuals or small entrepreneurial groups, possessing the ability to improvise, experiment, and reinterpret resource utilization to adapt to changing and uncertain market demands (Boccardelli & Magnusson, 2006).

2.2.3 Dynamic capabilities in commercialization

Literature establishes DCs as a useful lens for examining how firms build and cultivate their commercialization capability, as commercialization itself represents an example of navigating opportunities in uncharted territories. Commercialization can be viewed as a non-linear and uncertain emerging process, hiding on the adaptation and response to an uncertain and rapidly changing environment (Munoz-Penas et al., 2024; Hällerstrand et al., 2023).

Some previous works have examined the role of DCs in the commercialization process of identifying and taking inventions to market (e.g., Munoz-Penas et al., 2024; Foss et al., 2011;

Hällerstrand et al., 2023; Paradkar et al., 2015). Munoz-Penas et al. (2024) propose that DCs facilitate the development of commercialization capability through four key organizational processes: 1) commercial alertness, involving the firm's ability to identify and respond to market opportunities, 2) market context learning referring to understanding stakeholders and identifying opportunities and threats, 3) organizational agility focusing on implementing flexible business models and strategies to adapt to market changes and 4) credibility building as in developing assets such as brand reputation to establish trust for initial sales and subsequent scaling.

Early-stage firms, in contrast to incumbents, encounter unique challenges in commercialization processes as they lack essential assets, established routines and resources for such tasks (Iakovleva et al., 2015; Paradkar et al., 2015). To effectively address these challenges present in commercialization processes, early-stage firms must cultivate agile and dynamic processes and routines. These processes constitute unique DCs, enabling them to fully leverage and adapt their resources and competencies in response to both external environmental events and internal organizational pressures (Hällerstrand et al., 2023).

In sectors such as the life science industry, entrepreneurial firms face the challenge of navigating diverse and interlinked stakeholders (Pucci, 2020), an uncertain and evolving nature of the market with advancing and immature technologies, scientific breakthroughs and regulations (Alvedalen, 2021).

Similar to Nguyen et al. (2018), this paper defines the commercialization process in the life science context as the ability to identify and seize business opportunities arising from scientific research or inventions.

We will utilize the following definitions of the microfoundations of DCs to explore the commercialization process in early-stage firms:

2.2.3.1 Sensing

Sensing involves scanning, learning and exploration activity and regards the firm's capability to identify and evaluate business opportunities (Teece, 2007; Teece, 2012). Sensing capabilities regards the ability to search, being alert for and interpreting the environment to recognize market opportunities and risks, crucial for strategic decision making (Munoz-Penas et al., 2024). Typical sensing activities include investigating customer needs, gathering and filtering market information from both external and internal sources, understanding its significance, and drawing actionable insights to reduce uncertainty and enhance opportunities for successful innovation (Day, 2004; Teece, 2007).

2.2.3.2 Seizing

Seizing involves addressing opportunities by taking action to transform ideas into the development of new products or services, processes, and activities (Bornay-Barrachina et al., 2022). This includes acquiring and mobilizing internal and external resources, often requiring investments in new resources, technologies, and complementary assets to construct sustainable business models around identified opportunities (Teece, 2014; Chesbrough, 2010; Kindström et al., 2013; Teece, 2010). When seizing opportunities, entrepreneurs assess both their emerging and existing capabilities, and invest in necessary designs and technologies that are likely to gain acceptance in the marketplace (O'Reilly & Tushman, 2008; Teece, 2007; Wilden et al., 2013).

2.2.3.3 Reconfiguring

Once opportunities are sensed and seized, reconfiguration implies that firms must continually modify, renew and reconfigure their resources and competencies as the enterprise grows, and as markets and technologies change (Teece, 2014; Bornay-Barrachina et al., 2023).
During reconfiguration, entrepreneurs are involved in activities including implementing new kinds of management techniques, enacting new or updated strategies, implementing new business processes, which may include discarding certain existing capabilities, acquiring and developing new ones, and recombining them so that new opportunities can be pursued (Wilden et al., 2013; Roundy & Fayard, 2018). Generally, startups find reconfiguration easier than mature firms because of the relatively fewer fixed assets and established positions to reconfigure (Leih et al.,, 2015).

2.3 Entrepreneurial Ecosystems and Dynamic Capabilities

As previously mentioned, research is scarce on the relationship between ecosystem components and entrepreneurial activities, in particular the DCs of early-stage firms (Roundy & Fayard, 2018; Wurth et al., 2021). Studies of DCs have been mainly analyzed in a traditional and closed organizational context (Maijanen, 2022) and few studies have investigated DCs in an ecosystem context (Linde et al., 2021). Research on DCs typically emphasizes the influence of intra-organizational factors on firm capabilities, rather than exploring how capabilities within one organization affect others (Roundy & Fayard, 2018).

Our review of prior literature on EEs and DCs suggests that EEs are likely to influence the DCs of entrepreneurs in early-stage ventures. First, from the EE literature, we know that the EE context impacts entrepreneurs (Brown & Mason, 2017; Balawi & Ayoub, 2022) and that it can either support or undermine entrepreneurial activities (Stam, 2015; Stam & Van de Ven, 2021). Second, based on our review of the DC literature, we understand that DCs can be learnt (Eisenhardt & Martin, 2000; Teece et al., 1997; Zahra et al., 2006) and developed over time by organizational

processes internalized by early-stage ventures (Corner & Wu, 2011; Teece et al., 1997). Thus, we expect that the DCs of early-stage firms could be shaped by the context of the EE, potentially enabling or constraining firms' DCs.

Further, we know from the EE literature that EEs by definition consist of different elements that affect entrepreneurial activity so possibly they differ in how they influence the DCs of early-stage firms. Thus, individually or together, these factors may have different effects on DCs and we cannot expect all of them to have the same influence. For instance, incubators and business accelerators appear to have a salient and broad function in exposing early-stage firms to their networks, providing business- and entrepreneurship learning and enabling entrepreneurs to access capabilities they lack internally, either through mentorship or professional consulting services (Bruneel et al., 2012; Hansen et al., 2000; Lalkaka, 2002; Eveleens et al., 2017; Spigel, 2017). Moreover, EE literature emphasizes the role of social, informal and formal networks in facilitating knowledge-sharing and information about market opportunities to new ventures, as well as improving entrepreneurs' vision and abilities (Spigel, 2017). While incubators and networks are likely to play an important role, we know little about how these elements of EEs influence a firm's DCs in the commercialization process.

All together, the relationship between EEs and the DCs of early-stage firms is possibly complex. Nevertheless, only a few studies investigate the influence of different EE components on different DCs. Roundy & Fayard (2018) conceptualize this relationship but do not empirically study it, while an empirical study by Garciá-Ochoa (2020) focuses specifically on how business accelerators influence startups DCs. In this study, we expand on this work and investigate how entrepreneurs in real life engage with different EE elements and how this supports (or undermines) their dynamic capabilities.

Figure 1 summarizes the theoretical framework guiding our investigation of EEs influence on DCs. The framework illustrates the relationship between EE components and the DCs of early-stage firms, acknowledging that there are different EE elements that may individually or together support or undermine different types of DCs.

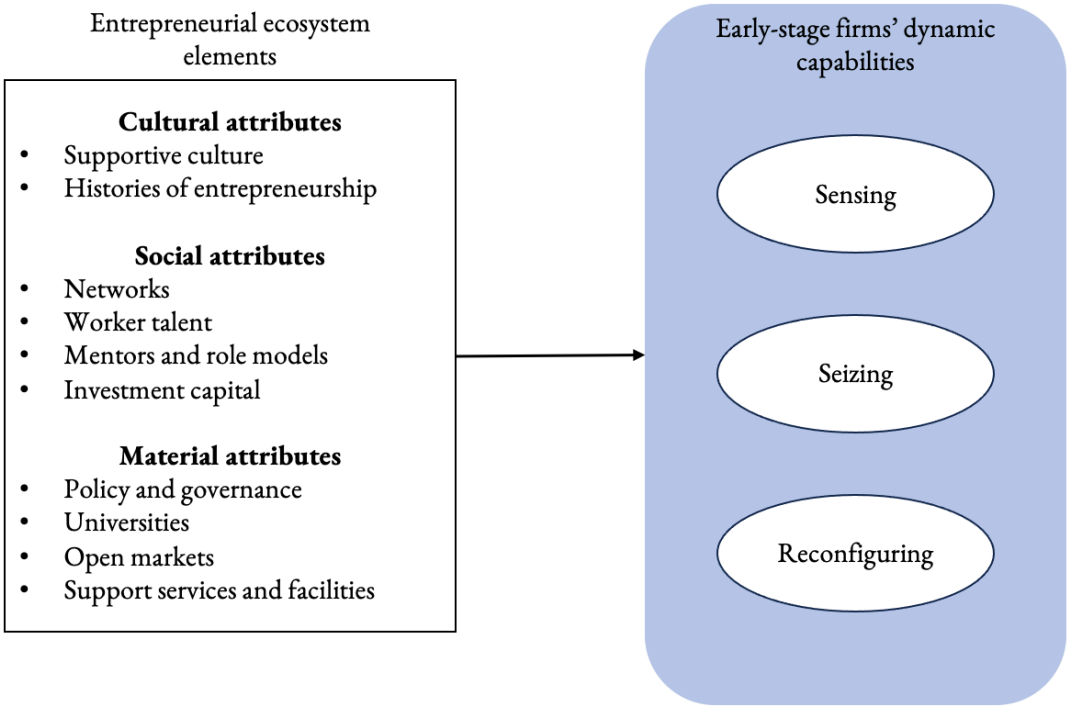


Fig. 1. The influence of entrepreneurial ecosystems on early-stage firms' dynamic capabilities
Source: The authors, adapted from Roundy & Fayard (2018)

3. Methodology

3.1 Introduction to the research setting (Stockholm as an Entrepreneurial Ecosystem)

Several factors support the decision to conduct a study with a focus on the Stockholm region, the largest urban area in Scandinavia. The region includes the cities of Stockholm, Södertälje and surrounding areas. The Stockholm region has a population of around 2.3 million inhabitants and is recognized as one of the most rapidly growing metropolitan areas in Europe (Statistiska Centralbyrån, 2022). Sweden has a strong social welfare system and governmental initiatives promoting entrepreneurship. Being ranked as the second-best producer of unicorns per capita globally, following Silicon Valley, Stockholm is renowned for its reputation as a unicorn factory (TechBBQ, 2024).

Apart from banking, finance, and IT, life-science is positioned as one of the strongest industries in the region and has emerged to be the center of the life science industry in the country. Currently, the life science sector employs approximately 17,000 individuals (Alvedalen, 2021). Many sub-sectors of the industry are represented in the area, including pharma, medtech, biotech, service

companies, and an emerging healthtech segment. The majority of the companies, approximately 60%, have fewer than 10 employees. Over a 10-year period, between 2009– 2019, the number of life science firms in the region increased by 48% (Stockholm Science City, 2024). Sole proprietorships account for the largest increase during the past ten years (Vinnova, 2023). Moreover, there is a long standing tradition of life science in the region, with large firms like Pharmacia and AstraZeneca leaving a strong impact on the EE. Additionally, several sales offices of global players are present and actively monitor new developments (Alvedalen, 2021).

Stockholm is known for its world-leading academic institutions, including Royal Institute of Technology (KTH), Karolinska Institute (KI), the University of Stockholm (SU), all with significant life science activities. Connected to these universities are entrepreneurial support systems and platforms, such as KI Innovations, KTH Innovations, and Drivhuset available for students and employees. Moreover, the Stockholm area hosts several significant hospitals and the region has made considerable investments in hospitals and research infrastructures, including the European-leading Karolinska University Hospital. The Stockholm EE further boasts Science Parks, such as the Karolinska Innovation Science Park, and industry organizations like SwedenBio (Alvedalen, 2021). Moreover, Stockholm is home to public-private held support infrastructures, including startup programs such as Stockholm Innovation and Growth, Sting (TechBBQ, 2024).

See Appendix 3 for further descriptions of the ecosystem actors mentioned in the report.

3.2 Methodological Fit

The research question focusing on how the EE influences the DCs of early-stage firms during the commercialization of scientific innovations necessitates understanding of how entrepreneurs and entrepreneurial activity is affected by particular attributes in the ecosystem. A qualitative approach is therefore considered appropriate as it enables an understanding of the lived experiences and viewpoints of the interviewees (Easterby-Smith et al., 2018), offering the potential to delve into the socially constructed aspects of the entrepreneurship process (Steyaert & Katz, 2004), allowing for nuanced insight into how entrepreneurs engage with the EE.

Moreover, considering the nascent nature of this research, it was essential to use a data collection method that allowed for interpretation of the responses provided by the participants. The research question concerns an open-ended exploration of "how", which is sought to be answered with a qualitative methodology (Edmondson & McManus, 2007). Thus, the qualitative approach facilitates the exploratory aim of the study (Bell et al, 2017).

Given the purpose and research question, the study adopts a social constructivist ontology, viewing reality as socially constructed, shaped by social actors through their interactions and interrelations. This view is appropriate because the influence of the EE is aimed to be understood from a subjective standpoint of the early-stage firms, shaped by their ongoing lived experiences and the meanings attributed to them, which is continuously evolving. Thus, it is subjective to the perceptions of the entrepreneurs, which are socially influenced. Further, an interpretivist epistemological stance is employed to analyze and grasp subjective meanings of the responses of the participants in the study. This is done to emphasize the influence of the EE from the viewpoint of entrepreneurs, to comprehend their perceptions, and interpretations of how the ecosystem supports and influences their capabilities (Bell et al, 2017).

3.3 Design of study

The thesis employs an abductive research logic. Our research began with an interest in the life science ecosystem in Stockholm, specifically in understanding how small life science companies bring innovations to market within this ecosystem. An abductive approach, as described by Flick (2014), begins with an element of surprise. Recognizing the limited existing research about the impact of EEs on entrepreneurial activities, we identified the need to further investigate this field. Further in the research process, the abductive approach enabled us to simultaneously draw from empirical observations and structuring it based on existing theory and literature, facilitating the development of our theoretical contributions, thereby enhancing the understanding of both theory and empirical findings (Saunders et al., 2012).

The study follows a cross-sectional research design consisting of data collected at a single point in time across a diverse sample of early-stage life science firms, relating to the specific period of the commercialization process of bringing an invention to the market (Bell et al, 2017). This approach enabled us to understand and analyze variation and identify patterns across a diverse range of early-stage firms regarding how the EE influences their DCs. (Bell et al, 2017).

3.4 Data Collection

The data collection uses a multi-method qualitative research approach, drawing from various primary and secondary sources of data. The primary data consists of semi-structured pre- and main study interviews conducted with several experts and early-stage life science firms. This was supplemented by supporting data and secondary sources obtained from websites and online articles about interview subjects prior to conducting interviews.

3.4.1 Pre-study

Probing the empirical field, the pre-study included two expert interviews with individuals who have extensive experience in the life science industry and possess particular insight into support structures for early-stage life science ventures, gained from their involvement with prominent incubators and investment firms specializing in this industry. See Appendix 1 for the full list of pre-study interview subjects.

The pre-study aimed to deepen the authors' understanding of the research topic and contextualize it within its broader context (Saunders et al., 2012). It yielded valuable insights into the life science ecosystem and the specific commercialization processes of different sub-industries within life science.

3.4.2 Interview Sample

The participants were selected using a purposive approach, specifically employing the theoretical and snowballing sampling methods. Interviewees were chosen based on their relevance to the research question and the objective of representing variation across key characteristics to increase generalizability (Saunders et al., 2012).

Desktop research combined with insights from the pre-study interviews allowed us to gain insights about incubators, hubs, industry organizations, and investor networks available and utilized by early-stage life science ventures in the Stockholm area. Subsequently, we mapped these actors, and compiled a comprehensive list of firms engaged with these actors. Furthermore, we employed snowballing, as interviewees shared contacts to other potential interview subjects, enabling us to access relevant interviewees through their personal networks (Bell et al, 2017).

The companies were screened prior to reaching out to them, to ensure alignment with the industry of focus, our definition of early-stage firms and our geographical boundary of Stockholm. These criteria were established from the beginning of the thesis. The sampling process was continued until theoretical saturation was reached, indicated by the repetition of similar patterns, which signaled that we had achieved a sufficient sample (Bell et al., 2017). See Appendix 2 for the full list of interview subjects included in the main study.

The choice of a broader theoretical sample range was driven by the objective to enhance the relevance of the results to a broader range of early-stage life science firms, to understand multiple perspectives of entrepreneurs and to attain a more comprehensive understanding of the phenomenon under investigation, aiming to identify any patterns that hold significant meaning (Bell et al, 2017). Therefore, the sample consists of a wide range of life science companies,

encompassing early-stage biotech, medtech, and healthtech firms, with participants representing various academic and professional backgrounds and holding different roles such as CEOs and founders. Due to the lengthy commercialization timeline in the life science sector we decided to include companies established across various years spanning from 2015 to 2023, allowing us to examine firms at different stages of the commercialization process. Notably, the firms included in the sample are not healthcare providers themselves; instead, they intend to provide products or services to end-users, other companies, researchers or healthcare providers. Our intention was to include pharmaceutical companies but due to lack of interested respondents, the pharma industry is not included in the sample.

3.4.3 Interview Design

We conducted a total of 27 main-study interviews, either in person or via Google meet or Teams, with scheduled appointments. To better understand the social context of the interviewee, our original aim, however, was to have in-person meetings at the respondents' offices. Interviews were conducted in English and Swedish, and lasted between 36-88 minutes. To explore new insights that emerged along the process, additional follow-up phone interviews were conducted with six participants within a week after the main interview.

To better understand the social context and commercialization stage of each company, we diligently prepared for every interview by conducting desktop research. This involved gathering information about the interviewee, company, and ecosystem interactions from online sources. The standard questionnaire was thereafter slightly modified before each interview to improve its suitability and relevance (Bell et al, 2017).

The main study interviews began with informal conversations, followed by an introduction to the research topic and interview procedures. Interview participants were informed that both their organizations and identities would be anonymized. We then asked interviewees for their permission to allow us to take detailed notes and transcribe the interviews via Teams, with the assurance that these transcripts would be handled confidentially to maintain ethical standards in data collection (Bell et al, 2017). Following this, we proceeded with the main sections of the interview questionnaire and concluded with wrap-up questions addressing overlooked or specific topics of relevance. We made consistent efforts to understand the interviewees' perspectives by asking follow-up questions and carefully noting any inconsistencies in their responses. The interview questions followed an open-ended format to allow for in-depth discussions about the interactions between the entrepreneur and the EE and to explore how these interactions influence their capabilities during the commercialization process. See Appendix 4 for the main-study interview guide.

While both researchers participated in discussions during the interviews, we alternated roles, with one researcher leading the conversation while the other took rigorous notes on responses and body language. We used "responsive interviewing" as described by Rubin and Rubin (2005), emphasizing the understanding of the interviewees' perspective by holding a collaborative conversation.

3.5 Data Analysis

Employing semi-structured data collection requires a thorough and consistent management of the gathered information to derive reliable conclusions, a process known to be time-consuming (Bell & Bryman, 2015). Directly following the interviews, both authors carefully reviewed the transcriptions, by cross-referencing, adjusting them to the notes to minimize the risk for misinterpretations and increase reliability. The transcriptions enabled a more complete analysis of participants' statements and provided the opportunity to revisit insights that may have been overlooked during the interviews.

During the data analysis phase, we followed the grounded theory approach outlined by Gioia et al. (2012), transitioning from an initial empirical categorization to a subsequent stage of iterative knowledge generation. Immediately after conducting the interviews, each author individually engaged in structured coding activities to identify initial first and second-order constructs. We thereafter compared the initial constructs, went back to the data, and engaged in discussions to develop a common interpretation. In the subsequent phase, a comprehensive list of first-order concepts consisting of ecosystem elements were distilled into representative themes aiming to answer the question of "what is going on here", aiming to make sense of the experiences of the entrepreneurs. The authors took on the role of "knowledgeable agents" to understand how different concepts in the data relate to each other, focusing on identifying the underlying patterns in the data of how the EE influences the DCs of entrepreneurs (Gioia et al., 2012).

Thereafter, the second-order themes were synthesized into overarching theoretical dimensions (Gioia et al., 2012). The development of these dimensions was an iterative process, following the abductive logic, moving between theory and practical insights. We revisited the initial codes and themes, made adjustments to ensure the aggregate dimensions were both theoretically robust and practically valuable for understanding the phenomenon being studied.

3.6 Trustworthiness Criteria

In qualitative studies, Guba and Lincoln (1985) propose the need for alternative terms to assess the trustworthiness of qualitative research, suggesting four key criteria: credibility, transferability, dependability, and conformability, which will be discussed.

3.6.1 Credibility

Credibility assesses the plausibility of the findings by adhering to sound research practices and verifying that the information aligns with the social reality being studied (Bell et al, 2017). Given that the research relied on interpretations of entrepreneurs' experiences and responses, credibility considerations were vital. Credibility was achieved through triangulation, utilizing multiple data sources to validate, cross-check the findings and provide diverse perspectives to the qualitative interviews, and by the authors both participating in the handling of the transcriptions and by independently making interpretations of the data before developing a shared one and (Yin, 2014). Additionally, both authors participating in all interviews minimize the risk of misinterpretations (Kvale & Brinkmann, 2014).

3.6.2 Transferability

Transferability refers to the extent to which findings can be applied to different contexts or settings beyond those specifically studied. To enhance transferability, detailed and comprehensive descriptions of the context and phenomenon under study were provided, serving as a foundation for evaluating the potential applicability of the findings to other contexts (Bell et al, 2017). Additionally, purposive sampling was employed to enhance transferability and generalizability, allowing other researchers to compare the findings with similar contexts or sample criteria. However, it is crucial to recognize that definite conclusions cannot be drawn, and generalizing to other contexts proves challenging (Guba & Lincoln, 1985; Bell et al, 2017)

3.6.3 Dependability

Dependability concerns the reliability of the study (Bell et al, 2017). To maintain consistency in explanations and ensure findings are not limited to a particular time and location, we implemented the inquiry audit technique in this paper. This involved collaborating with the supervisor to assess the research process and verify the accuracy of our interpretations.

3.6.4 Confirmability

Confirmability aims to ensure that researchers act in good faith, minimizing the influence of personal values, theoretical biases on their conduct and findings (Bell et al, 2017). In order to uphold this criterion, the authors dedicated efforts to practicing reflexivity. To mitigate potential biases stemming from theoretical preconceptions and prior research about the companies, which may have impacted the interview and interpretation processes, we engaged in reflexivity by continuously reflecting on our biases and discussing how our roles as researchers might affect research decisions, the interview process, and results (Shenton, 2004). For instance, we identified

discrepancies between interviewees' lived realities and the stated characteristics of DCs according to literature, prompting us to address these theoretical assumptions as a team. Confirmability was further supported by employing multiple observers and sources of data to mitigate bias in the process. However, even though we remain careful to accurately represent the perspectives of the interviewees and have taken steps to reduce interviewer bias in our methodology, subjective interpretations are inevitable (Bell et al, 2017).

3.7 Ethical considerations

The primary ethical consideration was safeguarding data privacy and anonymity for all study participants. As a result, the identities of respondents and organizations were not revealed, and interview materials were promptly deleted upon completion of the report. Consent for participation was also explicitly obtained prior to each interview.

3.8 Methodological limitations

One concern involves the risk of participants forgetting information about their interactions with the ecosystem, particularly considering that these interactions may have occurred several years ago for some of the interviewees. Additionally, participants may have not been afforded sufficient time to fully describe the entirety of their experiences with the EE given that we conducted only one interview with most of the participants. Although we altered the standard questionnaire to the specific interview subjects and conducted some follow-up interviews, a longitudinal research design or more follow-up interviews, could potentially have provided more comprehensive insights, however this was not possible due to resource constraints (Bell et al, 2017).

4. Empirics & Analysis

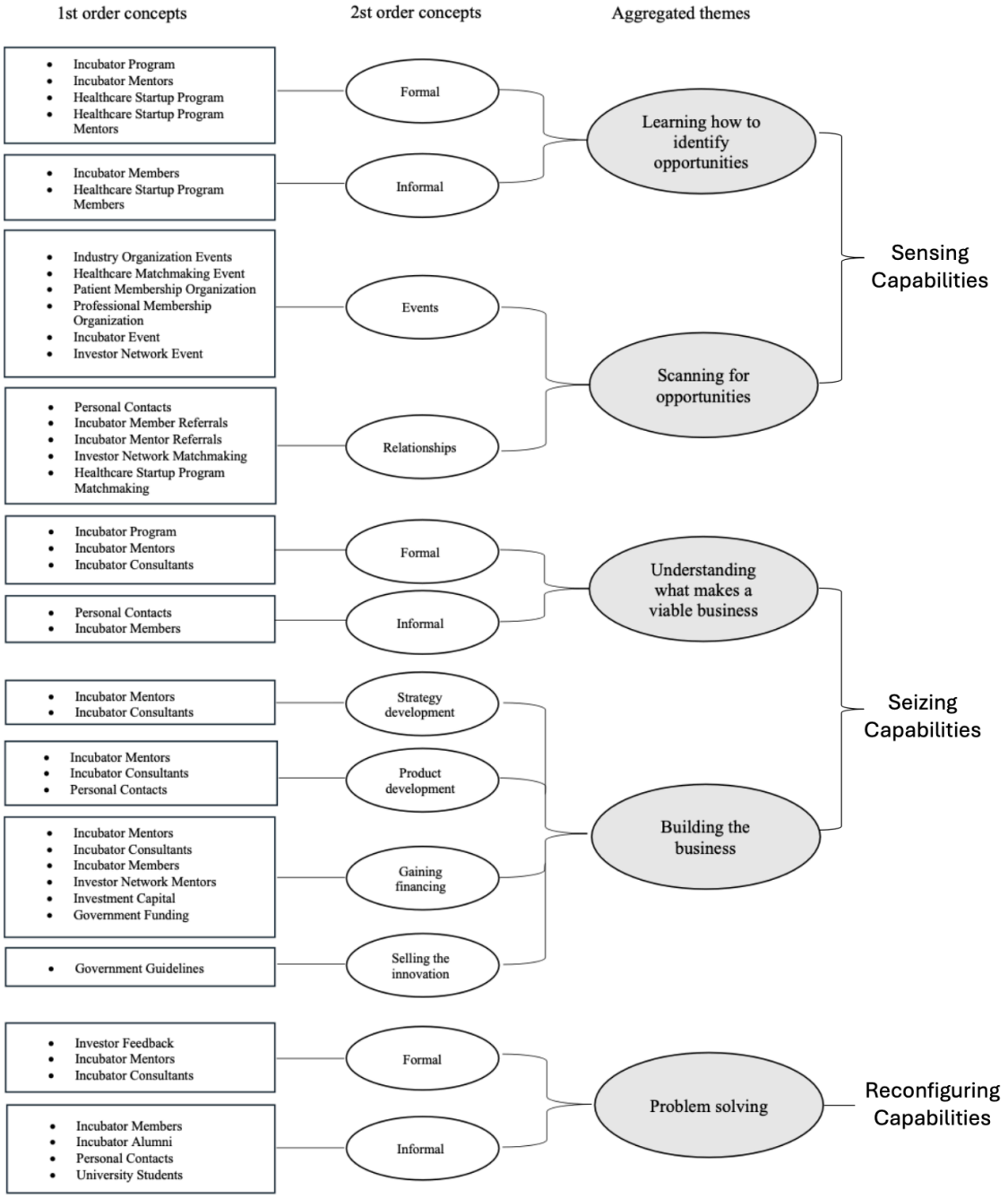


Fig. 2. Coding process of empirical data
Source: The authors

4.1 The Influence of Entrepreneurial Ecosystems on Dynamic Capabilities

The empirics show that the EE influences early-stage firms in identifying and capitalizing on market opportunities, including customer and investor opportunities, in the commercialization process of bringing their invention to the market.

4.1.1 Sensing capabilities

The interviews reveal specific dynamic capabilities central for sensing market opportunities, including customer and investor opportunities. This includes evaluating the commercial viability of an invention, understanding market needs, as well as scanning opportunities for customers and investors. Empirical findings demonstrate that the sensing capabilities of early-stage firms are influenced by the EE through two general processes, Learning how to identify opportunities and Scanning for opportunities, which will be described in the subsequent two sections.

4.1.1.1 Learning how to identify opportunities

Learning how to identify market opportunities, including customers and investors, is a crucial aspect of sensing. We find that the EE influences the early-stage firms in how to identify these opportunities through both formal and informal learning processes. Formal learning processes refer to structured methods of knowledge acquisition, often through education guided by a predefined set of learning objectives. This includes traditional lecturing and interactions with mentors and consultants, who offer personalized guidance tailored to the specific needs of the early-stage firms. In contrast, informal learning processes involve more spontaneous and flexible interactions, such as those between fellow entrepreneurs and other personal contacts.

Formal processes

Interviewees who have participated in the KI Innovations, KTH Innovations and Sting incubators describe that they make use of education and mentors to understand the importance of assessing the commercialization potential of inventions and to learn methodologies for doing so. For instance, respondents with experience from KI Innovations highlight the individualized guidance and techniques that support firms in the early stages of the program to evaluate commercialization viability, which guides their strategic decision-making.

"In the incubator program, we did all kinds of analysis to evaluate the commercialization potential of two different projects, partly with the help of the mentors at KI innovations. This made us see that the patient benefit was bigger with one of the projects so we proceeded with that one. I learned that when you are commercializing, the technology has to somehow make life or something ten times better, cheaper or faster. This is necessary to be adopted by the market, but also by investors." - Participant 2

"These courses inform me about strategic priorities, meaning what to hold on to, what to focus on, so that it has the most impact on commercialization and the potential for intellectual property."- Participant 26

Participants interviewed from KTH Innovations and Sting also stressed the significance of the incubator education and mentorship in helping them develop a thorough understanding about user needs, highlighting the necessity to interact with customers and users. Respondents explain that they found the education on how to approach potential customers and users highly useful.

"The incubators taught me that you need to start with exploring the market, already when you are ashamed of your product, and co-develop it with your users or customers. It taught me personally how to practically approach customers and their needs, for instance how to ask the right questions when doing customer interviews." - Participant 22

Similar to the value provided by incubators, interviewees utilize the education and mentors in the Healthcare startup program Clinical Innovation Fellowship to learn processes for evaluating market potential and user needs.

"We learned how to identify and prioritize needs based on impact and business potential, following user journeys and deep analysis of the identified needs, and selecting one to address based on certain criteria and then seeking the appropriate technology solution. As a scientist, I am used to research methodologies, but design thinking and the double diamond design thinking process adds an extra dimension that I now apply across various aspects of my work." - Participant 23

Informal processes

Interviewees with experience from KTH Innovations, KI Innovations and Sting also describe how they engage with fellow incubator participants to learn how to identify investors opportunities by understanding which investors are suitable for their company and stage of development. Participants highlight that they learn from the experiences of the other entrepreneurs in the incubator community about the importance of finding investors with relevant knowledge about their industry, crucial for shaping the development of the business.

"From talking to other incubator companies we got good insights that the best type of investor is not only someone who can help us with finances, but also someone who has interest and knowledge about what we do, who can help us develop as a company." - Participant 7

Respondents also highlight that engaging with peers in the Clinical Innovation Fellowship Healthcare startup program was useful for understanding how to identify customer and user needs.

"I learned a lot from the other people in the program, especially the designers. It helped me see things from different views and how to include the perspectives of customers and users in developing the company." - Participant 22

4.1.1.2 Scanning for opportunities

Scanning the environment for opportunities is a central part of sensing. The findings reveal that the early-stage firms engage in different types of activities to seek potential opportunities and to gather information about market opportunities, including customer preferences and other relevant factors. We find that firms attend events to seek out and interact with potential customers and investors. They also leverage their relationships with different actors, including personal contacts and interactions with fellow entrepreneurs who provide information and referrals to relevant connections, as well as agents who arrange matchmaking meetings.

Events

Interviewees describe that they utilize events to seek potential customers and users, and gather information about customer and user preferences. For example, respondents make use of healthcare events, such as Vitalis, and life science industry events, such as those organized by the industry organization Sweden Bio, to interact with healthcare professionals, researchers, and industry stakeholders. This enables them to gain an understanding about customer and user needs, which is crucial for comprehending the commercialization potential of their invention.

"I attended a fair where I showcased our product. Most importantly, it was a chance to directly gain insights into where our product can be used. I learned that urologists, not just gynecologists, could use our product. However, to meet the complex needs of the gynecologists' patients, we understood the need to incorporate another function to our product." - Participant 21

However, interviewees highlight that they face resistance from patient and professional membership associations, such as the General Practitioners Association and the Breast Cancer Association, in interacting with their members. Participants explain that this constrains them from understanding the needs of these potential customers and users. Therefore, some respondents wish for these organizations to be more open in supporting and marketing their companies, as this could potentially allow them to access relevant patient groups necessary to evaluate needs.

"We reached out to the Breast Cancer Association to get input on how our product could solve the needs of patients, but they were not interested at all. My impression is that these individuals are not up-to-date with new innovations and technology." - Participant 14

Similarly, interviewees also wish for the incubators to act as a better bridge between entrepreneurs and the market. Respondents would like to see incubators organize events and meetings to facilitate better interactions between entrepreneurs and researchers, decision-makers, healthcare professionals and potential customers and users from healthcare clinics or the life science industry. This to acquire diverse perspectives on user needs, but also to better understand the customer potential of their inventions. Especially those entrepreneurs lacking a background and personal network in healthcare and life science, express disappointment with the incubators' failure to provide support in this regard.

"The incubators could do more in terms of inviting dialogues to put patient groups, patient associations, researchers, and healthcare professionals in the same room. This would be very useful to understand if there is a need, how we can solve it and where my product can be used." - Participant 13

"I find it strange that we haven't been able to speak with anyone at Karolinska Hospital through KI Innovation. I had hoped that the incubator would organize some meetings with the hospital ." - Participant 14

Furthermore, participants also make use of events to find potential investors. Incubator investor events at KTH Innovations, KI Innovations and Sting allow participants to interact with investors, which is mentioned by the interviewees as one of the most central reasons to join the incubator. Many companies, even those with pre-existing investor contacts seek to expand their investors networks and gain visibility through these events.

"Most of the investors we have met are through the help of KI innovations and their investor events, which is one of the main reasons why we joined the incubator." - Participant 7

"Even though I know a lot of investors, the investor events are an important way for me to meet investors and expand my investor network. After all, an investor group will come, and it is a quality mark to be part of Sting."- Participant 27

Further, many interviewees, regardless of their participation in an incubator or their existing investor contacts, make use of investor and pitching events organized by different investor networks, such as Sciety and Connect, in order to meet and interact with investors.

"Sciety has been a prerequisite for us to succeed. They hold pitch events quite often where we meet really

interesting investors, and then through those investors we have received recommendations to other relevant investors and investment firms." - Participant 19

Relationships

Participants describe that they leverage their personal connections within the healthcare and life science industry to seek potential customers and users, and gather information about their needs as well as the potential applicability in the healthcare system. This, for instance, includes leveraging personal contacts to directly access healthcare clinics to assess needs, a significant barrier highlighted by those participants lacking established personal connections within the healthcare field.

"Contacts are truly crucial. The pharmaceutical world is very small, I must say. If you've worked in the pharmaceutical industry, you pretty much know everyone. So we reached out to various key companies, individuals, and researchers within our own network who could potentially benefit from our product. Through this, we learned about what the customers want from our technology. "- Participant 10

"Thanks to a doctor in our network, we were introduced to Karolinska and got to run a project there, so we were able to visit and observe how things work within healthcare." - Participant 27

"Since I don't know that many people in healthcare, I tried to contact the Head of a department at Karolinska to understand his thoughts on patient needs, but I have not received a response, and I cannot find a designated person available to address these questions." - Participant 14

In terms of investor opportunities, interviewees with strong personal connections to investors describe that they leverage these networks extensively to seek investor opportunities. A few of these entrepreneurs with extensive personal investor contacts mention that this reduces their need to participate in an incubator.

"I have a broad network of investors, so I just reached out to my contacts at a suitable investment firm, and they were the first investors we secured. So we didn't need KI Innovations and that route, all investors came through my connections." - Participant 11

Besides drawing on personal connections to seek, interact and understand customers, entrepreneurs who have participated in the Clinical Innovation Fellowship program, leverage the connections of the mentors in the program who match them with suitable healthcare clinics to assess customers and user needs.

"I see a lot of healthcare or healthtech companies struggling with getting into hospitals to observe needs. Therefore, Clinical Innovation Fellowship was so important because it made it possible for me to spend two months following doctors, nurses, and other personnel." - Participant 23

Similarly, participants with experience from KI Innovations, KTH Innovations and Sting describe that they make use of fellow incubator member companies as well as incubator mentors to seek potential customers and investors. The significance of leveraging incubator members' referrals to potential customers is emphasized both by participants lacking personal contacts within healthcare and life science, as well as interviewees with established contacts in the field who seek to expand their connections with customers. Respondents emphasize the importance of tapping into their peers' networks, since the healthcare and life science sector is marked by considerable skepticism, in which personal connections are essential for credibility and consideration.

"The biggest advantage with Sting is the other member companies and the mentors. They challenge me with feedback and valuable advice. This is useful even though I know a lot of people within this field. They ask questions like 'Have you considered approaching these healthcare providers or pharmaceutical companies?' which helps me to broaden my thinking and receive tips on which customers I can approach." - Participant 10

"Accessing others' networks is crucial to come in contact with customers, and we have done that through KI Innovations. There is significant skepticism within the life science field, and it is very challenging to simply reach out to someone saying, "Hi, we have a new technology."- Participant 16

Similar to the significance participants attribute to the incubator investor events, enabling them to build and expand their investor networks, respondents, whether or not they already have existing investor contacts, also emphasize the value of receiving investor connections from fellow members.

"There are driven individuals here at Sting who always share their tips about which investors they have during these tough times. It's crucial for the value of our participation in Sting that everyone is so open and willing to share tips when looking for similar investors"- Participant 10

Besides the investor matchmaking provided by incubator member referrals, entrepreneurs also leverage the investor matchmaking meetings facilitated by mentors at the investors networks, such as Sciety and Connect, to build and expand their investors networks.

"The mentors set up all the pitch meetings, some online and some at their office, with selected investors who are interested, so it becomes quite an efficient matchmaking process." - Participant 16

4.1.2 Seizing capabilities

The interviews revealed specific seizing capabilities used to capitalize on the identified market opportunities. This involves mobilizing resources to build a viable business, and developing new products, processes and activities, including tasks related to product development, strategy development, gaining financing and selling the innovation. Empirics show that the seizing capabilities of early-stage firms are influenced by the EE through two general processes, Understanding what makes a viable business and Building the business, which will be described in the following two sections.

4.1.2.1 Understanding what makes a viable business

Understanding what makes a viable business is a crucial aspect of seizing, enabling entrepreneurs to evaluate necessary capabilities, and learn about skills important for mobilizing resources and building a business. We find that the EE influences this understanding through both formal and informal learning processes, which were explained previously.

Formal processes

In particular, participants without previous business experience, such as academics who recently transitioned from the lab, make use of incubator education and mentors from KI Innovations, KTH Innovations and Sting, to build up their general business skills. Examples mentioned by the interviewees include learning how to organize business operations, the key components constituting a strong business plan, and understanding the specific business plans required for their company, such as clinical testing plans.

> *"As an academic researcher, I benefited a lot from the business knowledge I learned in the incubator, like the Catalyzer program which is like a crash course in business related topics, to prepare yourself to have a comprehensive business plan."* - Participant 8

Entrepreneurs with prior business experience especially emphasize that they perceive the incubator education to be primarily designed towards entrepreneurs with limited business experience. Therefore, these entrepreneurs express a desire for the incubator to assess the participants' knowledge levels at the early stages of the incubator program, in order to tailor the educational content more closely to their specific needs and knowledge gaps.

> *"My criticism of Sting is that it is too "one size fits all" and aimed at young tech entrepreneurs. In order for Sting to reach its full potential, they need to adapt their support to each entrepreneur's unique experiences and needs. I don't need a standardized six hour sales*

training, I have like 20 years of experience in sales from large international companies." - Participant 21

For instance, participants with business experience but new to the life science field, highly value incubator education on business knowledge specific to the life science industry. To exemplify, these respondents appreciate the insights provided by the KI incubator into regulatory pathways and how they impact their particular business and product development processes. Additionally, participants with such backgrounds value the opportunity to learn how to develop business models specific to their sub-sector within the life science industry.

"For us tech and business people, we learned a lot about running a company in this industry and about the importance of regulations in life sciences, how to comply with them, and how they affect your own company." - Participant 14

Similar to remarks on the lack of tailored incubator support based on participants' existing knowledge levels, many participants from all the incubators emphasize that they oftentimes perceive the incubator education as being too general. For instance, while most participants at KI Innovations and KTH Innovations appreciate that the incubator program and external consultants provide an overview of different IP strategies and how the patenting processes can vary, some express further need to better tailor the teaching according to companies' unique goals and industries.

"In Catalyzer we talked about the legal aspects, but it wasn't useful because the course is not customized to you. I mean, a couple of us focus on drug design, some focus on medtech, and someone was doing stem cell research, it's such a variety of fields. There's a lot of lectures and half days about patents that were not applicable to us at all." - Participant 1

Another example of perceived lack in customized support regards coaching on business models. Entrepreneurs at KI innovation express a need for mentors with broader experience in industries such as medtech and healthtech, to enable better support in how to develop business models within these fields.

"I would need to exchange ideas with a coach who has experience of running medtech companies. Generally, more support is needed for healthtech startups, especially when it comes to looking at different business models, how to calculate the monetary components, understand reimbursement, regulatory changes and be more innovative about it." - Participant 13

Informal processes
The interviews show that entrepreneurs also leverage their social networks, either personal contacts or the connections to fellow entrepreneurs at the incubator community to understand what makes a viable business.

For instance, some participants with established contacts in the life science field explain that they rely on these connections to understand how to tailor IP strategies according to their specific industry.

"Through one of the co-founders' network we learned about IP strategies and specifically how to do this optimally for biotech. Because at my co-founders lab, they are already patenting a lot." -Participant 3

Moreover, participants leverage the networks of incubator members to gain insights also into certain business aspects. For instance, interviewees from the KI incubator use the experiences and knowledge of fellow entrepreneurs to discuss business model strategies.

"We turned to other companies in the incubator to discuss our business model - can we attract people and scale the business model? Should we use subscriptions or another payment model, etc? " - Participant 13

4.1.2.2 Building the business

Critical to seizing capabilities is the actual mobilization of resources to address identified opportunities. The interviews show that early-stage firms engage in different activities to develop and shape the business, relating to product and strategy development, gaining financial capital and selling the innovation. We find that the EE influences the ability of entrepreneurs to build their businesses primarily through mentors, consultants and personal contacts. Additionally, the structure of the healthcare system, the investment capital and the governmental funding in the EE impact entrepreneurs´ seizing capabilities.

Strategy development
Interviewees from the KTH, Sting and KI incubators emphasize that one of the most important reasons to join the incubator is the access to internal mentors and external consultants, who support the entrepreneurs in actively building a commercially viable company. Participants highlight the significance of accessing Vinnova government funding, through the KI and KTH incubators, so-called validation grants, allowing participants to leverage specialized knowledge from expert consultants in the incubators´ network.

"I only got good things to say about the quality of support I get from the incubator mentors, and if they are not knowledgeable they sync me up with the right people to do stuff through the validation grants. They provide me with a network of validated experts that I would not have been able to reach otherwise, which is very good." - Participant 26

As an example, participants use validations grants provided by, for instance, KI innovation to outsource strategy development to external consultants found in the incubators' network. To exemplify, this includes the creation of financial strategies.

"We received great help from KI Innovations with experts who created a financial strategy for us, since we needed to prepare numbers and objectives in a professional way, to later show to potential investors." - Participant 15

However, participants also emphasize that a key aspect of the incubator support involves developing strategies in collaboration with a mentor or consultant. Respondents from KI Innovations, for instance, highlight the important role of direct support, co-development and continuous feedback from these coaches, enabling them to develop strategies and business plans more effectively and avoid mistakes.

"It is a lot about your own engagement in Ki Innovations, which is good because the aim is to have an independent company coming out of this. I like this direct support, such as when we're doing a lean canvas together in a 4 hour slot with an expert. Then you have instantaneous feedback and learn all the tricks, because you're doing it with somebody." - Participant 26

However, participants with experience from KI Innovations also emphasize limitations to the incubator support in helping to develop strategies related to commercialization, such as launch strategies, stressing the lack of entrepreneurship experience among the mentors and consultants.

"KI really needs to get closer to commercialization. There is a lot of focus on learning how to build business plans but less about doing the actual commercialization and launch of our product. Now we will create a launch plan, and I get no assistance in this. I would need help in developing pricing, geographical expansion, marketing and PR strategies. These are issues that need special attention and should be addressed and integrated into our business plan. So this is really what KI Innovations lacks." - Participant 6

Product development

Participants also describe that they engage with incubator external consultants to receive help in navigating and developing product processes aligned with regulatory requirements. This for instance includes developing plans for clinical testing, in collaboration with experts.

"Going down the regulatory path together with an expert is really good. The consultant guided me in the creation of a product plan by continuously providing knowledge about the regulatory environment, and challenging me with useful feedback." - Participant 2

Interviewees describe that incubator mentors also help them understand what tasks in regards to product development that they should outsource to external consultants in the incubator network. By using the validation grants provided by the KI and KTH incubators, participants, for instance, outsource the creation and submission of patent applications, the development of quality management systems (QMS) and prototyping to external consultants at firms in the incubators' network. The monetary support for using patent lawyers is highlighted by participants as one of the incubators' most important support offerings.

"The most important help from KI innovation was the financing of our first patent application because that was right when we started. It is a lot of money so I don't think we could have done it ourselves." - Participant 7

"KI Innovations confirmed that there are certain things I shouldn't focus on, we need professionals to do the ISO certification and QMS, for instance, as there is no room for error there. - Participant 14

Some participants with relevant personal networks instead leverage their own contacts to outsource tasks, such as QMS, and prototyping based on their connections within universities or from prior business experience in the life science field.

"The prototype was done entirely by some of our contacts, including someone I knew from KTH and a mechanical electrical developer that he knew."- Participant 7

Gaining financing

Participants, particularly those without prior entrepreneurship experience, describe that they find incubator mentors and consultants as well as mentors from investor networks, such as Connect and Sciety, useful to develop effective pitch decks and pitching skills for communicating with investors.

"We focused a lot on investors and creating a good pitch deck. We went through it several times with the incubator coach, who gave hands-on feedback on what needed to be clarified and removed. For instance, he helped me develop slides that talked more about the business model instead of the product and the technical solution." - Participant 1

Moreover, incubator participants also describe that they observe how other incubator members pitch at the incubator investor events, which has inspired them when developing their own pitch decks.

"During the KI investor events we found it very useful to hear the pitches of other companies, especially those that are a bit further down the line. I have listened to how these people speak about their projects to investors, and used this to create good pitch decks of my own." - Participant 8

In terms of the general investor landscape, participants perceive a notable lack of investment capital available for early-stage life science firms as well as limited government funding. Entrepreneurs consider these limitations as hindrances to the commercialization process, given the crucial role of capital in developing the business. Respondents point out the difficulties with raising investment capital in the life science industry due to the long, capital intensive and risky development cycles and a general lack of understanding of these aspects among investors. Interviewees therefore stress the importance and need for more government initiatives to provide funding to early-stage life science firms.

"It's very, very difficult in life science to raise money in Stockholm. It's much easier if you have software, for instance. Also, the amount of capital available is nothing compared to abroad. I think that the state could do much more to support life science companies." - Participant 19

Despite perceiving a generous number of Vinnova government funding opportunities available for early-stage life science firms, participants stress that most grants provide relatively low funding amounts. Interviewees also highlight that they find the application processes and requirements very complex and time-consuming. There is a notable lack of feedback on submitted applications, highlighted by interviewees to limit their knowledge on how to improve in subsequent applications.

"There are many announcements by Vinnova but the amounts are quite low since they spread the capital across like 300 companies. There must be better ways to distinguish ideas that are serious and worth investing in. However, we have never received the money, and I have no idea why because we never got feedback. Generally, I must say that I find the application process incomprehensible." - Participant 14

Selling the innovation

In order to eventually launch and sell their innovation, the majority of the interviewed companies need to conduct clinical studies in healthcare. Participants strongly emphasize the structural challenges and cultural barriers in healthcare, constraining them from conducting necessary studies. This includes an absence of government guidelines and financial support for testing innovations in healthcare, as well as issues of self-interest among decision makers and healthcare personnel.

"It has been impossible to test our product in clinical studies because it is not in the interest of doctors. If, for example, a surgeon promotes a diagnostic test by accepting testing in the clinic, there will be fewer operations, less budget and salary. There are so many cultural barriers, vested interests and no national requirements to support this."- Participant 5

Additionally, when it comes to eventually selling the innovation to customers in healthcare, participants once again highlight the structural challenges and lack of government guidelines, hindering them from potentially gaining customers within healthcare. Interviewees emphasize the lack of functioning mechanisms that facilitate innovation adoption in healthcare and the absence of a clear and effective reimbursement system for innovations. Respondents generally note difficulties engaging with the public healthcare sector because decision-makers for purchasing innovations may differ from those interested in them. Thus, participants describe the system as rigid, slow, and biased towards vested interests and connections, highlighting problems with the current national healthcare guidelines system. Some participants therefore stress the need for new clear government guidelines that can streamline the healthcare system.

"Even though we have clinical studies as evidence, officials in the regions are not interested, and if they were, it's up to all 21 individual regions to get the product sold on a larger scale. The biggest problem with commercialization in Sweden is that there is no system to receive them. So we will focus on countries where we get paid and where it is very clear how you get paid. " - Participant 20

"The national guidelines system is in the hands of a few. We need new national guidelines that ensure payment and fair treatment of products, avoiding lengthy and biased processes. There is a need for an actor, like the National Board of Health and Welfare, to act as a regional representative. " - Participant 5

4.1.3 Reconfiguring capabilities

After opportunities are sensed and seized, the interviews show specific DCs needed to renew existing competencies and resources, related to developed strategies, business models, and product development. This includes identifying when reconfiguration is needed and what specific changes are required. Empirics show that reconfiguring capabilities are influenced by the EE through one general process, problem solving, which will be described in the following section.

4.1.3.1 Problem solving

Problem solving represents the process of renewing existing competencies and resources when encountering problems or challenges in the business and commercialization process. Again, we find that the ecosystem influences this process through both formal and informal learning processes, which were explained previously.

Formal processes

Entrepreneurs mention that they make use of actors in the incubators to identify current problems in their businesses, but also to understand how to make the necessary changes to the identified problems.

For instance, participants describe that through feedback from investors at the incubator investors events at KI Innovations, they receive feedback on their business and commercialization strategies, helping them understand and identify where problems with the strategy exists, indicating the need for change.

> *"From the investor panel at the KI Investor Days, I understood that there is a problem with our strategy, they said that we needed to change a lot of aspects that I had not considered before"* - Participant 2

Interviewees also explain that through the help of incubator mentors from KI Innovations and Sting, they receive support in understanding how to solve already identified problems. Participants emphasize the valuable assistance by incubator staff in helping to resolve issues related to the business, such as business model concerns, encountered by the entrepreneurs.

> *"The incubator keeps asking what they can improve all the time, and when they can they do improve. If you encounter problems, like when I realized that the reimbursement part of the business model no longer holds, then Sting listened to me and brought in a coach who was an expert in my area and helped me to understand how I could change this."* - Participant 22

Informal processes

Furthermore, participants from KTH Innovations, KI Innovations, and Sting highlight the value of drawing on interactions with fellow incubator members to exchange ideas, useful for identifying problems and learning about specific problem-solving strategies.

Incubator participants emphasize the supportive culture of the incubator as central to realizing that you are not alone in facing challenges, which entrepreneurs mention encourages them to seek out help from their incubator peers to work through issues. For instance, participants not only turn to incubator mentors, but also to fellow members to address problems identified with aspects such as the business model, and to seek input on necessary modifications.

"I believe it is crucial to interact with other companies to understand that you are not alone in your struggles. I must say that the culture of Ki innovation has been extremely supportive and positive."
Participant 6

"The non-disclosure agreements facilitate open conversations, which is valuable when you stumble upon issues and want inspiration from others who have gone through the same journey. For instance, I can just pose a question in the lunchroom like "I need to change my business model because I am struggling to see how it will hold in the future, do you have any idea why and how to solve it?"-
Participant 26

Similarly, by attending incubator alumni events where current entrepreneurs in the incubators get to connect with successful entrepreneurs who were previously part of the program, participants gain inspiration and ideas for how to solve challenges related to, for instance, product development.

"The events at KI Innovations have opened my eyes for other companies, like when a CEO ran a breakfast lecture and talked about their product development journey. It was so inspiring, we understood that many of our problems are common, for instance the struggle to design user-friendly solutions for healthcare professionals, so it was interesting to hear how they solved it." - Participant 16

Respondents also explain how they leverage their personal networks, such as university connections to gather ideas on problem-solving strategies.

"I always turn to my friends from my study time at KTH who have also founded companies in the same field, so we discuss how they tackled challenges and exchange ideas on various topics." -
Participant 19

Some companies also describe that they hire students from the universities with the purpose of innovating their product and gaining new perspectives on encountered problems.

"We've had a lot of help from students at KI. Of course, you're not very experienced when you're a student, but often you have some fresh eyes on things. Different backgrounds like this make us more innovative." - Participant 7

5. Discussion

5.1 The influence of Entrepreneurial Ecosystems on Dynamic Capabilities

The purpose of this study was to investigate how the EE shapes the DCs of early-stage firms in the commercialization process. Based on the literature review, we suggested a complex relationship between EEs and firms' DCs, where different EE elements may be differently important in regards to their influence on DCs. In accordance with our expectation, we find in the empirics that mainly Support services and facilities, in particular incubators, but also Networks are two of the most central EE elements that influence the DCs of early-stage firms. In addition to this, our findings also highlight the important impact of Investment capital and Policy and governance on specific DCs.

Networks

Regarding Networks, we see that this element impacts all the microfoundations of DCs in early-stage firms.

An important part of the early-stage firms' sensing activities involves scanning for potential opportunities by attending different events provided by the Stockholm EE, but also by leveraging their personal networks of existing contacts. The entrepreneurs participate in both investor events as well as healthcare- and life science industry events to seek and gain information about customer and user preferences, and to meet and interact with investors, in line with Spigel's (2017) characterization of the Network element, which emphasizes the role of social networks in gathering information about opportunities and seeking finance and customers.

Consistent with Kwon et al., (2013) who argue that previous connections and trust among entrepreneurs and other actors in the EE facilitates the advantage of acquiring information about potential opportunities, the interviews further use personal contacts stemming from previous connections in the healthcare or life science industry to gain information and seek potential investors, customers and users. As Spigel (2017) also establishes about social networks, the entrepreneurs further draw on their personal networks to access suppliers and to improve their own abilities. For instance, entrepreneurs use personal contacts of manufacturers to develop

prototypes and to acquire skills related to, for example, the development of IP strategies, both which represent critical seizing activities.

Furthermore, as highlighted by Brown and Mason (2017), social networks facilitate tacit knowledge sharing, and this enables firms' reconfiguration activities as shown in our findings. According to the empirics, entrepreneurs leverage the experiential insights from personal contacts for problem-solving and the renewal of existing competencies and resources.

Support services and facilities

In terms of Support services, the empirics show that the incubator heavily influences all the entrepreneurs' DCs.

Incubator participants mainly rely on incubator events and the connections to other people in the incubator community to scan for opportunities, which constitute a major part of the firms' sensing activities. In line with literature stating that one of the most important roles of incubators is to facilitate networking events to help startups connect with financiers (Bruneel et al., 2012; Hansen et al., 2000; Lalkaka, 2002; Eveleens et al., 2017; Spigel, 2017), the interviewees reveal that the incubator investor events are one of their most central reasons to join the incubator, regardless of whether or not they already possess pre-existing networks of investor contacts from prior business experience in the life science industry.

Consistent with Brown & Mason (2017) who emphasize the importance of networking forums, such as business clubs, mentoring programs and startup networks, to facilitate tacit knowledge sharing for new ventures, the incubator programs in our study act as important networking platforms to facilitate such knowledge sharing. Entrepreneurs specifically highlight that the opportunity to network with other incubator companies is another key benefit of participating in the incubator programs. Both entrepreneurs with limited business experience and connections within the healthcare and life science industry, but also those entrepreneurs with pre-existing contacts, highly value accessing the networks of their fellow incubator members to sense opportunities through scanning. By providing referrals to suitable customers, users and investors, often based on their own experience and previous interactions, these fellow incubator members help their peers to seek and gather information about potential opportunities. Thereby, the entrepreneurs can be seen to make use of other ecosystem actors' sensing activities, in this case other incubator companies, which may be interpreted to improve the efficiency of their search and scanning activities, as Roundy & Fayard (2018) suggest in the context of well-established social networks that facilitate the transfer of information among EE participants.

Furthermore, the empirics reveal that entrepreneurs also draw on these connections with fellow incubator members in the incubator community for reconfiguration activities. By tapping into the previous experiences and knowledge of other entrepreneurs at the incubators, the early-stage firms understand when reconfiguration is needed and what specific changes are required.

In terms of the incubator mentors and external consultants in the incubators' network, our findings show that these mainly influence the seizing capabilities of early-stage firms. While entrepreneurs, through mentors at the incubators, learn skills in evaluating the commercialization viability of their inventions and assessing customer needs, both of which are important abilities for identifying opportunities (sensing), the majority of the skills and abilities they develop through incubator coaching, relate to business development (seizing). In line with literature on the importance of coaching and mentorship in incubators (Bliemel, Flores, De Klerk, & Miles, 2018), we find that the incubators play an important role in providing mentorship and advice from experts with relevant knowledge in both business and life science aspects. Our findings show that this mentoring is crucial to help the entrepreneurs seize the opportunities they have sensed, that is, to build a viable business around opportunities.

Prior research suggests that support services, such as incubators, are particularly important for life science firms in accelerating technology commercialization, as they support entrepreneurs in overcoming information asymmetries, offering information on property protection, and navigating clinical trials within life science (Clayton et al., 2018). Our work confirms this and suggests that the incubator fulfills several important functions to science-based entrepreneurs. For instance, we see that incubator mentors and external consultants in the incubators' network provide entrepreneurs with knowledge on IP strategies and support them in developing product processes that comply with the regulatory environment. Moreover, we find, in line with research by Kulkov et al. (2020), that, as many of the interviewed entrepreneurs come from universities and are specialized in life science but possess limited business experience, they learn important business skills in the incubators to help them shape a viable organization. Entrepreneurs not only acquire knowledge in theory, necessary for building the business, but they also receive hands-on support from incubator mentors and external consultants. By actively engaging with the entrepreneurs in practical activities, such as developing business plans, and providing them with simultaneous feedback, these coaches assist entrepreneurs in developing their own skills needed for the ability to seize and create an organization.

Interestingly, different entrepreneurs in the incubators appear to prioritize different skills that they can learn in the incubators, important for their ability to seize and develop their business, based on their existing capabilities. While gaining basic business skills, such as creating a business plan, seems especially important for entrepreneurs coming from academics, the empirics reveal that

entrepreneurs with prior business experience outside of the life science industry value other business learnings from the incubators, specific to the life science industry. This includes insights into how industry regulations affect the company and how to create a sustainable business model based on the regulatory environment and the healthcare reimbursement system.

While the discussion above suggests that the incubators in the Stockholm EE in many ways support the DCs of early-stage firms, our findings also reveal instances where the incubator programs constrain the entrepreneurs' DCs. For instance, interviewees express the lack of customized courses in legal aspects as well as coaching in business models that are specifically tailored to their sub-industry within life science, thus constraining their seizing capabilities. This suggests that the incubators may be too general in some of its teaching and mentorship, which may be particularly serious to entrepreneurs in this industry, where aspects such as navigating regulations are crucial to understanding how to develop the business. Noteworthy from the empirics is also the limited focus on commercialization strategies, such as launch strategies, that entrepreneurs express particularly about one of the incubators, which also impedes their skills needed to be able to seize identified opportunities.

This raises questions about the extent of entrepreneurs' learnings and readiness for real-world market interactions upon exiting the incubators. In other words, if entrepreneurs do not know what to do next after the incubator, such as how to work with marketing or pricing when the firm is ready for the market, the incubator can be seen to constrain their skills crucial for the ability to advance in the commercialization process and interact with the market. When further considering the gap between the incubator and the market, in terms of sensing opportunities, our findings also show that entrepreneurs wish that the incubators could act as a better bridge to interact with potential customers and users by organizing events for different stakeholders in healthcare and life science to simplify their scanning activities. Hence, while literature emphasizes incubators as important intermediaries that operate in the gap between scientific discovery and the final realization of value from commercialization (Clayton et al., 2018), the incubators' efforts to integrate entrepreneurs with the market seem limited to some extent. From a commercialization process perspective, this prompts concerns about the actual function of the incubator. Is it a closed system where firms are not really interacting with the market or does it work as a bridge to integrate firms with the rest of the EE?

Despite these potential constraints of the incubators, the fact that the entrepreneurs are dependent and place such heavy reliance on the role of the incubators to support its DCs, may also indicate a weakness in the rest of the EE. Perhaps in a more well-functioning EE, we would see entrepreneurs interacting more with other actors or elements in the EE as well. This might imply a lack of information provided by the actors or awareness among entrepreneurs regarding the available

support functions within the EE to help them in identifying and pursuing commercialization opportunities. At the same time, entrepreneurs may purposely choose to primarily engage with the incubators out of convenience and comfort. However, evidence from the empirics also suggests that actors outside the incubators in fact constrain entrepreneurs' DCs. For instance, entrepreneurs experience resistance from healthcare patient- and professional membership associations to assess customer and user needs, thus hindering their sensing scanning activities. Additionally, entrepreneurs without a personal network of contacts in healthcare or life science experience struggles to, for instance, get into hospitals to observe and gather information about healthcare needs, due to lack of response and interest from healthcare personnel. Hence, the lack of openness and resistance towards their business that many of the entrepreneurs face outside the incubators, may make them more dependent on the incubators to scan for opportunities. This includes relying on the networks of other incubator members, but also expectations on the incubator to arrange connections with potential customers and users.

However, this dependence on incubators that we see for entrepreneurs' sensing and seizing activities could also carry drawbacks. If the incubators represent most of the entrepreneurs' interactions with the ecosystem, a potential risk is that they will view everything from the eyes of the incubator, which may limit the opportunities they see and the resources they can gather. The incubator then acts as a filter, where entrepreneurs only get access to certain people, contacts, knowledge and education, thus shaping the opportunities they obtain. Given the incubators' crucial role in providing mentors, experts and valuable networks, questions that have been evoked during this study include: What impact would the absence of incubators have on entrepreneurs DCs and their commercialization process?

Policy and governance

Regarding Policy and governance, we find that this element mainly influences the seizing capabilities of early-stage firms.

While the incubators support entrepreneurs to sense and seize opportunities in many ways, developing the business within the incubator is not enough to commercialize. The empirics indicate that entrepreneurs are hindered in their ability to fully pursue identified opportunities due to the healthcare system's lack of receptiveness toward innovations in the market. According to the data, interviewees emphasize the structural and cultural barriers in healthcare, constraining their ability to conduct clinical testing but also to eventually launch a product and sell the innovation. The absence of governmental national guidelines to facilitate innovation testing and adoption within the healthcare system as highlighted in the interviews, suggests that the government is not providing the bureaucratic pre-conditions necessary for fostering entrepreneurship, in this case the commercialization of early-stage life science firms, as discussed in the Policy and governance

element in the literature (Isenberg, 2011; Brown & Mason, 2014; Cohen, 2006; Isenberg, 2010). Thus, the barriers within the healthcare system, preventing early-stage firms from bringing their innovations to market and establishing a sustainable business, constrain the firms' abilities to seize.

Investment capital

In terms of investment capital, our work further shows that this element also influences the seizing capabilities of firms' DCs.

Besides the importance of a healthcare system receptive to new innovations, access to financial capital is equally vital for developing the business, and thus for seizing opportunities, according to the findings. Similarly, Spigel (2017) points to the role of investment capital to catalyze the growth of startups. However, empirical findings suggest that the investment capital available for early-stage life science firms in the Stockholm EE is lacking, undermining the commercialization process of the firms. According to Edquist (2019), activities critical for the ecosystem should only fall under the responsibility of public organizations if they are not or cannot be performed by private actors. This is reflected in the empirical findings where government funding initiatives, such as Vinnova, are considered by the entrepreneurs as crucial for early-stage financing, compensating for the insufficiency of the private investment capital system. Following the emphasis of Zahra et al. (2014), early-stage firms in our study stress the importance of accessing initial government financing through the public incubators, which they use to, for instance, access external experts in the incubators' networks, such as patent lawyers, necessary to establish the business. Nonetheless, they also apply for government grants available outside the incubator. However, entrepreneurs stress the need of increasing both the amounts and the availability of government funding. On one level, the findings show that due to the tedious application process and lack of feedback from Vinnova, entrepreneurs fail to understand and develop the skills necessary for their seizing abilities in writing applications and acquiring the financing that is available. On another level, the inadequate investment capital and amounts of government funding themselves, represent a lack of resources that directly limit the entrepreneurs' ability to grow their businesses, thus their seizing capabilities.

5.2 Early-stage firms approaching Dynamic Capabilities

By examining early-stage firms in this study, the empirical findings suggest specific implications on the DCs of such firms.

While the incubators, through education and mentorship, support the entrepreneurs in developing their own seizing capabilities needed to shape and develop the business, the empirics also show that some capabilities remain fully dependent on external actors. In line with EE literature establishing that support services offer specialized support for startups, enabling entrepreneurs to access

capabilities that they lack internally (Spigel, 2017), our findings demonstrate that entrepreneurs use grants provided by the incubators to outsource tasks to experts, such as patent lawyers, QMS consultants and financial consultants. According to research by Brinckmann et al. (2019), the idea of outsourcing some capabilities to entrepreneurs' local EEs is potentially a source of competitive advantage for resource-strapped early-stage ventures, allowing entrepreneurs to adopt more adaptable, fluid, and open organizational structures. Thus, for the early-stage firms in our study, building and internalizing all capabilities might not be feasible or effective. In particular, certain capabilities, such as those possessed by patent lawyers, require extensive knowledge about the regulatory environment in the life science industry, which are beyond the entrepreneurs' capability to internalize themselves. Compared to more established firms, the idea of early-stage firms outsourcing certain capabilities, in this case important for seizing opportunities, appears to align with DC literature suggesting that DCs of early-stage firms are typically fewer and more focused (Zahra et al., 2006) than those of larger and established firms.

Additionally, the empirical findings show examples of improvisation and imitation, which, according to literature, are key methods used by early-stage firms for discovering and developing DCs, in contrast to the emphasis on learning from experience and planned changes seen in established companies (Zahra et al., 2006). First, similar to how established firms may be more likely to draw on experience for developing DCs, we see that entrepreneurs with established networks of investors or potential customers built from previous experience, tend to leverage their existing contacts for their sensing activities, namely scanning for potential customer and investor opportunities. Although many of these entrepreneurs also find it valuable to join the incubators to expand their existing networks, the data shows that entrepreneurs without established investor contacts or networks within healthcare and life science are more reliant on improvisation to gather information about potential opportunities. These entrepreneurs appear more creative in, for instance, seeking and gathering information about customer preferences, by reaching out to patient- and professional membership associations, hospitals and asking for referrals and advice from fellow incubator companies.

Second, the empirics reveal instances where entrepreneurs use imitation to develop their DCs. For instance, in terms of seizing capabilities, entrepreneurs describe how they gain inspiration for developing and improving their pitching skills, including creating effective pitch decks, by observing the pitches of other incubator companies at the incubator investor events. Similarly, by learning and taking inspiration from fellow incubator members who have undergone similar experiences and faced shared challenges, entrepreneurs can be seen to use imitation methods to address problem-solving and reconfiguring of their business.

To conclude our discussion on implications for DCs of early-stage firms, we generally find that the entrepreneurs' demonstrated capabilities in sensing and seizing align with characteristics described in the literature. In accordance with prior literature, our work shows that learning and scanning activities are central to sensing (Teece, 2007; Teece, 2012). The empirics also demonstrates that seizing, in line with prior work, involves bringing opportunities into new products, processes and activities, which includes acquiring and mobilizing resources necessary for building sustainable business models around identified opportunities (Teece, 2014; Chesbrough, 2010; Kindström et al., 2013; Teece, 2010).

Our findings also show that reconfiguring is needed for the early-stage firms to renew competencies and resources that have been developed and tested in the market. However, we find that reconfiguration is not necessarily spurred by market changes such as shifts in technologies or demands, which is what the literature emphasizes (Teece, 2014). Since many early-stage firms may not have experienced these shifts yet, our work shows that adjustments are instead often driven by challenges to align with market needs or obstacles in achieving objectives and targets. These adjustments could thereby reflect the process of experimentation commonly seen in early-stage companies (Bhide, 2000; Boccardelli & Magnusson, 2006). To solve the problems that they encounter, we find, in line with Borney-Barrachina, López-Cabrales and Salas-Vallina (2023) that successful reconfiguring in the early-stage firms benefits from learning and knowledge-sharing processes, which as shown in the empirics, are facilitated through interactions among fellow entrepreneurs at the incubator.

6. Conclusion

6.1 Adapted theoretical framework

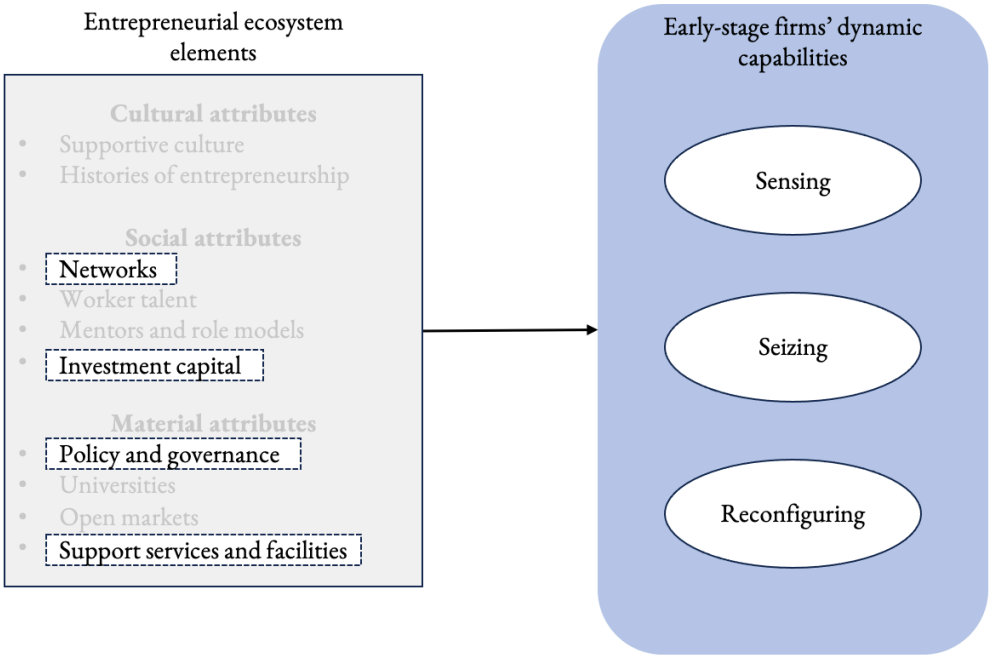


Fig. 3. The adapted version of the theoretical framework

Based on the previous theoretical discussion, an adapted version of the theoretical framework is presented above, incorporating the main take-aways from the study. The purpose of this study was to investigate how the EE shapes the DCs of early-stage firms in the commercialization process. To answer the research question, the framework illustrates the most central EE elements that influence the DCs of early-stage life science firms in the commercialization process. This includes Support services and facilities, particularly incubators; Networks, mainly represented by events and personal contacts; Policy and governance reflecting the healthcare system and public funds; and finally, the Investment capital within the Stockholm EE. While Networks and Support services and facilities impact all the firms' DCs, Policy and governance, as well as Investment capital primarily influences the seizing capabilities of the early-stage firms.

The influence of these EE components is both supportive and constraining on the DCs of early-stage firms in this context. Both Networks and Support services and facilities support the DCs of early-stage firms across all microfoundations, yet Support services and facilities also constrain the firms' sensing and seizing capabilities in certain aspects. Further, the elements of

Policy and governance, and Investment Capital, are primarily seen as factors that due to their limitations constrain the seizing capabilities of the firms, according to what has been emphasized in prior analysis and findings.

6.2 Theoretical Contributions

Firstly, to our knowledge, the findings from this study represents the initial efforts towards outlining how EEs influence the DCs of early-stage firms, which addresses a fundamental research gap. Previous research on EE lacks clarity in the linkages through which EE components influence entrepreneurs' abilities and the functioning of early-stage ventures (Roundy & Fayard, 2018; Wurth et al., 2021). Specifically, the literature identifies a gap regarding the connection between research on the structure of EEs and the DCs of their actors (Roundy & Fayard, 2018; Wurth et al., 2021). By incorporating theories of DCs from strategic management, with studies on EE, we aim to respond to these limitations of prior research to improve the understanding of how EEs influence entrepreneurial activities. Our theoretical contribution thus consists of the proposed theoretical framework shown in Figure 3, along with previous discussions.

Secondly, this study contributes to DCs research. Previous studies have primarily investigated DCs in closed organizational settings (Maijanen, 2022), often emphasizing the impact of intra-organizational factors on firm capabilities (Roundy and Fayard, 2018). This study addresses these gaps by providing insights into how inter-organizational factors influence firm capabilities. Additionally, this study provides implications on the development and understanding of DCs in early-stage firms, responding to a gap in the literature which mainly focuses on large or established firms (Soluk et al., 2023; Iakovleva et al., 2015).

Thirdly, the findings from this study expands research in the life science field, which has been lacking in studies explaining the activities of entrepreneurial actors in the commercialization process, as current literature in this field primarily centers on large, publicly traded corporations (Alvedalen, 2021).

Fourthly, this study found a considerable influence from incubators on the DCs of early-stage firms. By showing how incubator practices can generate DCs of firms, this study extends work on business accelerators, answering recent calls for more research on the processes and practices by which accelerators influence new ventures (Goswami et al., 2018; Hallen et al., 2017), and especially the role of intermediary organizations, including incubators and accelerators and how they contribute to science commercialization (Clayton et al., 2018).

6.3 Managerial/Practical Implications

The proposed theoretical framework shown in Figure 3, along with its accompanying discussion linking EE elements to DCs of early-stage firms, can further guide the decisions of practitioners in the Stockholm EE. Regional stakeholders and policymakers seeking to foster the Stockholm EE support for entrepreneurs and early-stage firms gain from understanding how this ecosystem influences entrepreneurial activity, allowing them to identify areas of further strategic investment, and thus optimize resource utilization.

Considering the influential role of incubators on early-stage firms' DCs found in the study, the findings have practical implications for incubators, business accelerators and other supporting institutions. By demonstrating the linkages between incubator practices and entrepreneurs' DCs, this study can inform incubators and decision makers of support organizations on how to design more effective support programs and allocate resources more efficiently.

Moreover, the findings suggest implications for both public and private actors in the Stockholm EE. Given the apparent inadequate investment capital available for early-stage life science firms in Stockholm, private actors should increase their investment capital spending, embracing riskier investments. At the same time, the government and public actors can help entrepreneurs to overcome these challenges by providing additional funding initiatives and improving the processes and accessibility of grants. Additionally, this study implies that public policies must be implemented that facilitates the adoption of new innovations in the healthcare system in order to enable commercialization of early-stage life science firms in the Stockholm EE.

Finally, the study provides early-stage firms' entrepreneurs within life science, with practical insights into meeting their needs to fulfill their business and commercialization potential. It provides an understanding of how they can expect the EE to support their commercialization journey, but also where gaps might exist.

6.4 Limitations

The findings found in this study are subject to certain limitations. First of all, despite our purposive sampling approach which aimed to achieve variation, we arrived at a quite narrow final sample in terms of firms' interactions with different EE elements. Most of the interviewed firms were or have previously been part of an incubator, especially KI Innovation. While this might fairly reflect the reality of many early-stage life science firms in the Stockholm EE, it may have limited our ability to capture more perspectives from firms without incubator experience, and how they navigate and potentially interact differently with other elements within the EE in their commercialization process.

Secondly, owing to the contextual nature of the life science sector and the specific setting of the Stockholm EE, findings on how the EE influences the DCs of early-stage firms, are limited in their applicability, thus requiring further studies to explore the phenomenon in different contexts.

6.5 Suggested Future Research

Several areas for further research have been identified. Firstly, following the previous limitation on the applicability of this study to other contexts, this study's findings on the phenomenon of how EEs influence early-stage firms' DCs, can be enriched by conducting studies on other industries but also in other regions with EEs that are more or less developed. It would then be interesting to observe whether entrepreneurs would engage differently with EE elements, and if the impact of EEs on a firm's DCs, whether supportive or constraining, varies.

Secondly, while our discussion highlights whether EE elements' influence on the DCs of early-stage firms are supportive or contraining, future research could seek to investigate whether entrepreneurs' ability to sense, seize and reconfigure opportunities have improved over time. To enable this, future studies could potentially be conducted on a longitudinal basis and look into identifying specific measures that allow for quantitatively tracking DCs.

Thirdly, future investigations might aim to explore how EEs might influence the DCs of other EE actors other than entrepreneurs. This may include examining the sensing, seizing and reconfiguring capabilities of support organizations, investors or suppliers.

Additionally, to further expand research on DCs within an ecosystem context and the impact of inter-organizational factors on firm capabilities, future research should examine how other ecosystems, such as business- and innovations ecosystems, affect actors such as incumbent firms, in their capabilities to sense, seize and reconfigure opportunities, given their pressures to stay innovative.

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8. Appendixes

Appendix 1: Pre-study interview subjects

	Pre-study interviews				
ID	**Role**	**Actor**	**Date**	**Duration**	**Channel**
1	Venture Partner	Industrifonden	2024-02-10	30 min	Teams
2	Business Advisor	KI Innovations	2024-02-14	45 min	Teams

Appendix 2: Main-study interview subjects

	Main study interviews						
ID	**Role & Industry**	**Company & Industry**	**Year of establishment**	**Number of employees**	**Date**	**Duration**	**Interview formal**
1	CEO & Co-founder	Company 1, Biotech	2021	7	2024-02-16	43 min	In person
2	Co-founder	Company 1, Medtech	2023	4	2024-02-19	66 min	In person
3	Co-founder	Company 2, Biotech	2017	7	2024-02-19	39 min	Teams
4	CEO	Company 2, Biotech	2017	7	2024-03-05	45 min	Teams
5	CEO	Company 2, Medtech	2015	12	2024-02-20	50 min	In person
6	CEO	Company 1, Healthtech	2017	5	2024-02-20	55 min	Teams
7	CTO & Co-founder	Company 3, Medtech	2021	4	2024-02-20	59 min	Teams
8	CEO & Co-founder	Company 3, Biotech	2017	2	2024-02-21	45 min	In person
9	CEO & Co-founder	Company 4, Medtech	2015	6	2024-02-21	73 min	Teams
10	CEO	Company 5, Medtech	2023	3	2024-02-21	63 min	In person
11	CEO	Company 4, Biotech	2016	8	2024-02-22	43 min	In person
12	CO-founder	Company 4, Biotech	2016	8	2024-02-23	36 min	Teams
13	Co-founder	Company 2, Healthtech	2021	2	2024-02-22	48 min	Teams
14	CEO & Co-founder	Company 3, Healthtech	2020	6	2024-02-26	57 min	Google Meet
15	CEO & Co-founder	Company 4, Healthtech	2018	2	2024-02-26	40 min	Teams

16	CSO & Co-founder	Company 5, Biotech	2020	3	2024-02-28	45 min	Teams
17	Head of business developme nt	Company 6, Biotech	2021	41	2024-02-28	50 min	In person
18	Co-founder	Company 5, Healthtech	2022	5	2024-02-29	44 min	Teams
19	CEO & Co-founder	Company 7, Biotech	2015	5	2024-03-01	60 min	In person
20	Co-founder & Board member	Company 8, Biotech	2020	31	2024-03-04	51 min	In person
21	Founder	Company 6, Medtech	2019	6	2024-03-04	45 min	In person
22	CEO & Co-founder	Company 9, Biotech	2020	3	2024-03-05	43 min	Teams
23	CEO & Co-founder	Company 7, Medtech	2020	2	2024-03-05	60 min	In person
24	CEO	Company 8, Medtech	2019	6	2024-03-19	76 min	Teams
25	Co-founder	Company 8, Medtech	2019	6	2024-03-19	36 min	Teams
26	CEO & Founder	Company 10, Biotech	2021	5	2024-03-18	64 min	In person
27	CEO & Founder	Company 9, Medtech	2021	6	2024-03-20	88 min	Teams

Appendix 3: Description of ecosystem actors

The following descriptions were derived from the actors' own websites.

Actor	Explanation
Sting	Stockholm Innovation and Growth (Sting) is an incubator that operates as a non-profit organization owned by a public-private foundation. As an independent entity, Sting prioritizes the best interests of startups, ensuring founder-centric support and guidance. Focal industries are climate, health, society and deeptech. In terms of Healthtech, Sting assembles accomplished coaches, entrepreneurs, and investors from Sweden's HealthTech sector to empower visionary entrepreneurs in reshaping healthcare. We prioritize advanced technologies and impactful solutions, offering exceptional support to propel HealthTech startups towards growth and success.
Vinnova	Vinnova is the innovation agency of Sweden, aiming to enhance Sweden´s innovative capacity and foster sustainable growth. Vinnova has the goal to position Sweden as a leading force in innovation within a sustainable global context. Through our support, companies and organizations get the opportunity to experiment and test new ideas before it becomes profitable. Every year, Vinnova invests approximately SEK 3.5 billion in research and innovation.

KI Innovations	KI Innovations is an incubator and a wholly owned subsidiary of Karolinska Institutet's holding company. KI Innovations leverages research findings in life science by assessing and validating projects with commercial potential, as well as providing support for business development through corporate partnerships or licensing. The services are provided confidentially and at no cost to our clients.
KTH Innovations	KTH Innovations is an incubator for innovation and entrepreneurship located in one of the world's most knowledge-intensive regions. KTH Innovation is specialized in the commercialisation of new technology at the earliest stages of development. We offer free, objective and confidential support in all areas relevant to taking an idea or research result to innovation. The team at KTH Innovation offers employees, researchers and students at KTH support in patents and law, business development, funding, project management, and much more.
Clinical Innovation Fellowship	The aim of the Clinical Innovation Fellowships is to enhance healthcare by identifying clinical needs and challenges observed during clinical immersion, and then developing solutions to tackle those needs. Participants, with backgrounds in medicine, engineering, design, and/or business, collaborate in multidisciplinary teams throughout the program. For numerous fellowship participants, this program serves as the initial stage in establishing a startup within the medical technology sector.
Karolinska Hospital	Karolinska University Hospital is one of Europe's leading hospitals with a mission to conduct and develop healthcare, research and education.
Industrifonden	Industrifonden was established by the Swedish government in 1979 as an autonomous foundation dedicated to fueling innovation and growth within Swedish industry. Today, we are an independant venture capital fund upholding our legacy through collaborations with innovators and entrepreneurs to bring groundbreaking Nordic innovations to the world. Our core areas of expertise encompass Deep Tech, Life Science, and Transformative Tech.
Vitalis	Vitalis is the Nordic region's leading meeting place for future healthcare with a focus on e-health, welfare technology and innovation. Here, the industry's most important players in the public sector, academia, politicians and industry meet to promote the development of sustainable healthcare.
Sweden Bio	SwedenBIO is the national industry organization for life science in Sweden. Our member companies develop biotechnology, diagnostics, pharmaceuticals and medical technology or are experts in areas such as business development, IP and law. We also gather financiers, incubators, science parks, regional investment promotion actors and many more.
General Practitioners Association	General practitioners association is the scientific and professional association of general practitioners and works to promote further education, research and development in general medicine. Both completed and future specialists in general medicine are welcome as members.
Breast Cancer Association	The Breast Cancer Association is Sweden's only interest organization that focuses solely on breast cancer. In order to achieve the vision that no one should be affected by breast cancer, we finance breast cancer research, offer support and rehabilitation to those affected and carry out advocacy work on breast cancer issues. We are close to 11,500 members and 33 breast cancer associations around the country.
Sciety	Sciety is the Nordic region's leading investor network in life science and digital health. We combine experience from life science and finance to select prominent companies in the industry. Sciety invests its own funds in all companies that have undergone the selection process and offers the investor network to participate on the same terms. The network includes venture capital companies, family offices and business angels. Sciety's vision is that innovations in life science should reach their full potential. Areas of investment: biotechnology, pharmaceuticals, medical technology and digital health.

Connect	Connect's mission is to act as a link and create meeting places between entrepreneurs, experts in business, researchers and investors. We provide growth companies with growth capital by recruiting, organizing and training investors in Sweden's largest investor network with over 450 business angels and investors. Connect is run in regional networks and is a private, non-profit initiative that is primarily financed by our partners in business.

Appendix 4: Main-study interview guide

1. Where in the process of commercializing your scientific invention are you currently in?

2. How and when did the process of commercializing your scientific invention come about? How did you identify the opportunity?

3. How did you identify and evaluate the commercialization potential of your scientific invention?

4. What resources/skills/knowledge/information were needed in the process of commercializing your scientific invention?
    a. What do you perceive were your strengths and weaknesses in this regard?

5. Why did you choose to start/expand your business in the Stockholm region?

6. Describe your knowledge about the Stockholm ecosystem and its influence on your company?
    a. In terms of support offerings: what they are, who can provide them and how you can receive it
    b. How/where did you get this information?
    c. How would you like to gain more knowledge about/use the Stockholm ecosystem with regards to commercializing your scientific invention?

7. What parts of the ecosystem (as infrastructure and actors) have influenced you?
    a. Has the Stockholm ecosystem assisted you in assessing and accessing the necessary resources/skills/knowledge/information for effectively commercializing your scientific inventions?
    b. What help have you received/not received?
    c. What was most and least useful for you?
    d. What did you perceive as most difficult and least difficult in this regard?
    e. Did you experience anything missing from the ecosystem in this process?

8. Currently, what resources and capabilities are needed to further advance in the process of commercializing your scientific invention?
    a. How can the ecosystem support you in this?
        i. What do you perceive as most difficult and least difficult in this regard?
        ii. Which aspects of the Stockholm Ecosystem are the most important in this regard? Why?
        iii. Do you experience anything missing from the ecosystem in this process?
        iv. Lesson learned?
        v. How has the ecosystem helped you to iterate your commercialization strategy? What learnings have you gained from the ecosystem throughout this process?