Entrepreneurial Ecosystems: Measurement, mechanisms and outcomes

Ecosystemen voor Ondernemerschap: Meting, mechanismen en uitkomsten
(met een samenvatting in het Nederlands)

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Acknowledgements

A PhD is an interesting journey with setbacks and obstacles that must be overcome but celebrations and accomplishments as well. Mine had some interesting bends in the road that created an adventurous trajectory across different countries. I already knew when I started my studies in Wageningen that I wanted to do a PhD. I enjoyed studying and doing research so this seemed a natural path to take. However, finding the right place to do a PhD turned out to be less straightforward than expected. After applying for different programs, I was accepted for a PhD at Cornell in the US. In 2018 I started this five-year long program with high expectations, but it soon became clear it was not the right place for me. Various factors played a role in this, among which the very technical focus of the program but also the competitive and somewhat anonymous academic environment. After long deliberation, I decided to quit the program and look for something else. Based on my negative experience I wanted to do something different and started looking for jobs in policy and industry. After a while it became clear however that my skills and interests were still strongly connected to research and somewhat reluctantly I started looking for PhD vacancies again. One of the first vacancies I saw talked about entrepreneurial ecosystems, a concept unfamiliar to me, and connected this with themes such as institutions and economic development. Coming from a development economics background, these themes sounded familiar to me but at the same time the focus on entrepreneurship was different enough to spike my interest. Quite spontaneously I decided to apply and a few weeks later I got offered the position. Still having doubts about academia I did not immediately take up the offer, but Erik lowered the barrier by saying that a PhD was just to learn how to do research and this research did not 'need to win a Nobel prize'.

While my supervisors, Erik, Niels and Steven, were the most important mentors during my PhD, I had several people that supported me on my academic journey. Maarten Voors provided me with a lot of guidance during my time in Wageningen, both as a bachelor student when I applied for master's programs and after my master's in Oxford when I worked with him as a research assistant. Doug Gollin was a great mentor during my time in Oxford and has always been willing to provide his advice afterwards. During my PhD I got the opportunity to spend a couple of months at MIT where Scott Stern generously invested his time in many talks about research projects and career planning. Sid Vedula gave me the opportunity to continue my research as a postdoc in Munich and learned me a lot about doing research and teaching in a management department.

Erik and Niels were my supervisors at USE and taught me a great deal about research and the field of entrepreneurship. While they are both busy people, they found the time to work on research projects with me and offered me various opportunities to develop my professional and research skills. When I needed it most they were always there to support me, for which I am very grateful. Steven was my supervisor from TNO since my PhD was part of a large European project on digitalization led by TNO, called Beyond 4.0. I greatly enjoyed being a part of this project, which brought me in touch with many international researchers and policymakers. It also offered me the opportunity to present my results at various occasions and get important feedback. The insights from Steven and other participants of the project helped to make my research more practically relevant. In addition, visiting project meetings and conferences provided a nice change of pace to working behind your own computer.

Unfortunately, a large part of my PhD was written from home. I started my PhD in November 2019 which was only a few months before the first lockdown started. The COVID crisis would continue for two years, which meant that during this period the office was often closed. Travelling or meetings in general were prohibited and I took part in my first conferences completely online. While this was a weird and difficult period, it greatly helped me to work with fantastic colleagues. All my research has been written in collaboration with great co-authors, which besides Niels and Erik, included Jan Jacob and Jip. In addition, in my first months at USE I had met several PhD colleagues who I kept in touch with during the lockdowns. Once the office opened again, I met many others who made my PhD a lot more enjoyable. The many social activities with the PhD community were a great way to relax and connect with people who shared an understanding of the challenges and rewards of the academic environment.

In general, I am very thankful for the welcoming environment at USE. Since USE is a relatively small department, it always felt like a place with a lot of personal attention and almost no hierarchy. I thus not only got to know various PhD colleagues but colleagues across USE in general. Some of them I did not only get to know in Utrecht but also abroad at various conferences in the US, Portugal and Denmark. There I also ran into colleagues from the innovation sciences department, who often worked on very similar topics but I did not see as much in Utrecht as they were located on another campus.

During my PhD I also did some teaching. Together with Niels and Friedemann we developed a new course on the economics of entrepreneurship, which I got to teach and improve again two years later with Timo. In addition, I supervised many master's and bachelor's theses, which was often a nice process once students had found a topic they were

excited about. In the last phase of my PhD, I also had the opportunity to contribute to a policy evaluation with Birch consultants. Here I learned a lot about the practice of entrepreneurship policy and all the challenges that come with it.

Finally, I want to thank my friends and my family who have supported me through my whole academic journey, from the start of my studies in Wageningen all the way to the end of my PhD. They were always ready to provide a listening ear or to cheer me up, even when I was thousands of kilometers away. Without them I would not have been able to finish this journey. Especially during the pandemic when the PhD could be very lonely, they were always there to support me. Sharing an apartment with my sister and knowing that I could always stay with my parents prevented me from feeling very isolated and got me through this difficult time. Just after the start of my PhD I also discovered a new sport I immediately fell in love with. Lacrosse was not only a great way to get moving and blow off some steam, but especially to meet new people in Utrecht. Laughing and playing with my team at the Domstad Devils always provided me with new energy for my PhD. I am also very happy I was a part of the board, which immediately became a group of friends.

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Chapter 1

Introduction

Without entrepreneurship there is no progress. Entrepreneurs bring innovations to the market by starting and scaling firms. There are many famous examples of visionary entrepreneurs that shaped the world we live in, ranging from Steve Jobs and Bill Gates to Henry Ford. Although it might seem obvious that entrepreneurship is needed to create economic development, the role of entrepreneurship in the classical economic literature remains very limited. The change that entrepreneurs create does not fit in many of the traditional economic models focused on creating and maintaining an equilibrium. Schumpeter (1934) was one of the first economists to recognize the important role of the entrepreneur in economic development. Following his lead, in the twentieth century a new field started to develop with entrepreneurship as its particular focus (Landstrom, 2020; Busenitz et al., 2014). Studies have shown that entrepreneurship has a positive effect on economic development, with job creation, productivity increases and the creation and diffusion of innovations (Haltiwanger et al., 2013; Haltiwanger et al., 2017; Bosma et al., 2018).

Entrepreneurship is a local event and entrepreneurs are both dependent on and shaping their local environment (Feldman, 2001). Some of these environments turned out to be very successful in enabling entrepreneurship, such as Silicon Valley in California or Route 128 in Boston. More generally, scholars found that entrepreneurship levels show very strong regional persistence and are highly unevenly divided (Fotopoulos, 2014; Fritsch and Wyrwich, 2014). This large disparity in the ability to create and nurture entrepreneurship is one of the reasons for the regional inequalities which have become so salient today. While some regions are booming, others are lagging behind. Regional inequality can have important political consequences as the Brexit vote in 2016 illustrated, in the election almost

all old industrial regions in England voted to leave while prosperous southern regions wanted to stay in the European Union (Arnorsson & Zoega, 2018).

Regional economic development is therefore becoming a more important topic for policymakers all over the world. However, policymakers and academics are increasingly aware that economic growth might not be the ultimate policy goal. The quality of life does not only depend on income but is influenced by many other aspects, such as the quality of the living environment, education or healthcare. Societal debates have evolved from a focus on increasing Gross Domestic Product (GDP) (or economic growth) to increasing societal wellbeing (Van den Bergh, 2009; Costanza et al., 2014). While the concept of societal wellbeing is more difficult to operationalize, it is worthwhile to have a discussion about what really contributes to higher welfare. Entrepreneurship should be part of this debate as it can increase economic welfare but can also play an important role in solving environmental and social issues. This has become more relevant as over the past decades new classes of entrepreneurs emerged with specific social or environmental goals (Santos, 2012).

Because of the economic and social promise of entrepreneurship, there has been a lot of interest in stimulating entrepreneurship. To understand how policymakers can enable entrepreneurship in their region a new concept emerged called 'entrepreneurial ecosystems'. The idea builds on the notion that entrepreneurship is a local event and tries to understand the interplay between the entrepreneur and the environment. This concept was initially developed by practitioners such as Dan Isenberg (2010) and Brad Feld (2012), who wrote about how regions can develop a stimulating environment for entrepreneurship. Consequently, the concept was taken up by academics and developed into a burgeoning

field of research (Wurth et al., 2023). Although various definitions of the entrepreneurial ecosystem exist, in this dissertation I will generally work with the following: a set of interdependent actors and factors that are governed in such a way that they enable productive entrepreneurship within a particular territory (Stam 2015; Stam and Spigel, 2018). While the concept itself is relatively new, it builds on various streams of literature such as the economic geography discipline. The idea that firms are affected by their environment can be traced back to Marshall (1890), who introduced the concept of agglomeration effects. Various other theories considering the environment of the firm followed, such as clusters, innovation systems and business ecosystems (Acs et al., 2017).

The entrepreneurial ecosystem concept builds on all these previous theories but is also different for two reasons. First of all, as the name suggests the entrepreneur is the focus of the theory (Wurth et al., 2023), other actors such as the government are also important but have a more supportive role in the entrepreneurial ecosystem. This contrasts with previous theories which were mostly occupied with big incumbent firms and the government as main actors. The famous triple helix model, often used in the innovation systems literature, for example considers universities, government and large firms as key stakeholders (Etzkowitz and Leydesdorff, 1997). In addition, the ecosystem concept borrows from the complex systems literature (e.g. Arthur, 2013). Instead of just using the word ecosystem as an analogy, it tries to take the idea of interdependencies and emergence within the system seriously (Wurth et al., 2023). This gives rise to important elements of the entrepreneurial ecosystem theory, such as feedback effects, path dependency and co-evolution.[1]

[1] While the entrepreneurial ecosystem strictly speaking only consists of the different factors and actors, it is often used as a shorthand to describe a wider framework in which the entrepreneurial ecosystem is connected with relevant outputs and outcomes. The terms entrepreneurial ecosystem, entrepreneurial ecosystem framework and entrepreneurial ecosystem concept will be used interchangeably.

As the entrepreneurial ecosystem concept was recently developed, there are still certain aspects which are undertheorized (Wurth et al., 2022). Since it originated in the practitioner's community and has quickly been adopted by many policymakers, the theoretical development of the concept has to catch up with its practical use (Stam & Spigel, 2018). While the academic literature on this topic developed exponentially (Wurth et al., 2023), there is still mostly a lack of quantitative empirical studies. So far there has been a lot of theoretical debate and qualitative studies such as case studies of specific regions. However, to understand more general mechanisms we have to study larger samples with quantitative data. Chapter 2 and 3 aim to fill this research gap. In Chapter 4, we then explore how successful entrepreneurs contribute to societal wellbeing with their firms. This goes beyond the sole focus on economic growth to include aspects such as sustainability and inequality. Given that this question has only received very limited attention, this chapter is more exploratory in nature and relies on qualitative data.

1.1 Aim and conceptual framework

This dissertation uses quantitative and qualitative data to further develop the entrepreneurial ecosystem concept. The aim of the dissertation is to better understand the mechanisms in the entrepreneurial ecosystem framework, specifically the interdependencies between ecosystem elements, the emergence of entrepreneurship from the ecosystem and the link between entrepreneurial outputs and societal wellbeing. The context in which this is done is the European Union. The overarching research question of the dissertation is as follows:

Main research question: *How can we improve the understanding of the mechanisms in the entrepreneurial ecosystem framework, specifically the interdependencies between elements, the emergence of entrepreneurial output and the contribution of this output to societal wellbeing?*

The different aspects of this question are addressed in three chapters using both qualitative and quantitative data (for an overview see Table 1.1). In the context of Europe, a large regional level dataset is developed in Chapter 2 to measure the quality of entrepreneurial ecosystems and its outputs. To do so we build on the entrepreneurial ecosystem framework developed by Stam (2015) and Stam and Van de Ven (2021) (see Figure 1.1). All elements of the ecosystem are operationalized with several quantitative indicators and the output of the ecosystem is measured with innovative startups. Various analyses are done with this data to better understand the relations in the ecosystem. Using Qualitative Comparative Analysis (QCA), this analysis is taken one step further in Chapter 3. QCA specifically allows for interaction between elements, one of the main characteristics of the ecosystem concept. With the European dataset developed in Chapter 2, we study the configurations of ecosystems that enable high levels of entrepreneurship output. This approach thus investigates the regional diversity of entrepreneurial ecosystems. In summary, the first two chapters explore how regional conditions enable entrepreneurship to emerge.

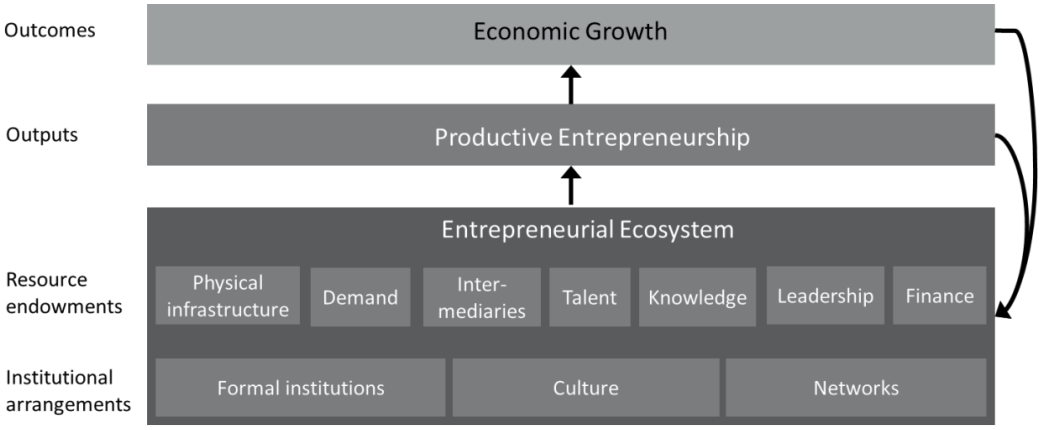
Table 1.1

Overview of the chapters

Chapter	Title	Co-authors	Status
2	Measure twice, cut once. Entrepreneurial Ecosystem Metrics.	Jip Leendertse, Erik Stam	Published in Research Policy
3	Figuring it out: Configurations of high-performing entrepreneurial ecosystems in Europe	Erik Stam, Niels Bosma	Published in Regional Studies
4	The impact of growth: Stakeholder value creation by high-growth firms	Jan Jacob Vogelaar	To be submitted to Small Business Economics

Fig. 1.1.

Elements, outputs and outcomes of an entrepreneurial ecosystem (Leendertse et al., 2022)



In Chapter 4 we focus on the output and outcome side of the entrepreneurial ecosystem. While entrepreneurship is the output of the ecosystem, societal welfare can be considered the outcome of interest. Previously, the main outcome considered in the literature was economic growth as shown in Figure 1.1, Chapters 2 and 3 also follow this more traditional approach. Entrepreneurship that contributes to economic growth is often called 'productive entrepreneurship', defined as "any entrepreneurial activity that contributes directly or indirectly to net output of the economy or to the capacity to produce additional output" (Baumol, 1990, p. 30). In line with the discussion on how we can better measure societal progress, an updated definition of productive entrepreneurship would probably include a contribution to welfare instead of economic output. This raises the question as to what types of entrepreneurship would fit this new definition.

The entrepreneurship literature has thus far mostly focused on high-growth firms, scale-ups or even unicorn firms (young firms valued above 1 billion dollars) as relevant outputs, as these can contribute extraordinarily to economic growth (Haltiwanger et al., 2017; Henrekson & Johansson, 2010). This has been taken over by policymakers and many countries have particular policies aimed to support this type of entrepreneurship (Mason and Brown, 2014). However, recently the academic and policy focus on these rather unique entrepreneurship outputs has been criticized (Aldrich & Ruef, 2018; Kuckertz et al., 2023), as scholars argue that these types of firms mostly create shareholder value. In this way high-growth entrepreneurship may exacerbate inequality by generating wealth for a select group of people. In addition, there has been some debate on whether it is useful to study these outliers and if we can actually say anything about the prevalence of these rare events (Coad et al., 2022).

As the most commonly considered output of entrepreneurial ecosystems is high-growth firms (Wurth et al., 2023), in Chapter 4 we study how these contribute to societal wellbeing. In this way we investigate the link between the output of entrepreneurial ecosystems and societal wellbeing, the outcome of interest. We aim to understand how high-growth firms create value for society by studying their interaction with stakeholders. As this is a relatively new field of research (Neumann, 2021), we use an exploratory approach and conduct interviews with CEOs and founders of high-growth firms in the Netherlands. Our aim is to uncover the most important mechanisms through which high-growth firms create and destroy value for their stakeholders. As this study focuses on the firm level, it starts to explore the micro-foundations of the link between the output and outcome in the entrepreneurial ecosystem framework.

Figure 1.2 shows the connections between the three main chapters of this dissertation. It shows the connection between concepts on the macro level, in this case the regional level, and the micro level, the individual (entrepreneur) or firm level. The figure is based on the Coleman's macro-micro-macro framework (Coleman, 1990) which tries to bridge macro and micro levels in one theoretical framework (Cowen et al., 2022). The aim of this framework is to put the dissertation in a broader perspective and show which relations I do and do not study. The arrows in the framework describe various relations or mechanisms between the different levels. While the upper part shows relations at the ecosystem level (similar to those in Figure 1.1), the lower part shows the micro-foundations of the concept.

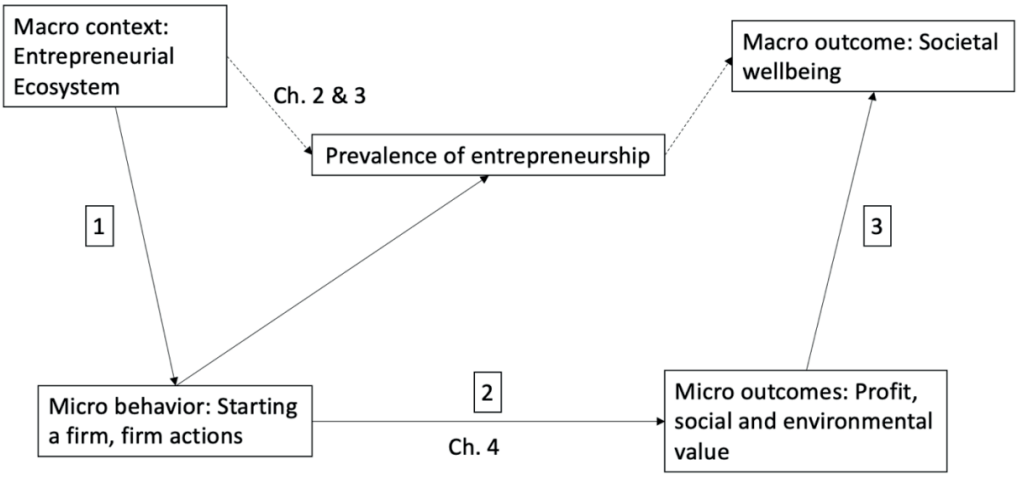
The first arrow refers to 'situational mechanisms' and shows how individual behavior might be shaped by the context, in this case how the entrepreneurial ecosystem affects entrepreneurial behavior. It is precisely this continuous interplay between individuals and

their context that characterizes the entrepreneurial ecosystem concept. The second arrow connects behavior on the micro-level to the outcomes of this behavior, showing the relation between the actions of the firm and its outcomes. The third arrow represents the 'transformational mechanism' and shows how the aggregation of outcomes of micro-behavior can explain macro-level outcomes. Since we are interested in how entrepreneurs can influence societal welfare, the arrow shows the connection between firm outcomes and societal outcomes.

In the framework, one additional element is added, the prevalence of entrepreneurship at the regional level. While this is an aggregation of the micro-behavior of starting a firm, it was added here to clarify that the outputs we study in Chapters 2 and 3 have micro-foundations (see Roundy and Lyons, 2023; Roundy and Fayard, 2019). The dotted arrow illustrates the connection studied, which is in fact a shortcut for the real relation which would follow arrow 1 and then be aggregated to the prevalence of entrepreneurship in a region. The first two chapters study entrepreneurship at a regional level, while Chapter 4 zooms in on individual firms to study micro-level behavior. This means that arrows 1 and 3 are not studied in this dissertation. These relations are interesting areas for future research, as reflected in various calls to pay more attention to the micro-foundations of entrepreneurial ecosystems (Roundy and Lyons, 2023; Roundy and Fayard, 2019).

Fig. 1.2

Framework showing the connections between the different chapters.



1.2 Research questions

The research in this dissertation is organized around three research questions which will be addressed in three different chapters. Chapters 2 and 3 are closely connected as they both study the relation between entrepreneurial ecosystems and entrepreneurial output and use the same dataset. Chapter 4 uses a qualitative approach to study the mechanisms connecting entrepreneurial output to societal wellbeing outcomes.

In Chapter 2 we aim to address the need for credible metrics for entrepreneurial ecosystems. We create a new harmonized dataset for entrepreneurial ecosystems in Europe, an interesting context because of the large variety. By creating a new dataset for European regions, we aim to answer the following research question:

Research question 1: *How can we measure the quality of entrepreneurial ecosystems in Europe?*

To generate measures for all ecosystem elements, we use statistical indicators and web-scraped data for 273 regions in Europe. With this data we compose an index to capture the quality of the entrepreneurial ecosystem. In addition, we perform several analyses to study the interdependencies of ecosystem elements. Finally, we use regressions to link the entrepreneurial ecosystem index to entrepreneurial outputs.

In Chapter 3 we use the dataset composed in Chapter 2 to dive deeper in the interdependencies between ecosystem elements. Specifically, we aim to test whether ecosystems must be complete to function well or whether elements can be substituted. We do this by studying configurations of ecosystems and answering the research question:

Research question 2: *Which entrepreneurial ecosystem configurations enable productive entrepreneurship?*

To study ecosystem configurations we use Qualitative Comparative Analysis (QCA), a research method that allows for causal complexity. QCA investigates which combinations of elements produce a certain outcome, in this case high entrepreneurship outputs. We use entrepreneurial ecosystem data for 273 regions and data on innovative startups and unicorns. Two separate analyses are performed to study ecosystems that enable good entrepreneurship performance and ecosystems that enable the highest levels of entrepreneurship output.

Chapter 4 is a qualitative study investigating value creation by high-growth firms. While high-growth firms are known to contribute to economic output, less is known about their wider impact on society. In this chapter we study the societal value of high-growth firms with the following research question:

Research question 3: *Through which mechanisms do high-growth firms create and destroy value for their stakeholders and what role does firm growth play in this process?*

To study the mechanisms, we interviewed the founders and CEOs of 23 high-growth firms in the Netherlands. We investigate who they consider important stakeholders and how they interact with them. We pay special attention to the dynamic high-growth environment and how this can affect interactions with stakeholders. To operationalize value, we build on the stakeholder capability approach developed by Ali and Cottle (2021). Capabilities relate to the opportunities stakeholders have to do or be certain things. The focus of the capability approach thus lies with the opportunity instead of the outcome or action itself. Ali and Cottle (2021) define five different categories of capabilities of stakeholders that entrepreneurs can influence, such as intellectual capabilities or economic capabilities. Using the stakeholder capability framework, we categorize our findings and analyze important patterns in the data.

1.3 Academic relevance

The entrepreneurial ecosystem concept has been around for almost twenty years. However, certain aspects of the concept have received more attention than others. Previous studies were mostly theoretical and qualitative as shown by the systematic literature review of Vedula and Kim (2019). In addition, the complex systems idea behind the concept has not

always been acknowledged and incorporated in academic studies (Wurth et al., 2022). There are exceptions to this, for example Àcs, Autio and Szerb (2014) developed an entrepreneurial ecosystem index at the national level combining institutional and individual-level variables in 14 pillars. In addition, some studies have looked at interactions between elements either by using QCA (Vedula and Fitza, 2019) or other methods such as factor analysis (Audretsch & Belitski, 2017). This dissertation aims to further the debate these authors have started. It takes as a starting point the Stam and Van de Ven (2021) framework that incorporates all elements important for entrepreneurs, based on findings in previous studies, at a reasonable level of abstraction. This framework also clearly distinguishes between inputs, outputs and outcomes of the entrepreneurial ecosystem. The analysis focuses on the regional level as the relevant level of analysis (Malecki, 2018) since most of the ecosystem mechanisms would operate within the area of a city region.

Using the European Union as a study setting, we can study regions which are very diverse and range from middle income to the highest income countries. As many previous studies have been situated in the US, this enables us to say something about the external validity of the entrepreneurial ecosystem framework. Doing a QCA to study configurations of ecosystems is also more interesting in this relatively diverse setting. The QCA explicitly tries to resolve contrasting views in the literature about the 'perfect ecosystem'. Some studies (e.g. Acs et al., 2014) implicitly state that all elements of the ecosystem are necessary for it to function. This means that the weakest element of the ecosystem should be addressed in a so-called penalty for bottleneck approach. Other authors (e.g. Spigel, 2017) argue that regions are very different and therefore also require different configurations. When some elements are very strong they can in a sense compensate for the absence of other elements.

Entrepreneurship comes in many shapes and sizes, ranging from high-growth entrepreneurship to social entrepreneurship to solo-entrepreneurship. Each of these types has unique aspects and is the subject of different literature streams in the entrepreneurship field. There has however been some discussion on which kind of entrepreneurship is most relevant to study. Extreme forms of entrepreneurship like gazelles and unicorns have received a great deal of scholarly attention and are generally thought to be the most important output of the entrepreneurial ecosystem (Wurth et al., 2023). This focus on high-growth entrepreneurship has recently been subject to strong critiques (Aldrich & Ruef, 2018; Patzelt et al., 2023). Some scholars argue that these rather rare types should not be the object of study and we should instead focus on more ordinary types of entrepreneurship (Welter et al., 2017). However, the interest in high-growth entrepreneurship did not arise without reason as various studies have shown their extraordinary contributions to economic growth (e.g. Haltiwanger et al., 2013). We want to further this debate by including not only financial but also social value in the evaluation of high-growth firms. Social value (which can include environmental value) has been gaining more attention as people realize that economic growth might not be the single or ultimate goal and we should consider other dimensions of wellbeing as well (Costanza et al., 2014).

1.4 Policy relevance

Policymakers were quick to adopt the entrepreneurial ecosystem concept for entrepreneurship and regional development policy. The early publications on entrepreneurial ecosystems were also explicitly aimed at them with titles such as ‘How to start an entrepreneurial revolution’ (Isenberg, 2010). While this sounded very appealing and simple, many efforts to promote entrepreneurship remained fruitless. Some of these failed

policy interventions are illustrated in the book of Josh Lerner (2009) fittingly called *Boulevard of Broken Dreams*. Just ticking off elements from a list on what is needed to promote entrepreneurship or copying policy interventions from elsewhere did not seem to be effective.

There are various difficulties with using the entrepreneurial ecosystem framework for policy. As it is a holistic approach it tries to incorporate many elements, however this also complicates discussions as it is often not clear what people exactly are referring to (Brown & Mawson, 2019). This is illustrated by the many terms which are in use such as 'startup system', 'entrepreneurship system', 'startup community' and so on. Even within the academic literature there is still discussion on what the definition of the entrepreneurial ecosystem should be (Malecki, 2018).

As a first step in solving this debate, it is useful to decide on one framework to work with. In this dissertation I use the framework developed by Stam and Van de Ven (2021), which includes ten elements important for entrepreneurs based on results of previous studies in the entrepreneurship and economic geography literature. The framework considers the entrepreneurial ecosystem to be broadly overlapping with the regional level and clearly distinguishes between inputs, outputs and outcomes. This framework can be useful when designing policy interventions in a regional context, for example to stimulate sustainable entrepreneurship, but it is important that the framework is understood and agreed upon by all stakeholders upfront. To be able to design effective policy interventions it is useful to start with an assessment of the current state of the entrepreneurial ecosystem. Chapter 2 explicitly aims to facilitate this by creating measures for the entrepreneurial ecosystems of all European regions. Using the Stam and Van de Ven (2021) framework, we operationalize

and measure the different elements and output of the ecosystem. With this data, policymakers can diagnose their entrepreneurial ecosystem and benchmark it to other comparable regions. A harmonized dataset of entrepreneurial ecosystems thus provides a first important step in creating informed policy interventions.

Another point which is often overlooked by policymakers is the idea of interaction between elements. Trying to adjust one element in the ecosystem may have unexpected consequences as it can affect other elements as well. At the same time, it might not be useful to just invest in one element as investment in multiple elements may be needed to create durable change. For example, while it is generally useful to invest in entrepreneurial facilities like incubators and accelerators, this will not have any effect when there is no cultural support for entrepreneurship. This already signals that regional conditions matter and the same policy intervention may produce different results in different places. The third chapter studies this regional diversity and tries to get a better understanding of how elements interact and which of the ecosystem elements are essential to enable productive entrepreneurship. Instead of assuming that every region should try and copy Silicon Valley, it thus tries to answer this question empirically. While chapters 2 and 3 answer questions which are very relevant for policymakers, the insights offered are somewhat abstract as we study large samples of data. The data and insights developed can be used as input for policymakers, who can combine these with local knowledge to design better informed entrepreneurship policy.

The aim of most policymakers is to stimulate regional economic development and as a consequence a lot of policy is aimed at enabling high-growth entrepreneurship (Brown & Mason, 2017). These policies often target scale-ups or firms in specific sectors which are

considered to have a lot of high-growth potential (although studies show one can find high-growth firms in all sectors (Coad et al., 2014)). Supporting these firms can however have unintended side effects such as an increase in inequality (Breznitz, 2021). When we consider development in a broader sense and take into account the consequences over a longer time horizon, it is therefore questionable if targeting high-growth firms is optimal. Firms with explicit social goals (which could also be high-growth firms) may be better situated to solve specific societal challenges. To understand whether high-growth firms are desirable from a societal viewpoint, in Chapter 4 we study how high-growth firms create stakeholder value and whether this value is mostly financial.

Chapter 2

Measure Twice, Cut Once. Entrepreneurial Ecosystem Metrics

Written together with Jip Leendertse and Erik Stam.

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2.1 Introduction

Even though the academic literature on entrepreneurial ecosystems has been flourishing recently, it does not yet provide an actionable framework for economic policy. An important reason for this is the scarcity of credible, accurate and especially comparable metrics of entrepreneurial ecosystems. An entrepreneurial ecosystem comprises a set of interdependent actors and factors that are governed in such a way that they enable productive entrepreneurship within a particular territory (Stam, 2015; Stam and Spigel, 2018). The entrepreneurial ecosystem approach has become popular due to the gradual shift from managerial economies to entrepreneurial economies (Thurik et al., 2013). In these entrepreneurial economies, entrepreneurship is considered a key driver of economic change (Schumpeter, 1934).

The entrepreneurial ecosystem approach offers a lens to empirically trace the systemness of entrepreneurial economies and the degree to which economic systems produce entrepreneurship as an emergent property of the system (Brown and Mason, 2014; Isenberg, 2010; Stam, 2015). It is instrumental to synthesize and integrate a large variety and quantity of data to measure the (changing) nature, outputs and outcomes of (regional) economies (Stam, 2015). The entrepreneurial ecosystem approach thus has the potential to provide an actionable framework that guides policymaking.

However, the scarcity of sufficient metrics on entrepreneurial ecosystems makes it difficult to have adequate diagnosis and monitoring in the policy cycle. The lack of adequate diagnosis and monitoring is one reason why economic policy often fails to achieve its objectives and learn from previous mistakes. The objective of this paper is to quantify and

qualify regional economies with an entrepreneurial ecosystem approach. We address the metrics gap by developing and applying entrepreneurial ecosystem metrics to analyze entrepreneurial economies. These metrics enable adequate diagnosis of entrepreneurial economies and allow for the monitoring of economic change generated by policy and other dynamics. This paper thus takes heed of the old carpenter's adage "measure twice, cut once", by reducing policy failures with better measurement tools.

While the entrepreneurial ecosystem approach has become very prominent over the last decade, it still lacks empirical evidence. The existing empirical studies are often qualitative case studies, such as those by Spigel (2017) in Canada and Mack and Mayer (2016) in the US. There are earlier attempts to measure entrepreneurial ecosystems with quantitative data, such as the study by Ács et al. (2014). However, these studies focus on the national level (Ács et al., 2014; Radosevic and Yoruk, 2013). In this study we instead focus on the regional level, because entrepreneurship is largely a regional event (Feldman, 2001), and there is substantial variation in entrepreneurship between regions within countries (Sternberg, 2009; Fritsch and Wyrwich, 2014). The level of the (city-)region is generally seen as the more adequate level from a policy (Katz and Bradly, 2013; Spigel, 2020) and entrepreneurship practice (Feld, 2012; Feldman, 2001) point of view. This study will be the first to create a harmonized dataset to measure entrepreneurial ecosystems at the regional level in a large number of countries.

Developing entrepreneurial ecosystem metrics encompasses quantification and qualification. Quantification involves measuring the key elements with a wide range of data sources (Credit et al., 2018). Qualification involves developing a methodology that provides insight into the extent to which these elements are interdependent, into the overall quality

of entrepreneurial economies, and how this relates to entrepreneurial outputs. We have three main research questions.

First and foremost, how can we compose a harmonized dataset to measure the quality of key elements of entrepreneurial economies? We develop a universal set of constructs for each entrepreneurial ecosystem element, and we source data from a large variety of datasets to compose credible, accurate, and especially comparable metrics of entrepreneurial ecosystems. We measure entrepreneurial ecosystems with a harmonized dataset in the context of 273 regions in 28 European countries. Europe provides an excellent laboratory for analyzing entrepreneurial economies because it contains a large number of regions that exhibit striking variation in socio-economic conditions, entrepreneurial activity, and economic growth.

Second, to what extent and how are the elements of entrepreneurial economies interdependent? Interdependence is a key aspect of complex systems (Aghion et al., 2009; Simon, 1962). Studying if there are strong interdependencies between the elements thus helps answer the question whether entrepreneurial economies can be seen as complex systems. Using multiple statistical methods, we show to what extent and how the elements of entrepreneurial economies are interdependent.

Third, how can we determine the quality of entrepreneurial economies? We answer this question with a synthesis of our entrepreneurial ecosystem element metrics into an entrepreneurial ecosystem index. We then analyze the relation of the entrepreneurial ecosystem index to entrepreneurial outputs. Entrepreneurial output is an indicator of the emergent property of entrepreneurial economies. We use multiple data sources and metrics

to determine entrepreneurial outputs at the regional level. Using novel methods, including web scraping and geocoding, we determine entrepreneurial outputs per region in the form of the number of (Crunchbase listed) innovative new firms and unicorns – young private firms with a valuation of more than $1 billion.

The outline of our paper is as follows. First, we discuss the key mechanisms that explain the prevalence of entrepreneurship and economic development. Second, we discuss and develop the measures needed to approximate the key elements of entrepreneurial economies. These measures allow us to quantify the elements and to qualify entrepreneurial economies. Third, we relate the developed metrics to entrepreneurial outputs. The final sections conclude, reflect on the findings and policy implications, and set out an agenda for further research.

2.2 Entrepreneurship and economic development

In this section, we discuss the state of the art of empirical research on the (inter)relation between entrepreneurship and (regional) economic development, synthesize this into an entrepreneurial ecosystem framework, and advance our understanding of entrepreneurial ecosystems with a complex systems perspective. The empirical literature on entrepreneurship and (regional) economic development can be divided into the economic growth literature[2], focusing on the aggregate economic growth effects of entrepreneurship, and the geography of entrepreneurship literature, focusing on the causes of the spatial

[2] While this literature is very extensive, we focus exclusively on the studies measuring the effects of (different types of) entrepreneurship.

heterogeneity of entrepreneurship. In the following two sections, we summarize the insights from these two types of literature.

2.2.1 Entrepreneurship and economic growth

The role of entrepreneurship in economic development has been studied for a long time, going back to Schumpeter (1934), Leibenstein (1968) and Baumol (1990). The economic growth literature is mainly concerned with the question of how and to what extent entrepreneurship affects economic growth. Even though the literature does not provide full consensus on the positive effects of entrepreneurship, there seems to be more evidence in favor of than against positive (causal) effects of entrepreneurship on economic growth (Audretsch et al., 2006; Bosma et al., 2018; Carree and Thurik, 2010; Fritsch, 2013). Key causal mechanisms are the creation and diffusion of innovations and the competition created by entrepreneurs (Bosma et al., 2018). The direction and strength of the effect of entrepreneurship on economic growth depend on the type of context and the type of entrepreneurship. Ambitious, opportunity and growth-oriented types of entrepreneurship are more likely to lead to economic growth than self-employed, necessity-based entrepreneurship (Bosma et al., 2018, 2011; Fritsch, 2013; Stam et al., 2011; Stam and Van Stel, 2011). In addition, entrepreneurship is most productive in contexts with inclusive and growth-enhancing institutions (Bosma et al., 2018; Sobel, 2008). Entrepreneurship does not occur in a vacuum but is very much a local event (Feldman, 2001). There is also substantial regional variation in the prevalence of entrepreneurship, with underlying causes being very much spatially bound (Alvedalen and Boschma, 2017; Guzman and Stern, 2015).

2.2.2 The geography of entrepreneurship

The literature on the geography of entrepreneurship has provided numerous insights into the role of different factors enhancing the prevalence of entrepreneurship in regions (Bosma et al., 2011; Stam, 2010; Stam and Spigel, 2018; Sternberg, 2009). We summarize the empirical literature on the geography of entrepreneurship with ten elements affecting the prevalence of entrepreneurship (cf. Stam, 2015; Stam and Van de Ven, 2021). The first element, formal institutions, provides the fundamental preconditions for economic action (Granovetter, 1992) and for resources to be used productively (Acemoglu et al., 2005). Formal institutions are not only a precondition for economic action to take place; they also affect the way entrepreneurship is pursued and the welfare consequences of entrepreneurship (Baumol, 1990). Informal institutions - in particular an entrepreneurship culture, which reflects the degree to which entrepreneurship is valued in society - also have substantial effects on the prevalence of entrepreneurship (Fritsch and Wyrwich, 2014). Networks of entrepreneurs provide an information flow, enabling an effective distribution of knowledge, labor and capital (Malecki, 1997). A highly developed physical infrastructure (including both traditional transportation infrastructure and digital infrastructure) is a key element of the context to enable economic interaction and entrepreneurship in particular (Audretsch et al., 2015). Access to finance - preferably provided by investors with entrepreneurial knowledge - is crucial for investments in uncertain entrepreneurial projects with a long-term horizon (see e.g., Kerr and Nanda, 2009). Leadership provides direction for the entrepreneurial ecosystem. This leadership is critical in building and maintaining a healthy ecosystem (Feldman, 2014) and involves a set of 'visible' entrepreneurial leaders committed to the region (Feldman and Zoller, 2012). The high levels of commitment and public spirit of regional leaders might reflect underlying norms dominant in a region

(Olberding, 2002). Perhaps the most important condition for entrepreneurship is the presence of a diverse and skilled group of workers ('talent': see e.g., Acs and Armington, 2004; Glaeser et al., 2010; Lee et al., 2004; Qian et al., 2013). An important source of opportunities for entrepreneurship can be found in knowledge from both public and private organizations (see e.g., Audretsch and Lehmann, 2005). In addition, the presence of financial means in the population to purchase goods and services - preferably locally, but possibly also at a further distance - is essential for entrepreneurship to occur at all. The presence of demand thus is an important element of the entrepreneurial ecosystem. Income and purchasing power in a region is both a cause and an effect of entrepreneurship in a region (Berkowitz and DeJong, 2005), hinting at the role of feedback effects in the evolution of entrepreneurial ecosystems. Finally, the supply of support services by various intermediaries can substantially lower entry barriers for new entrepreneurial projects, and reduce the time to market of innovations (see e.g. Clayton et al., 2018; Howells, 2006; Zhang and Li, 2010).

2.2.3 An entrepreneurial ecosystem framework

It is necessary to combine the approaches of economic growth and geography of entrepreneurship to understand the long-term development of economies and the role of entrepreneurship. Entrepreneurship plays a double role: it is the output variable in the geography of entrepreneurship approach, and it is the input variable in the economic growth approach. To complicate matters even more, entrepreneurship and economic growth also affect the inputs of the geography of entrepreneurship approach, for example with serial entrepreneurs becoming venture capitalists and creating networks; and with economic growth leading to growth in demand, investments in knowledge, and congestion effects in

the physical environment. One solution to these conceptual complications is to build on complex systems approaches (Arthur, 2013; Hidalgo and Hausmann, 2009; Ostrom, 2010; Simon, 1962) to develop and use a complex systems perspective on the evolution of entrepreneurial economies (Feld and Hathaway, 2020; Roundy et al., 2018; Stam and Van de Ven, 2021). A complex systems perspective is able to integrate the geography of entrepreneurship and economic growth literature. We build on the integrative model of entrepreneurial ecosystems by Stam and Van de Ven (2021), which includes institutional arrangements and resource endowment elements (see Figure 1.1). The model consists of three key mechanisms: interdependence and coevolution of elements, upward causation of the ecosystem on entrepreneurship, and downward causation of entrepreneurial outputs on the quality of the ecosystem (Stam and Van de Ven, 2021).

The empirical literature on the geography of entrepreneurship and economic growth reveals several factors to be relevant in explaining the spatial heterogeneity in entrepreneurship. This suggests that there is a limited set of factors that affects the prevalence of entrepreneurship in a region. The insights from the empirical literature on the geography of entrepreneurship and economic growth can be integrated into one figure (see Figure 2.1), reflecting an entrepreneurial ecosystem framework with ten elements (cf. Stam, 2015; Stam and Spigel, 2018; Stam and Van de Ven, 2021). This framework with ten elements provides a compromise between other frameworks with five (Vedula and Kim, 2019), six (Isenberg and Onyemah, 2016), seven (Radosevic and Yoruk, 2013) and 14 elements (Ács et al., 2014). We build on these frameworks and develop them further by separating inputs and outputs of the system, providing an academically grounded set of elements, and using empirical indicators more closely reflecting productive entrepreneurship (Baumol, 1990; Schumpeter, 1934).

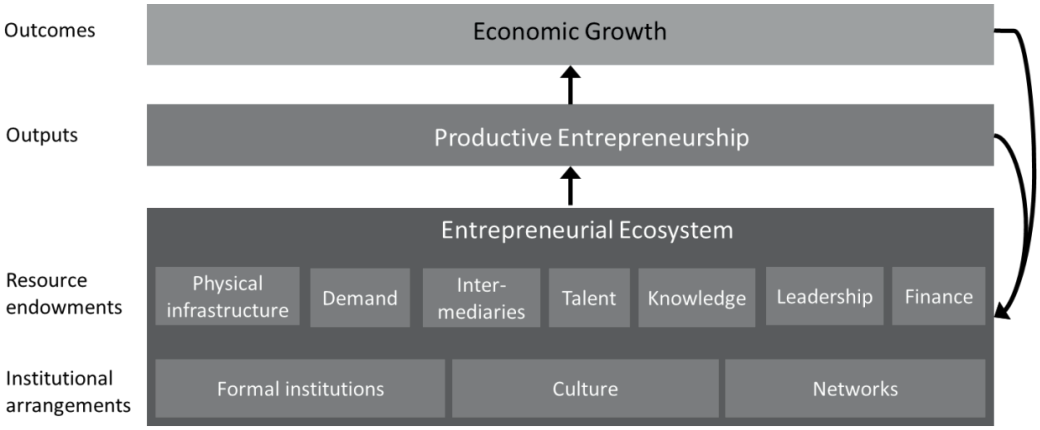


Fig. 2.1 Elements, outputs and outcomes of an entrepreneurial ecosystem (adapted from Stam, 2015; Stam and Van de Ven, 2021).

2.3 Measuring entrepreneurial ecosystems

The ecosystem framework discussed above identifies ten key elements of an entrepreneurial ecosystem. Based on previous literature (Stam, 2015; Stam and Van de Ven, 2021; Wurth et al., 2022), these ten ecosystem elements should be able to capture the most essential conditions for entrepreneurship to flourish. In this section, we discuss how we source data from a large variety of datasets to compose credible, accurate and especially comparable metrics of entrepreneurial ecosystems. Since there is no perfect dataset available for measuring entrepreneurial ecosystems, we have to compose one, with imperfections that we will discuss. This is also an invitation for follow-up research to improve our metrics when new data becomes available.

Several existing metrics studies on the regional level focus on themes closely related to entrepreneurship, especially in the European Union. For example, the Regional

Competitiveness Index (RCI) (Annoni and Dijkstra, 2019) measures the general competitiveness of a region, including factors such as human capital and infrastructure. While the RCI and other studies such as the Regional Innovation Scoreboard (RIS) include several key indicators related to entrepreneurship, none of these explicitly focus on entrepreneurship. Therefore, a study starting from a clearly defined framework and explicitly focusing on productive entrepreneurship provides a novel and valuable contribution to understanding entrepreneurial conditions in a region.

We thus set out to operationalize the entrepreneurial ecosystem elements into measurable variables at the appropriate geographical level. We start by discussing the boundaries of an ecosystem to determine the appropriate level of analysis. Then we shortly illustrate the main data sources and describe the operational measures of each ecosystem element (for an overview, see Table 1).

2.3.1 Level of analysis

The outputs and outcomes of entrepreneurial ecosystems result from a complex set of actors and factors that occur in a temporal and varying regional setting. As Feldman and Lowe (2015, p. 1785) rightly state, there is often a disconnect "between the theoretical definition of a region as integrated contiguous space and the political and census geography for which data are readily available". In addition, since ecosystems are continuously evolving and are not limited to a specific sector, it is hard to precisely determine their boundaries (Stam and Van de Ven, 2021). The primary demarcation criterium should be the spatial reach of the causal mechanisms involved. This does not lead to one straightforward unit or spatial level of analysis.

First, given the multiplicity of causal mechanisms involved in nurturing entrepreneurship, there will be different spatial reaches: for talent, it may be the daily urban system (within a 50-mile radius), while for credit it may be the local bank, and for venture capital a two-hour drive radius (which may overlap with the regional level in large countries, but might be beyond the national level for small countries).

Second, there is a spatial nestedness of contexts: formal institutions at the municipal, regional, national, and supranational level might be important context conditions. These first two considerations make it difficult to delineate the spatial boundary of entrepreneurial ecosystems from a causal mechanism point of view.

From a practitioners' point of view, the stakeholders of entrepreneurial ecosystems, the relevant boundaries will again differ depending on their role in the ecosystem. For civil servants, it will be a particular jurisdiction, while for entrepreneurs it may be a multiplicity of layered (regional, national) or connected ecosystems (different city-regions). To determine the spatial level of analysis (although almost always imperfect), we therefore search for a common spatial denominator in combination with data availability (to allow for comparisons). It should be kept in mind that even though we choose a spatial unit to represent the entrepreneurial ecosystem, entrepreneurial ecosystems are not closed containers but open systems.

In the European context, the most relevant spatial level of analysis is between the municipal and national level, since the spatial reaches of the different elements are most likely to overlap with regional boundaries (e.g., the 50-mile radius for talent). The regional level in Europe is best defined through the NUTS 2 classification, which identifies 281 geographical

regions[3] over the 27 member states and the United Kingdom. The boundaries of NUTS 2 regions are based on existing administrative boundaries and population thresholds. The population of a NUTS 2 unit is roughly between 800,000 and 3 million people (European Commission, 2018).

While for some countries and/or indicators, data is available on the more fine-grained NUTS 3 level; this was not the case for most countries or indicators we are interested in. We therefore decide to keep the unit of analysis at NUTS 2 as this would enable us to cover a larger set of regions all over Europe. It is important to include a large set of regions because it enables comparison, which is one of the main goals of this paper. This is the first step, and future studies could dive deeper into certain topics or countries and use more detailed data to do so. By defining entrepreneurial ecosystems at the NUTS 2 level, we use the same region size as the recent study by Stam and Van de Ven (2021) but instead of one country, we include all countries in the European Union and the United Kingdom.

A disadvantage of looking at regions is that data on a regional level is, for most countries, scarcer than national data. However, the European Union performs several large data collection exercises on the regional level to inform regional policy, which results in the availability of a fairly large amount of regional data. Furthermore, we use web scraping to create new metrics at the regional level. Finally, we use several national measures to account for the aforementioned spatial nestedness of, for example, institutions. This combination of

[3] We remove seven French and Spanish regions that are located in either Africa or South America as there is limited data available for these regions, and we perceive them as significantly different from the European regions.

data on different geographical levels is discussed in detail for each element below and summarized in Table I.A1 in the Appendix.

2.3.2 Data sources and element construction

To measure the entrepreneurial ecosystem elements, we combine data from various sources and complement this with data obtained by web scraping. For most elements, we use very specific datasets, e.g., for finance we use the regional venture capital data of Invest Europe and for formal institutions the Quality of Government Survey. For other elements, we use specific indicators from existing datasets on related topics, e.g., the accessibility of a region from the Regional Competitiveness Index (RCI) for physical infrastructure or the percentage of innovative SMEs that collaborate from the Regional Innovation Scoreboard (RIS) for networks. The data sources used for each element are described in detail below.

When operationalizing the ecosystem elements, we aim to get the most robust measure possible with the lowest number of indicators. In doing so, we consider and combine the accuracy – do they accurately capture what we aim to measure? – the credibility – can the sources be confidently relied on? – and the comparability of data sources – is comparable data available for all regions? For accuracy reasons, we choose to measure some elements with multiple indicators, but we sometimes have to resort to one indicator per element for credibility and comparability reasons. In the discussion, we will elaborate on how the operationalization of the elements can be improved in the future.

We choose to measure some elements with multiple indicators for two reasons. First, some elements such as institutions are multi-faceted and hard to capture in one variable. In

particular, there is a certain spatial nestedness when studying regional ecosystems. Second, some elements can be measured on a more general level and in a more specific manner for entrepreneurs, such as the workforce's education level and specific entrepreneurial skills. We thus combine variables to capture these various dimensions of one element.

Seven of the ten elements are constructed by combining multiple indicators. For those elements, we calculate the element score by first standardizing the individual measures (mean of 0 and standard deviation of 1). This ensures that the different measures each have a proportionate influence on the composite indicator. We then take the average of the standardized measures.

To measure four of our variables, high-growth firms, unicorns, leadership, and the number of incubators, we use the location of individual organizations to calculate a regional aggregate measure. The methodology of geocoding and region allocation for these measures is as follows. First, we use the nominatim package in R to geocode the given locations using OpenStreetMap (OpenStreetMap, 2019; Rudis, 2019). This is an online map that allows users to pass a list of locations into the software and obtain their coordinates. For the few regions without a match in this procedure, we manually search and add their coordinates. Subsequently, we used Eurostat shapefiles to determine in which NUTS 2 region these coordinates are located. These shapefiles contain an exact overview of the NUTS 2 boundaries (Eurostat, 2019). We then use the rgdal package in R to assign the coordinates to the corresponding NUTS 2 region (Bivand et al., 2019; Eurostat, 2019). With this procedure, we can assign 99.9% of the organizations to a region. We manually searched the remaining organizations and located the remaining geocodes through the browser tool of OpenStreetMap. After this, we were able to assign all organizations for all four variables to

a region. For each of the four variables, we then count the number of organizations in each NUTS 2 region and divide this by the region's population to obtain our final measure.

For a few indicators, in some countries, data is only available at the NUTS 1 level. In those cases, we follow the approach of previous measurement studies and impute the NUTS 1 values for the NUTS 2 regions (Annoni and Dijkstra, 2019; Hollanders et al., 2019; Léon et al., 2016). While this is a second-best strategy, we only had to do this imputation for a maximum of five countries for seven (of the 33) indicators. Table A1 clearly describes these cases. Since the number of observations affected is relatively small, we do not expect this to affect our results significantly. Future research efforts to collect data for these indicators at NUTS 2 level would clearly improve our dataset. Table 2.1 provides an overview of each element's empirical indicators and data source, while Table I.A1 in the Appendix provides a more detailed description for each measure.

Table 2.1

Operationalization of the indicators of entrepreneurial ecosystem elements and output.

Elements	**Description**	**Empirical indicators**	**Data source**
Formal institutions	The rules of the game in society	Two composite indicators measuring the overall quality of government (consisting of scores for corruption, accountability, and impartiality) and the ease of doing business	Quality of Government Survey (QOG) and the World Bank Doing Business Report
Entrepreneurship culture	The degree to which entrepreneurship is valued in a region	A composite measure capturing the regional entrepreneurial culture, consisting of entrepreneurial motivation, cultural and social norms, importance to be innovative, and trust in others	Global Entrepreneurship Monitor (GEM) and European Social Survey (ESS)
Networks	The connectedness of businesses for new value creation	Percentage of SMEs that engage in innovative collaborations as a percentage of all SMEs in the business population	Regional Innovation Scoreboard (RIS)
Physical infrastructure	Transportation infrastructure and digital infrastructure	Four components in which the transportation infrastructure is measured as the accessibility by road, accessibility by railway and number of passenger flights and digital	Regional Competitiveness Index (RCI)

		infrastructure is measured by the percentage of households with access to internet	
Finance	The availability of venture capital and access to finance	Two components: The average amount of venture capital per capita and the percentage of SMEs that is credit constrained	Invest Europe and European Investment Bank (EIB)
Leadership	The presence of actors taking a leadership role in the ecosystem	The number of coordinators on H2020 innovation projects per capita	Community Research and Development Information Service (CORDIS)
Talent	The prevalence of individuals with high levels of human capital, both in terms of formal education and skills	Four components: The percentage of the population with tertiary education, the percentage of the working population engaged in lifelong learning, the percentage of the population with an entrepreneurship education, the percentage of the population with e-skills	Eurostat and the Global Entrepreneurship Monitor (GEM)
New knowledge	Investments in new knowledge	Intramural R&D expenditure as a percentage of Gross Regional Product	Eurostat

Demand	Potential market demand	Three components: disposable income per capita, potential market size expressed in GRP, potential market size in population. All relative to EU average.	Regional Competitiveness Index (RCI)
Intermediate services	The supply and accessibility of intermediate business services	Two components: the percentage of employment in knowledge-intensive market services and the number of incubators/accelerators per capita	Eurostat and Crunchbase
Output	Entrepreneurial output	The number of Crunchbase firms founded in the past five years per capita	Crunchbase
	Unicorn output	The absolute number of unicorns in the region founded in the last ten years	CB Insights and Dealroom

2.3.4 Formal institutions

Well-functioning institutions are essential for entrepreneurship (Granovetter, 1992). Even when fundamental conditions of the institutional framework, e.g. property rights, are in place, the quality of these institutions affects entrepreneurship (Baumol, 1990; Boudreaux and Nikolaev, 2019; Webb et al., 2019). To operationalize this element, we use a generic and an entrepreneurship specific indicator. These indicators cover two different aspects of

the institutional environment, namely the overall quality of government and the regulatory framework for businesses.

To operationalize the quality of government, we use the Quality of Government study (QOG), which is the largest subnational governance study that has been performed (Charron et al., 2019). The Quality of Government study has been used in numerous other studies and is a reliable measure of institutional quality (Charron et al., 2015). The quality of government indicator consists of three components: corruption, accountability, and impartiality. These are each measured by a large regional citizen survey and complemented by the World Governance Indicators on a national level. The survey questions measure both experiences and perceptions of institutions in the particular region of the respondent (Charron et al., 2019). This measure thus accounts for the nestedness of the regional variation in the quality of government within national institutions.

To measure the entrepreneurship specific regulatory framework, we use a composite indicator: the Ease of doing business index from the World Bank, which incorporates seven elements concerning business regulations at the national level (World Bank, 2014). These elements are highly linked to national regulations, and as such, a national measure is sufficient for this indicator. By combining this entrepreneurship specific national measure with the regional measure for the quality of governance, we arrive at a measure capturing a combination of general and entrepreneurship specific institutions.

2.3.5 Entrepreneurship culture

The next element, culture, represents an informal institution. Entrepreneurship culture can be described as how much entrepreneurship is valued and stimulated in a society (Fritsch and Wyrwich, 2014). The cultural context can have a substantial effect on entrepreneurship by influencing the aspirations of entrepreneurs and whether people are likely to become an entrepreneur at all (Wyrwich et al., 2016).

To measure entrepreneurship culture, we use four indicators: entrepreneurial motivation and cultural and social norms encouraging new business activity from the Global Entrepreneurship Monitor (GEM) measured at the country level (Bosma and Kelley, 2019), and the perceived importance of being innovative and creative, and trust in others from the European Social Survey[4] measured at the NUTS 2 level (Norwegian Center for Research Data, 2014)[5]. Again, we combine entrepreneurship specific measures with a more general measure of the regional culture (trust). This general indicator is important because in societies where people trust others it is, for example, easier to have economic interaction and invest in the first place (Zak and Knack, 2001).

[4] Data on these variables is missing for six regions; for these regions we calculated the culture score based on the two indicators for which data was available. We performed robustness checks in which we set the value for these indicators to the European average and in which we removed these regions. Both did not significantly affect our results, proving the robustness of this choice.

[5] Stam and Van de Ven (2021) use the number of new firms per 1,000 inhabitants as an alternative measure of culture. We initially aimed to combine our current indicator with this data. However, there is not (yet) a harmonized dataset on this variable for all European NUTS 2 regions, and we thus had to use a combination of OECD, Eurostat, and national statistics offices to construct this variable (see Table I.A1). These data sources were not consistent in their definitions and data demarcations. Hence, we deemed the validity of this alternative measure to be questionable, and we excluded this measure from our analyses. We did perform a robustness test in which we combined the birth rate of new firms with our current culture measure. The results of our analyses remained largely identical.

2.3.6 Networks

When actors in a region are well connected in networks, this allows information, labor and knowledge to flow to firms that can use it most effectively (Malecki, 1997). Networks are essential for entrants as it helps new firms to build social capital, which firms can leverage to access resources, information and knowledge (Eveleens et al., 2017; Van Rijnsoever, 2020). The connections between firms can be measured through their cooperation projects. Our focus on entrepreneurship entails that we specifically want to measure cooperation on innovative projects. Therefore, we measure networks as the number of Small and Medium Enterprises (SMEs) that collaborate on innovation projects as a percentage of all SMEs in a specific region. These SMEs will not all necessarily be entrepreneurial firms, but the focus on innovation projects means this measure captures the kind of productive collaboration that is likely to contribute to entrepreneurial output. We therefore believe that this is the best data currently available. In addition, the size of SMEs (enterprises with between 10 and 250 employees) matches our focus on entrepreneurial growth since it does not include micro firms (less than ten employees) or large firms, both of which are less relevant for our research goal. We use the data from the RIS, complemented with the European Innovation Scoreboard (EIS) for countries with only one NUTS 2 region. The RIS and EIS base their data on the Community Innovation Survey, a large survey on innovation activity including thousands of enterprises in every country in the European Union (Arundel and Smith, 2013).

2.3.7 Physical infrastructure

Physical infrastructure is essential for economic interaction between actors and thus essential for entrepreneurship as well (Audretsch et al., 2015). In this highly digital world,

not only physical infrastructure enables this interaction but also digital infrastructure. Digital infrastructure provides the opportunity to meet other actors, even if they are not in close physical proximity. Therefore, it is important to include this when creating an empirical measure of infrastructure. For our indicator, we follow the approach of the RCI, which uses accessibility by road, accessibility by railway and the number of passenger flights to measure the physical (transportation) infrastructure of a region (for details, see Table A1). To this, we add a measure for the digital infrastructure of a region, which is the percentage of households with internet access and also available from the RCI (Annoni and Dijkstra, 2019).

2.3.8 Finance

An important condition for starting a new firm and growing an existing firm is access to capital (see e.g., Kerr and Nanda, 2009; Samila and Sorenson, 2010). We measure the availability of capital with two indicators: the amount of venture capital and the percentage of SMEs that is financially constrained. Again, this is a combination of an entrepreneurship specific and a general measure. It is valuable to add a measure of finance constrained firms because this is not limited to one specific form of finance and thus takes into account that firms may use different financial resources in different countries (Criscuolo and Menon, 2015).

Venture capital is measured as the average amount of venture capital in the last five years per capita. The data for this variable is from Invest Europe, an association of private capital providers which conducts research on private equity activity in Europe (Invest Europe, 2020). The percentage of finance constrained SMEs is taken from the investment survey by

the European Investment Bank (Alanya et al., 2019). SMEs are enterprises with less than 250 employees. They are considered financially constrained when they were either rejected for loans or received less than applied for, or were discouraged from applying because it was too expensive or they expected to be turned down. The use of data on SMEs does, similarly to the measure for networks, not fully overlap with our focus on productive entrepreneurship but is again the best data available.

2.3.9 Leadership

Leadership in an entrepreneurial ecosystem is necessary to provide the actors in the ecosystem with a certain direction or vision to work towards and make the ecosystem function more effectively (Normann, 2013). Leadership can be provided by individual leaders but also by collaborative efforts that try to guide the system in a certain direction. Since leadership is an intangible concept, it is quite hard to measure and remains understudied (Sotarauta et al., 2017). Our study operationalizes leadership as the number of project coordinators of Horizon 2020 innovation projects in a region.[6] We thus follow the approach of Stam and Van de Ven (2021), who use the number of innovation project leaders as their operationalization for leadership. Although this measure is not limited to entrepreneurial leaders, it does capture whether organizations in a region are willing to initiate new and innovative projects. These organizations, either public or private, are likely to create collective action in entrepreneurial ecosystems. To construct this variable, we use the CORDIS database, which contains data on 23,693 innovation projects that are

[6] Horizon 2020 is the research and innovation program funded by the European Commission. It encompasses private-public partnerships working on innovation projects with the aim to stimulate economic growth in the European Union (European Commission, 2019a).

subsidized as part of the Horizon 2020 program of the European Union (CORDIS, 2019; European Commission, 2019a). We then use the geocoding approach outlined in section 2.3.3 to create our leadership indicator, the number of innovation leaders per capita.

2.3.10 Talent

Human capital (or talent) encompasses individuals' skills, knowledge and experience (Stam and Van de Ven, 2021). Human capital is a critical input for entrepreneurship and has been shown to be linked to new firm formation (see e.g., Acs and Armington, 2004; Glaeser et al., 2010). It is clearly a broad concept that asks for several empirical measures to cover its different facts adequately. We break human capital down into two different components: general human capital and entrepreneurship specific human capital (Becker, 1964; Rauch and Rijsdijk, 2013). We use two measures for the general human capital component, both from Eurostat (Eurostat, 2020). The first measure is the percentage of the population having completed tertiary education and the second measure is the percentage of the population aged 25-64 that participates in education or training (lifelong learning).

Entrepreneurship specific human capital is directly related to start-up activities (Brüderl et al., 1992; Rauch & Rijsdijk, 2013). We include two measures: the quality of entrepreneurship and business education from the GEM (Bosma and Kelley, 2019), and the percentage of the population with high-level e-skills from Eurostat (Eurostat, 2020). The inclusion of digital skills is important because digital literacy is essential for working in any type of enterprise in the current digital society. In addition, a lot of productive forms of entrepreneurship currently involve some digital aspects.

2.3.11 Knowledge

The creation of new knowledge by either private or public organizations provides new business opportunities (Kim et al., 2012; Qian et al., 2013). It is therefore an important source of entrepreneurship. We measure this element as the intra-mural R&D expenditure as a share of the total Gross Regional Product (GRP). This measure includes R&D spending in both the public and private sectors. The higher the investment in R&D, the more knowledge is likely to be produced, which can then be translated into business opportunities. The data for this variable is available in both the Regional Competitiveness Index (Annoni and Dijkstra, 2019) and Regional Innovation Scoreboard (Hollanders et al., 2019). We choose to use the data from the RCI as this is available at the NUTS 2 level for a larger number of regions.

2.3.12 Demand

The purchasing power and potential demand for goods and services are important for entrepreneurs since it will only be interesting to market new products if the population has the financial means to buy them. Several studies have shown that market growth increases firm entry (Eckhardt and Shane, 2003; Sato et al., 2012). Even though most firms nowadays serve larger markets than just those in their own region, it is important for start-ups to have a potential regional market which they can easily access (Cortright, 2002; Reynolds et al., 1994; Schutjens and Stam, 2003). We measure the demand using data from the RCI, which combines three measures (Annoni and Dijkstra, 2019). The measures are disposable income per capita, potential market size expressed in GRP, and potential market size expressed in

population. This measure captures both consumer demand and demand from existing businesses in the region.

2.3.13 Intermediate services

Intermediate services or producer services can help producers to start a new enterprise and market an innovation. This support can substantially lower entry barriers for new entrepreneurial projects and speed up the introduction of innovations (Howells, 2006; Zhang and Li, 2010). For this element, we again combine a general and an entrepreneurship specific measure. We operationalize the general measure as employment in knowledge-intensive market services representing the general availability of intermediate services, such as legal, marketing, accountancy, and consultancy services. The required data is available in Eurostat (Eurostat, 2020).

For the entrepreneurship specific measure, we look at incubators and accelerators as intermediate service providers. These organizations specifically aim to help people with innovative ideas to start their own companies. Incubators and accelerators typically provide various services such as access to networks of entrepreneurs and training in business skills (Cohen et al., 2019; Eveleens et al., 2017; Van Weele et al., 2017). Several studies have shown that incubators and accelerators can significantly contribute to the success of start-ups (see Ayatse et al. (2017) and Eveleens et al. (2017)). Since these organizations are put in place to support entrepreneurs and can improve the performance of new firms, it is important to include them in the analysis. For this variable we scraped a total of 950 incubators and accelerators from the Crunchbase website (Crunchbase, 2019). We then use the geocoding approach outlined in section 2.3.3 to determine the number of incubators per

capita in a specific region. Note that we measure the prevalence of intermediate services in general and incubators and accelerators in particular, but not the quality of these services per se.

2.3.14 Entrepreneurial Ecosystem Index

To determine the quality of entrepreneurial ecosystems, we explore the option of combining the measures of the ten elements of the entrepreneurial ecosystem to calculate an index. The calculation is done using the same method applied in Stam and Van de Ven (2021). This approach relies on the crucial assumption that all ten elements are of equal importance in the ecosystem as we standardize the value for the different elements. This is clearly a very agnostic approach since one could think of reasons why certain elements should be given more weight than others. Some studies have investigated this and found that certain factors matter more than others (see e.g. Corrente et al. (2019)). However, these studies used other elements and data, and it is therefore not possible to directly transfer these weights to our data. We are aware that the index we create in this manner will not be a final solution. Instead, we present it here as a first step to determine the quality of entrepreneurial ecosystems using the metrics we have developed in the previous sections. We also perform a principal components analysis in the next section, which does not rely on the assumption that all components are equally important, as an alternative method of combining the elements. Subsequently, we also perform a series of robustness checks on the index. Finally, we present a future research agenda on ways to further improve the measurement of the quality of entrepreneurial ecosystems that includes weighting the different elements.

To calculate the index, we first standardize the composite indicators which we have created for each element. This ensures that all elements get similar weights in the creation of the index. Subsequently, to normalize the standardized values, we take the inverse natural log of the standardized values. This is necessary because normalizing requires division by the mean, which is 0 after standardization. We then normalize the element values by setting the European average of each element to 1 and by letting all other regional values deviate from this. If an element in a region performs less than average, this results in a value between 0 and 1; above-average performing regions have a value above 1. This allows us to compute an index value based on the ten elements and compare the quality of different entrepreneurial ecosystems. We calculate the Entrepreneurial Ecosystem Index in three ways. First, in an additive way (E1 + E2 +…+E10) where regions with an average value on each element will thus score an index value of 10. Second, to better account for the systemic nature of the entrepreneurial ecosystem, we also calculate the index in a multiplicative manner (E1*E2*…*E10). The disadvantage of the normalization around 1 in both these indices is that values above 1 have a stronger effect on the index than below-average values, which are between 0 and 1. We therefore take the natural logarithm to let the values oscillate symmetrically around 0; this logarithmic way (log(E1) + log(E2) +….+log(E10)) is our third index value.

2.3.15 Output

The output of the entrepreneurial ecosystem is productive entrepreneurship (see Figure 2.1). This kind of entrepreneurship contributes to the economy's output and consequently leads to aggregate value creation, which is the outcome of the system (Baumol, 1990). Previous research has shown that proxies of productive entrepreneurship have strong positive effects

on economic growth and job creation (Criscuolo et al., 2014; Haltiwanger et al., 2013; Stam et al., 2011; Wong et al., 2005). Productive entrepreneurship is a subset of total entrepreneurship and thus requires another measure than, for example, the total number of new firms.

In this study, we take the number of new firms (i.e. founded less than five years ago) that are registered in Crunchbase as our measure for entrepreneurial output (Crunchbase, 2019; Dalle et al., 2017). Crunchbase predominantly captures venture capital oriented innovative entrepreneurial firms and largely ignores companies without a growth ambition and is thus a good source for data on productive entrepreneurship (Dalle et al., 2017). We choose the five-year timeframe to ensure that we select firms that experience their growth phase during the same time period (2015-2019) as most of our indicators are measured (see Table I.A1). This time period also helps to limit our sample towards innovative new firms as Crunchbase also includes incumbent, long-established, innovative firms. Our sample includes 31,236 innovative new firms. The data on Crunchbase mostly comes from two channels, a community of contributors and an extensive investor network. This data is then validated with other data sources using AI and machine-learning algorithms.

A limitation of the Crunchbase dataset is that it is uncertain if the coverage of start-ups is equal among the different countries. Overall, we find that around 0.2% of all new European firms are registered in Crunchbase.[7] This varies between 0.003% and 1.5% and follows a (zero-inflated) normal distribution.[8] We further acknowledge that not all start-ups are

[7] The data sources for the number of new firms in each country are outlined in Table I.A1.
[8] However, one specific region (UKI3 – Inner London West) has an extreme value of 11,3%. This extreme value is also reflected in our Crunchbase output measure. Further research showed that this was partly the result of all central London based start-ups being assigned to UKI3 instead of to both UKI3 and UKI4 (UKI4 – Inner London East) due to these regions having the same name in Crunchbase. We therefore decided to

innovative (cf. Autio et al., 2014), and are also aware that our measure of entrepreneurial output does not capture all innovative activity in the economy. Nevertheless, Crunchbase is currently the most comprehensive dataset available to measure innovative new firms as entrepreneurial output (Dalle et al., 2017). Crunchbase is increasingly used for academic research (Dalle et al., 2017; Nylund and Cohen, 2017). We also explored using the ORBIS data of Bureau Van Dijk as an alternative (Bureau van Dijk, 2020; Dalle et al., 2017). However, we perceived this data to be inadequate for our purposes. First, the serial correlation between the different years in the database was very low. Second, the data also contained disproportionally large differences between countries, which were hard to render and would thus impede cross country regional comparisons. We did perform a robustness test on our measure of entrepreneurial output using data provided by Dealroom (2021). Similarly to Crunchbase, Dealroom provides data on start-ups.[9] The correlation between the Crunchbase and Dealroom output measures was 0.841, and regressions using the Dealroom data resulted in nearly identical results (Appendix I.B4).

In addition to the Crunchbase output measure, we use a measure for extreme entrepreneurial output in the form of unicorns, which are young private firms valued above $1 billion. Data was collected from CB Insights which keeps a list of current unicorn companies all over the world (CB Insights, 2020). As these firms are so rare, all (49) firms founded in the last ten years that acquired unicorn status were included. This was done by scraping data from historical web pages of the internet archive and cross-checking this with Dealroom data (Dealroom, 2020).[10] We then used the geocoding procedure to allocate these 49 unicorns to

combine these regions to form one Inner London region. Nevertheless, this region remained an extreme value and to achieve a normal distribution for the regression analyses, we performed a Tukey transformation (λ = 0.2) on this variable. In the next section, we discuss the remaining transformations in our data preparations.

[9] We obtained data from Dealroom on 31,761 start-ups founded between 2016 and 2020.

[10] We used Dealroom data for the unicorn variable because Dealroom keeps a list of all European unicorns.

a total of 20 NUTS 2 regions. As such, unicorns are a scarce and selective form of productive entrepreneurship that is only present in a small number of regions. Besides unicorns being a scarce type of organization, the value of unicorns as a measure of productive entrepreneurship has also been a topic of discussion (see for example, Aldrich and Ruef, 2018; Economist, 2019), which is why we only use this as an additional output measure.

2.3.16 Extreme values

Since the European Union covers a large and diverse set of regions, the data show a lot of variety. In particular, for the measures of knowledge, intermediate services, leadership, and entrepreneurial output there are a few regions with very high values (up to 14 times the standard deviation). Even though this variation is plausible, these outliers do disproportionally influence the correlation results and regression results. Most importantly, for the regions that score extremely high on one particular indicator, the index for the quality of the entrepreneurial ecosystem is disproportionally influenced by that indicator. This does not reflect the systemic nature of entrepreneurial ecosystems as argued in the existing academic literature (Spigel, 2017; Stam, 2015). Therefore, we performed two transformations on the data to provide better interpretable results. First, before the standardization of the composite indicators, we cap the maximum value at four standard deviations of the mean (for more information on the standardization procedure, see section 2.3.14 on index calculation).[11] In practice, this means that we change the values for UKI3&4 (Inner London) of the Crunchbase output, leadership, and intermediate services measures, for DE91 (Braunschweig) of knowledge (as a result of the high R&D intensity), and DK01

[11] We performed a robustness test in which we implemented a cap at three standard deviations; this required capping a total of twelve regional values but did not significantly change our findings.

(Hovedstaden) of leadership. Without these transformations, the high deviations of these values skew the outcomes of the normalization process in such a way that only a few regions achieve above-average scores. Second, we set the maximum score for any single element to five to prevent a disproportionate influence of strong performing ecosystem elements on the overall index. We perform several robustness checks on the construction of our index, which we discuss in Appendix I.C.

2.4 Quantifying and qualifying entrepreneurial ecosystems in Europe

2.4.1 Descriptive statistics

The descriptive statistics of the empirical measures for the ten ecosystem elements, entrepreneurial outputs, and index scores are shown in Table 2.2. In total, our data covers 273 NUTS 2 regions divided over the 27 EU member states and the United Kingdom. We see a large variation for several variables, from regions with less than 2 percent of the EU average to regions with over 56 times the average value. These findings are nevertheless in line with our expectations since we study regions across different countries and levels of development. Looking at the three index values that we calculated using the methods of Stam and Van de Ven (2021), we find that the difference between the smallest and largest value for the multiplicative index is a factor 10^{15}. This difference is disproportionately large compared to the actual variation in the data, as a result of the multiplicative way of calculating the index. Hence, we deem the external validity of the multiplicative index to be insufficient and instead use the additive and the logarithmic indices in our further analyses. Throughout the remainder of this study, we primarily focus on the additive index due to the intuitiveness of its interpretation.

Table 2.2

Descriptive statistics

	N	Mean	Standard Deviation	Minimum	Maximum
Crunchbase output	273	0.852	1.018	0.014	5.000 (31.958)
Unicorn output	273	0.179	1.051	0.000	15.000
Formal institutions	273	1.000	0.812	0.098	3.497
Culture	273	0.990	1.072	0.026	5.000 (6.219)
Networks	272	0.984	1.147	0.117	5.000 (6.110)
Physical infrastructure	272	0.907	1.060	0.058	5.000 (8.916)
Finance	273	0.993	0.823	0.053	5.000 (6.907)
Leadership	273	0.703	1.111	0.181	5.000 (25.751)
Talent	273	0.968	0.964	0.072	5.000 (11.913)
Knowledge	273	0.722	1.031	0.109	5.000 (33.503)
Demand	273	1.000	0.932	0.032	4.761
Intermediate services	273	0.697	1.014	0.082	5.000 (56.011)
EE index additive	272	8.934	6.462	1.262	35.081
EE index multiplicative	272	323.444	2778.293	0.000	39364.109
EE index logarithmic	272	-6.061	7.157	-21.962	10.581

Notes: The uncorrected maximum value of each element is presented between brackets. We do not have data for all elements for Aland, a small island region of Finland, so the total number of regions for which we calculate the index is 272.

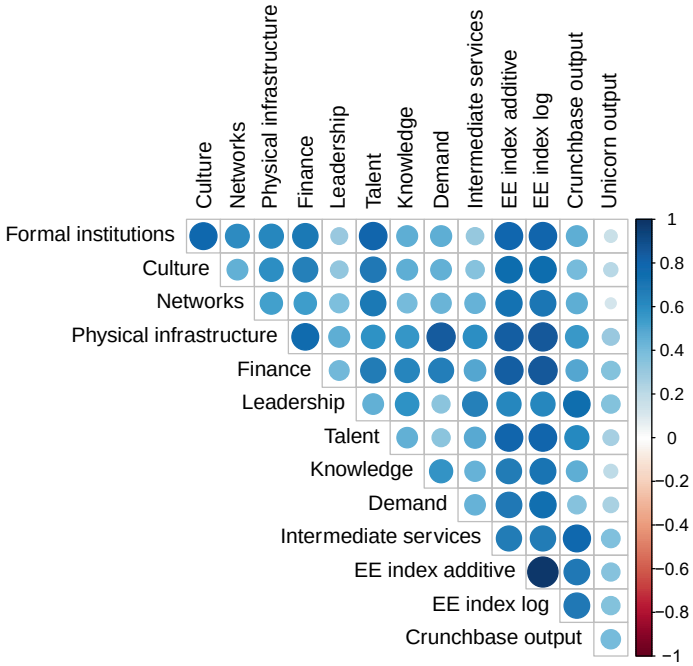
2.4.2 Interdependence between entrepreneurial ecosystem elements

Table 2.3 shows the correlations between the different elements of the entrepreneurial ecosystem, the index, and the outputs. We see high, positive, and significant correlations between all of the elements of the ecosystem.[12] The strong positive correlations illustrate the interdependencies in the entrepreneurial ecosystem. This corresponds to the results shown in Stam and Van de Ven (2021) and confirms the systemic nature of entrepreneurial ecosystems. Considering the entrepreneurial output measures, we see positive and significant correlations with all elements, and with the entrepreneurial ecosystem indices we constructed.

[12] For an overview of the numeric correlation coefficients with p-values see Table I.B1.

Table 2.3

Correlation matrix. Correlation coefficient is indicated by color and the significance level by size, only correlations that are significant at 5% level are shown.



We use a network methodology to show the interdependencies between the ten elements in Figure 2.2. Physical infrastructure and finance take the most central position in the interdependence web. This central role is supported by the finding that physical infrastructure and finance have respectively eight and six interdependencies with a correlation above 0.5 (Figure 2.3), followed by formal institutions and talent that each have five. When looking at the interdependencies with correlations above 0.6, formal institutions and finance are the most central in the interdependence web, with each of the five correlations above 0.6 (Figure 2.3). Physical infrastructure, culture, and talent also have central positions with four correlations above 0.6. Finally, formal institutions and physical

infrastructure each have two interdependencies with correlations above 0.7 (see also Table I.B1). This provides an indication for a potential role of these elements as fundamental conditions of the entrepreneurial ecosystem.

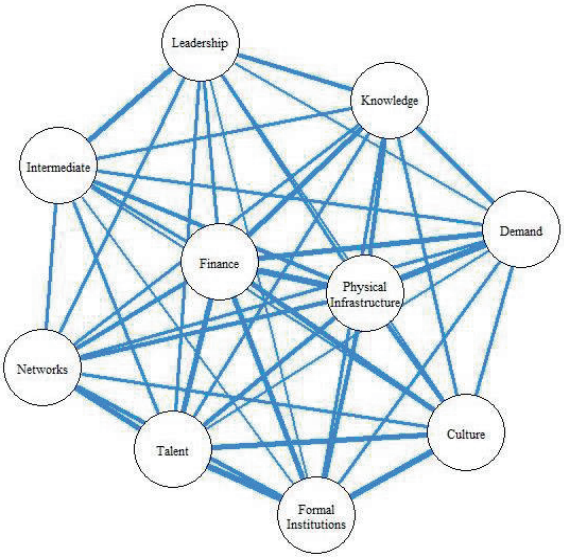


Fig. 2.2

Interdependence web of entrepreneurial ecosystem elements with the blue lines indicating positive correlations. The edge weight is defined based on the correlation strength.

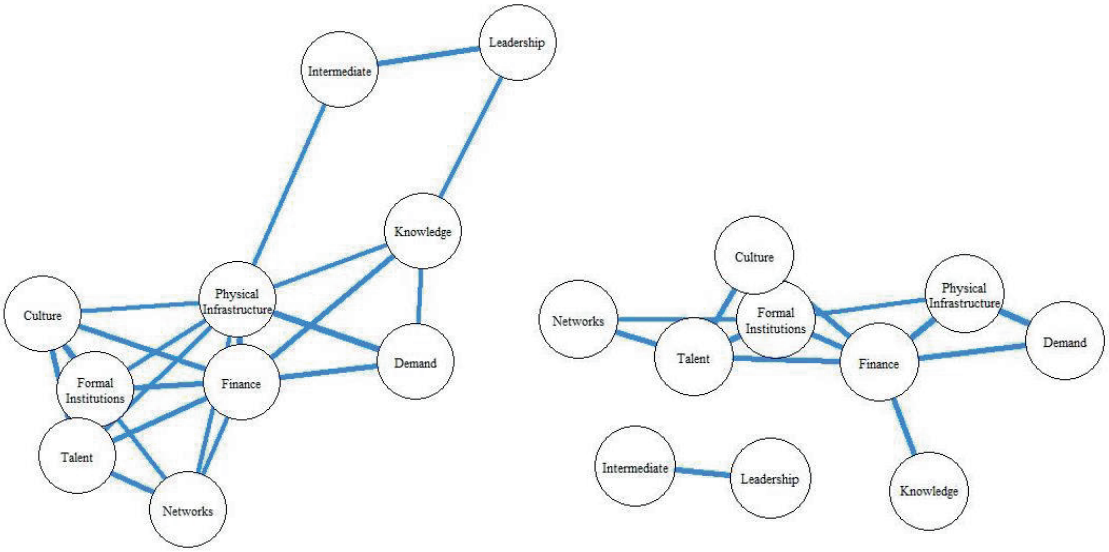


Fig. 2.3

Interdependence webs of entrepreneurial ecosystem elements with correlations above 0.5 (left) and 0.6 (right)

To further explore the interdependencies, we performed principal component analysis (PCA) on the ten individual elements. This method does not assume that all elements are equally important as the elements are assigned different loadings. The results are presented in Table 2.4; the first component explains 44.9% of the variance and has loadings of 0.21 or higher for all components. The four elements with the highest loadings are finance (0.40), physical infrastructure (0.38), talent (0.36), and formal institutions (0.35). This result confirms our findings from the interdependence graphs, which show a strongly connected set of elements with a central role for the elements of finance, physical infrastructure, talent, and formal institutions. The second component, which explains an additional 12.8% of the variation, has loadings of 0.21 or higher for six components. Similarly, the third component explains 12.4% of the variation and here six elements have loadings above 0.24. The results

of the PCA thus confirm the strong interdependencies between the entrepreneurial ecosystem elements. The high loadings of all elements also show that all elements are related to the underlying dimensions of the data and are thus likely to be relevant to the entrepreneurial ecosystem.

Table 2.4

Principal components analysis

	PC1	**PC2**	**PC3**
Proportion of Variance	0.449	0.128	0.124
Standard Deviation	2.119	1.132	1.113
Cumulative Variance	0.449	0.577	0.701
Formal institutions	0.348	-0.476	0.161
Culture	0.308	-0.164	0.437
Networks	0.212	-0.393	-0.367
Physical infrastructure	0.379	0.041	-0.381
Finance	0.397	0.133	-0.041
Leadership	0.249	0.478	0.154
Talent	0.356	-0.256	0.357
Knowledge	0.222	0.207	0.240
Demand	0.334	0.039	-0.541
Intermediate	0.297	0.484	0.032

2.4.3 Entrepreneurial Ecosystem Index

We now use the Entrepreneurial Ecosystem Index to determine the strongest and weakest entrepreneurial ecosystems in Europe. The scores for the ten highest (Figure 2.4) and lowest ranking (Figure 2.5) regions are shown in the bar graphs below. The highest scoring regions are, as expected, mainly Western European and densely populated, while the lowest scoring regions are mainly Bulgarian and Greek rural regions. To look at the different entrepreneurial ecosystems in more detail, Figure 2.6 shows the map of Europe with all NUTS 2 regions colored based on the value of the Entrepreneurial Ecosystem Index. The highest index values can be found in European capital regions, including London, Helsinki, and Stockholm. Many regions in Eastern Europe show very low index values, as do some of the more rural areas in Spain. The map also shows that there is a substantial difference between urban and rural areas. Most of the high-scoring regions include large cities. In section 2.4.6, we will compare our index to existing variables and rankings (including GDP and the RCI) to discuss the added value of the Entrepreneurial Ecosystem Index.

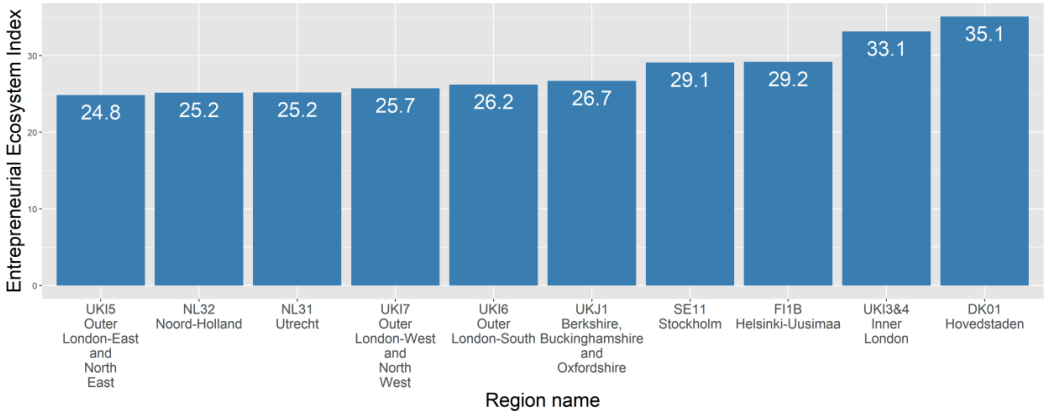


Fig. 2.4

NUTS 2 regions with the highest Entrepreneurial Ecosystem Index scores.

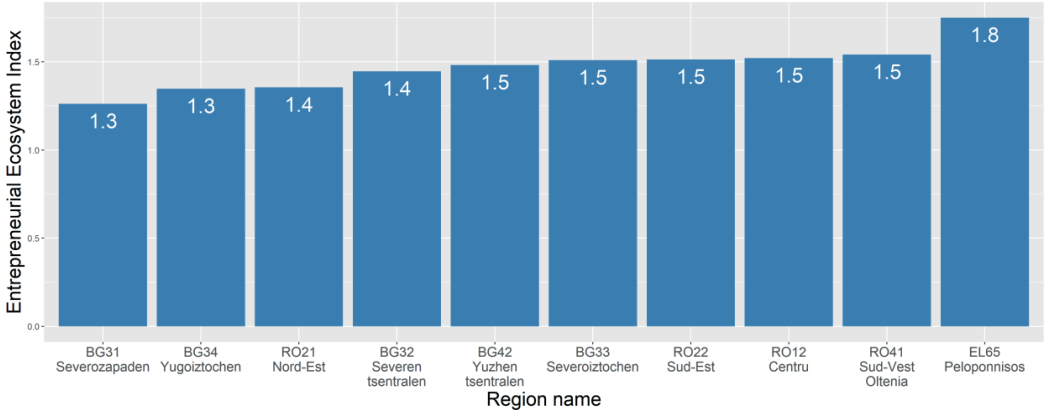


Fig. 2.5

NUTS 2 regions with the lowest Entrepreneurial Ecosystem Index scores.

The Entrepreneurial Ecosystem Index adds the different elements and subsequently creates a ranking based on the total value of the ten elements. A different approach to classify regions is to use cluster analysis on the ten ecosystem elements, which creates groups of regions closest to each other on the scores for each element. Particularly, we use k-means clustering, which minimizes the total intra-cluster variation (sum of squared errors) using

Euclidean distance measures for an a priori fixed number of clusters (Tan et al., 2018). K-means clustering is the most popular clustering technique and was originally proposed by MacQueen (1967). The number of clusters is a parameter that has to be set by the researcher. After considering the total intra-cluster variation, the average silhouette of clusters, the gap statistic, and the interpretability of the outcomes, we selected the approach with three clusters. The results (Table 2.5) show a sizeable first cluster that includes low-performing regions, including for example Athens, Budapest, and Sicily. The second cluster forms a middle group and includes Manchester, Cologne, and Luxembourg. Finally, the third cluster is the smallest group with high performing regions, including Berlin, London, and Brussels. Table 2.5 shows a clear pattern in the average index values of the regions across the clusters. This is further confirmed through the visual representation of the clusters, which shows that the cluster distribution closely aligns with the scores of the Entrepreneurial Ecosystem Index (Figure I.B1 in the Appendix). Using clustering as an alternative method to classify regions, we thus find highly similar results to the index.

Fig. 2.6

Map of NUTS 2 regions showing Entrepreneurial Ecosystem Index (273 regions are divided among groups of equal size).

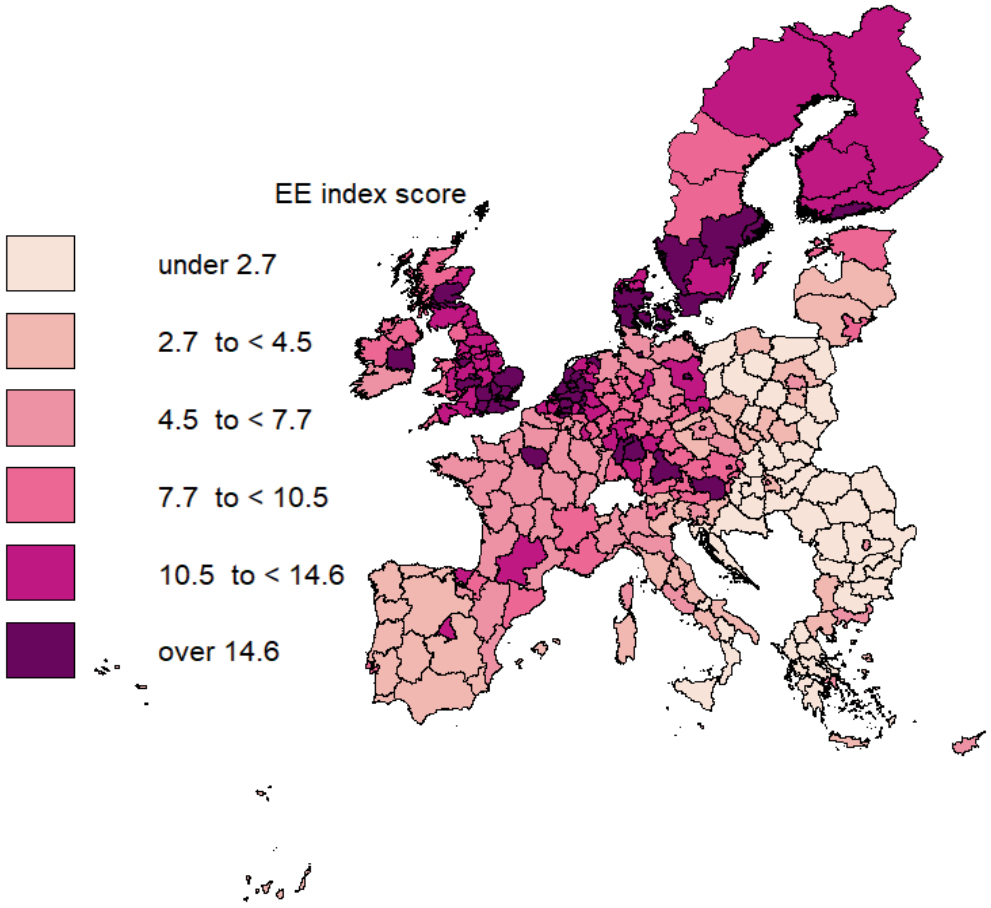


Table 2.5

Summary statistics of index and output by cluster

	Cluster 1 (N=148)	**Cluster 2 (N=95)**	**Cluster 3 (N=29)**	**Overall (N=272)**
Crunchbase output				
Mean (SD)	0.575 (0.767)	0.777 (0.554)	2.51 (1.64)	0.852 (1.02)
Median	0.337	0.685	2.18	0.466
[Min, Max]	[0.0143, 5.00]	[0.178, 4.47]	[0.288, 5.00]	[0.0143, 5.00]
EE index additive				
Mean (SD)	4.34 (2.25)	12.0 (2.62)	22.3 (5.13)	8.93 (6.46)
Median	3.58	11.8	21.4	7.66
[Min, Max]	[1.26, 11.4]	[7.58, 19.1]	[14.4, 35.1]	[1.26, 35.1]
EE index log				
Mean (SD)	-11.3 (4.75)	-1.39 (2.34)	5.32 (2.52)	-6.06 (7.16)
Median	-11.5	-1.52	5.09	-5.29
[Min, Max]	[-22.0, -1.56]	[-6.34, 3.51]	[0.970, 10.6]	[-22.0, 10.6]
Unicorn output				
Mean (SD)	0.0203 (0.183)	0.0316 (0.176)	1.48 (2.91)	0.180 (1.05)
Median	0	0	0	0
[Min, Max]	[0, 2.00]	[0,1.00]	[0, 15.0]	[0, 15.0]

2.4.4 Entrepreneurial Ecosystem Index and entrepreneurial output

After discussing the creation and reliability of the Entrepreneurial Ecosystem Index, we now use regression analysis to study if regions with better ecosystems indeed have higher entrepreneurial outputs. Table 2.5 shows that the regions in the third cluster with a high Entrepreneurial Ecosystem Index score have significantly higher outputs than the middle and laggard clusters. This indicates that the relation between the index and entrepreneurial output is not linear. A scatter plot of the Entrepreneurial Ecosystem Index and Crunchbase output confirms this suggestion (Figure 2.7).

An increase in performance on the index thus goes together with a disproportionately large increase in the number of Crunchbase firms. To capture this nonlinearity in the relation between the quality of an entrepreneurial ecosystem and its entrepreneurial outputs, we performed a regression with quadratic effects; for the results, see Table I.B2 in the Appendix. The quadratic effects are significant ($p<0.001$) and show that the relation between the index and the entrepreneurial output is indeed nonlinear. However, the convex relationship between the index and output means that adding quadratic effects forces a quadratic curve on the observations that looks like a U-shape. This is an unintended side effect of using quadratic effects in linear regression.[13]

Therefore, to better capture the nonlinear relationship between the index and output, we instead perform a piecewise linear regression. This allows breakpoints in the regression line that is fitted to the data. The results are presented in Figure 2.7 and Table 2.6. The breakpoint

[13] We use the two lines test of Simonsohn (2018) to confirm that there is indeed no U-shape relationship between the index and output.

that optimizes model fit for the additive index is located at an index score of 19.[14] At this point, the slope quite sharply increases from 0.08 to 0.39. For both the first and the second line, we find a positive and statistically significant relationship between the index and entrepreneurial output ($p<0.01$). The large increase in the slope of the regression line further shows there is a small group of regions with very high performance regarding entrepreneurial output at the high end of the index. This corresponds with our findings in the cluster analysis presented above. The results of the regression analyses with the unicorn output as a dependent variable are consistent with the findings reported in Table 2.6 and are presented in Table I.B4 in the Appendix[15].

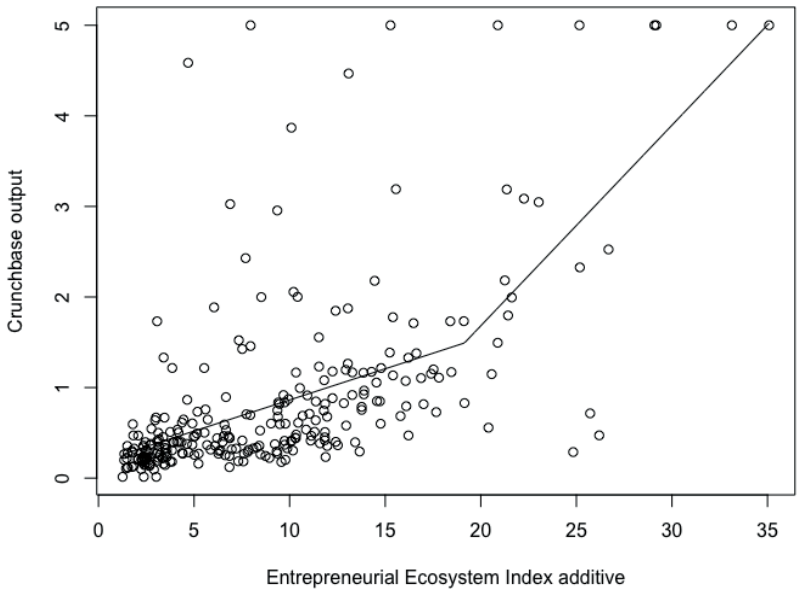


Fig. 2.7

Scatter plot with the line showing the fitted values of the piecewise linear regression

[14] We get a very similar result when we allow for a structural break in the line. The primary method shown assumes a continuous relationship and uses the R package *'segmented'* (Muggeo, 2008).
[15] We only report these findings in the Appendix because of the limited number of regions with unicorn observations (20 out of 272).

Table 2.6

Piecewise linear regression

	Crunchbase output	
	(1)	(2)
EE index additive	0.081***	
	(0.014)	
Difference slope EE	0.315**	
index additive	(0.146)	
EE index logarithmic		0.047***
		(0.009)
Difference slope EE		0.475***
index logarithmic		(0.088)
Constant	0.103	1.034***
	(0.120)	(0.129)
Observations	272	272
R^2	0.422	0.431
Adjusted R^2	0.415	0.425
F Statistic	65.213***(df=3;268)	67.697***(df=3;268)

*Notes: Clustered standard errors at country level in parentheses. * p<0.05 ** p<0.01 *** p<0.001*

The scatter plot (Figure 2.7) shows that several regions do not seem to fit the plotted line, even with the piecewise linear regression. Particularly, we see some regions with very high entrepreneurial output and low index values. The regions in the upper left corner of the plot are, for example, Malta and Luxembourg, known for very favorable tax regulations, which previous studies have demonstrated to increase high growth entrepreneurship (Guzman and Stern, 2015). On the other hand, regions with high index values but relatively low

entrepreneurial output are, for example, several outer London regions.[16] These are all regions with good conditions for entrepreneurship but located very close to even more 'vibrant' entrepreneurial areas, which attract a disproportionate share of innovative new firms (e.g., Inner London).

Since we compare regions in different countries, it is important to check whether the index not just captures differences between countries but also has explanatory power within countries. We therefore run a multilevel analysis with country-specific intercepts and our Entrepreneurial Ecosystem Index. The results of the multilevel analysis are presented in Table 2.7. The index variables still show a statistically significant and positive relationship with the entrepreneurial output ($p<0.001$). Adding country-specific intercepts improves the model, as evidenced by an increased R^2 as well as the likelihood ratio tests. The random effects at the bottom of the table show the regional variation (σ^2) and the variation between countries (τ_{00}). Our index's strong coefficient and statistical significance when we compare regions within countries shows the index's robustness. In addition, the high regional variation supports our choice to focus on the regional level when studying entrepreneurial ecosystems.

[16] For some regions, this also has to do with the fact that the data for some indicators is measured at the NUTS 1 level, as described in Table II.A1.

Table 2.7

Multilevel analysis

	Crunchbase output	
	(1)	(2)
EE index additive	0.149 ***	
	(0.008)	
EE index logarithmic		0.168 ***
		(0.010)
Constant	-0.285 *	2.202 ***
	(0.144)	(0.203)
Random Effects		
σ^2	0.32	0.34
τ_{00}	0.32 country	0.76 country
ICC	0.50	0.69
N	23 country	23 country
Observations	267	267
Marginal R^2	0.594	0.570
Conditional R^2	0.798	0.868

*Notes: This regression excludes countries that exist of only a single NUTS 2 region, which are Luxembourg, Malta, Estonia, Cyprus, and Latvia. Standard errors in parentheses. * p<0.05; ** p<0.01; *** p<0.001*

Finally, to test the robustness of our index, we perform seven robustness checks to study its sensitivity to different calculation methods and extreme values. These robustness tests include the use of the principal components instead of the index as independent variables,

as well as different ways of calculating the index. A description of the robustness checks and their results are presented in Appendix I.C. The findings prove that our index is robust.

2.4.6 Comparison with existing indices

In the previous sections, we showed that the Entrepreneurial Ecosystem Index proved to be a good predictor of productive entrepreneurship. However, the question remains whether the Entrepreneurial Ecosystem Index also outperforms existing rankings on similar phenomena. Therefore, we compare the Entrepreneurial Ecosystem Index with two existing indices, first the Regional Competitiveness Index (RCI), which measures the competitiveness of a region, and second the Regional Innovation Scoreboard (RIS), which measures the innovative ability of a region. Furthermore, we also include the GRP per capita as an alternative measure of economic development. The results (Table 2.8) show that, as expected, there are strong correlations between our index and the RCI (0.92), the RIS (0.90) and GRP (0.77). However, our index clearly has a higher correlation with both entrepreneurial output measures than any of the alternatives. This shows that there is added value in developing theory-based metrics to measure the quality of regional entrepreneurial ecosystems and that our measure captures dimensions of the ecosystem which go beyond the level of economic development of a region. An example of this is Estonia (EE00), a low GDP region with very high entrepreneurial output due to a well-performing entrepreneurial ecosystem. The Entrepreneurial Ecosystem Index captures the quality of this entrepreneurial economy better than GRP measures or other indices do.

Table 2.8

Correlation table indices and outcomes

	EE index add	**EE index log**	**RCI 2019**	**RIS 2019**	**GRP per capita**	**Crunchbase output**
EE index log	0.985****					
RCI 2019	0.919****	0.941****				
RIS 2019	0.900****	0.903****	0.885****			
GRP per capita	0.771****	0.780****	0.820****	0.724****		
Crunchbase output	0.696****	0.695****	0.573****	0.588****	0.585****	
Unicorn output	0.351****	0.362****	0.300****	0.286****	0.281****	0.400****

*Note: *p<0.05; **p<0.01; ***p<0.001; ****p<0.0001*

2.5 Discussion and conclusions

The objective of this paper was to quantify and qualify regional economies with an entrepreneurial ecosystem approach. Quantification involved measuring the ten key elements of entrepreneurial ecosystems with a wide range of data sources. Qualification involved applying a network methodology to provide insight into the interdependencies between the elements and the construction of an Entrepreneurial Ecosystem Index to approximate the overall quality of entrepreneurial economies. Finally, we related the elements and the index to entrepreneurial outputs.

We answered three main research questions. First, how can we compose a harmonized dataset to measure the quality of key elements of entrepreneurial economies? We built on prior entrepreneurial ecosystem research and composed a harmonized dataset that measures

each element of entrepreneurial ecosystems in the context of 273 regions in 28 European countries. To do so, we sourced a wide variety of data from existing datasets and online databases. However, not all elements could be measured in an entirely satisfactory way. Often, adequate data is available, but not at the same regional level or for all regions. An example is the data we used for the finance element: we prefer to have a composite indicator that includes objective data on the supply of different types of entrepreneurial finance. However, this is currently only available for venture capital in European regions. This could be improved by also including bank loans and crowdfunding. Another example is the data we used for the element networks. Even though the data provided on the engagement of SMEs in innovative collaborations is very informative, additional network data on collaborative networks and influencer networks, for example based on Twitter or LinkedIn data, could enrich the diagnosis of entrepreneurial ecosystems (Eveleens, 2019). This kind of network data would also allow for more refined measures of network diversity, density, and centrality. For other elements, there is no straightforward data available, and new variables had to be constructed. This was the case for leadership, for which others (Stam and Van de Ven, 2021) have constructed country-specific regional indicators, and we have created a pan-European indicator. However, even though this indicator provides information on the prevalence of (public-private) leadership in the context of European projects, improvements can be made to measure leadership that is more relevant for the quality of entrepreneurial economies, for example, with the prevalence of public-private regional partnerships (see Olberding, 2002). Overall, there is a significant trade-off between getting richer context-specific data (often only available in a relatively small number of regions) and getting widely available, harmonized data, enabling comparisons between regions. We invite other researchers to take up the gauntlet and improve these metrics further by collecting new and richer data.

Second, to what extent and how are the elements of entrepreneurial economies interdependent? We performed correlation, principal component, cluster, and network analyses to visualize the interdependencies between elements. These analyses revealed that entrepreneurial economies are systems with highly interdependent elements. Our analyses showed that physical infrastructure, finance, formal institutions, and talent take a central position in the interdependence web, providing a first indication of these elements as fundamental conditions for entrepreneurial ecosystems.

Third, how can we determine the quality of entrepreneurial economies? We answered this question by composing our Entrepreneurial Ecosystem Index and analyzing its relation to entrepreneurial outputs. We used multiple data sources and methods, including web scraping and geocoding, to determine entrepreneurial outputs at the regional level. We have shown that it is possible to measure the quality of entrepreneurial economies in a way that has external validity: showing a ranking of European regions and range of variation that is credible. Our analyses reveal the wide-ranging quality of entrepreneurial ecosystems in Europe, showing a large group of substantially lagging regions and a smaller group of leading regions. We also tested the internal validity using the fact that high-quality entrepreneurial ecosystems are more likely to produce emergent properties, which we measured with indicators of productive entrepreneurship. The prevalence of innovative new firms is strongly positive and statistically significantly related to the quality of entrepreneurial ecosystems, as captured with differently constructed entrepreneurial ecosystem indices. Our empirical findings are thus in line with the upward causation found by Stam and Van de Ven (2021) and Vedula and Kim (2019). The current index is formed under the assumption that each element is equally important for the quality of the ecosystem. While we find highly similar results when we challenge this assumption by employing

principal component analysis, there is still a clear opportunity to improve the index in the future. We invite further research to study the respective importance of the ten elements for the quality of the entrepreneurial ecosystem and believe that the metrics developed in this study provide them with the opportunity to do so. In particular, future research should address if there are combinations of elements that are either necessary or sufficient for high outputs of productive entrepreneurship. Methods such as latent cluster analysis or qualitative comparative analysis (see Chapter 3) can play an important role in doing this and thus improve our understanding of the workings of entrepreneurial ecosystems.

There are several additional opportunities for improving the developed metrics that deserve substantial attention in follow-up research. First, the internal validity of the index should be tested more carefully, in particular with other (more direct) tests of causality, with longer time lags between changes in the quality of entrepreneurial ecosystems and the resulting entrepreneurial outputs, and with quasi-natural experiments in which a set of similar regions is confronted with substantially different changes in one or a few elements. In sum, we need to move from a comparative static analysis to a dynamic analysis, and therefore we need longitudinal datasets. This would make it possible to better trace processes within entrepreneurial ecosystems (Spigel and Harrison, 2018) and allow us to measure the distinct properties of complex evolving systems that arise from interdependencies, such as nonlinearity, emergence, tipping-points, spontaneous order, adaptation, and feedback loops.

Second, even though Europe provides a wide variety of regions to develop and test our entrepreneurial ecosystem metrics, these metrics also need to be developed and tested in other contexts, in large sets of regions in the US, Asia, Africa, and Latin America.

Third, our output measure of productive entrepreneurship is based on Crunchbase, and it is uncertain if the coverage of this database is equal among all regions. The same goes for the Dealroom data, which we used to test the robustness of this measure. There is a need to gain more insight into the coverage and quality of these private databases to assess their credibility. This is especially urgent given the increasing use of these databases in research on entrepreneurship and, in particular, on entrepreneurial ecosystems (Dalle et al., 2017).

Finally, statistical regions are not always overlapping with either the relevant jurisdictions or the spatial reach of the causal mechanisms involved (for example, related to culture and the provision of finance). Developing tailor-made spatial units and taking into account the nestedness of elements (cities, in regions, in countries), and neighborhood effects is also a challenge for future research. With the help of spatial econometrics, spill-over effects between regions could be analyzed. Our empirical research implicitly assumed an equal weight of all regional units. Future research can improve upon this by considering the differential (population, economic) size of regions, which might lead to more adequate regression analyses.

2.6 Policy implications

Despite the popularity of the entrepreneurial ecosystem approach in science and policy, there is a scarcity of credible, accurate and especially comparable metrics of entrepreneurial ecosystems. In this paper, we bridge this gap and measure the quality of entrepreneurial ecosystems by collecting and combining relevant data in a comprehensive set of metrics. These metrics are essential for data-and-dialogue-driven policy.

Measures of the elements of entrepreneurial ecosystems are an essential input for ex-ante policy diagnosis: to discover the weaknesses and strengths of entrepreneurial ecosystems. These weaknesses and strengths are always relative to other relevant regions: the benchmark. This is why the construction of large-scale datasets is a necessity for regional policy. Benchmarking the region could trigger policy by learning from regions that have comparable, entrepreneurial ecosystems. Tackling the weakest elements of entrepreneurial ecosystems is likely to provide the most efficient and effective way of improving the overall quality of the entrepreneurial ecosystem and stimulating productive entrepreneurship (Ács et al., 2014). However, a limitation in applying our metrics is that they provide insight into where to look for improvement, but not how this improvement should be achieved. It is thus important to combine these metrics with qualitative insights about particular entrepreneurial ecosystems.

The metrics are also an essential input for ex-post policy evaluation. They enable monitoring whether and to what degree the envisioned improvements of particular entrepreneurial ecosystem elements have been achieved and whether this has resulted in an increase in productive entrepreneurship and economic growth. For this monitoring, regular measurement of the quality of the entrepreneurial ecosystem elements is essential. For structural economic policy, annual data points would suffice, but in the context of rapidly evolving crises, including the COVID-19 crisis, more frequent monitoring with quarterly or even monthly data might be needed.

However, entrepreneurial ecosystem policy can never be entirely data-driven: comprehensive planning is computationally intractable (i.e., practically impossible) in large regional entrepreneurial ecosystems (cf. Bettencourt, 2014). Data on social phenomena are

likely to remain insufficient, and interdependencies between elements and their emergent properties are unlikely to remain stable over time. Entrepreneurial ecosystem metrics facilitate a collective learning process to improve regional economies: this process combines data and dialogue. The diagnosis based on the metrics should, ex-ante, be used to facilitate dialogue between stakeholders of the entrepreneurial ecosystem about policy interventions, and facilitate, ex-post, a dialogue about the effectiveness of these interventions. Entrepreneurial ecosystem metrics are thus essential for data-and-dialogue-driven policy.

In sum, the entrepreneurial ecosystem approach, including the metrics we propose, provides the means to improve every regional economy in its own way. In particular, the approach and its metrics provide a lens for public policy to better diagnose, understand and improve entrepreneurial economies.

Chapter 3

Figuring it out: Configurations of high-performing entrepreneurial ecosystems in Europe

Written together with Erik Stam and Niels Bosma.

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3.1 Introduction

Regions differ greatly in their ability to enable entrepreneurship, which is an important driver of economic development (Fritsch and Schindele, 2011; Fritsch and Wyrwich, 2017; Haltiwanger et al., 2013; Stam et al., 2011). Entrepreneurship is predominantly a local event (Feldman, 2001) and its prevalence is highly uneven across space (Bosma and Sternberg, 2014; Dahl and Sorenson, 2012; Stam, 2007). In previous decades most geography of entrepreneurship studies investigating spatial factors important for entrepreneurship assumed that each factor affects entrepreneurship independently and in a linear way (see e.g. Armington and Acs, 2002; Bosma and Sternberg, 2014; Delgado et al., 2010). However, the relationship between geographic factors and entrepreneurship is likely to be more complex, as various factors interact in different ways to enable entrepreneurship. The emergence of the entrepreneurial ecosystem concept can be seen as a response to incorporate non-linear mechanisms, since it offers a complex system way of thinking about the regional environment enabling entrepreneurship (see e.g., Cavallo et al. 2019; Malecki, 2018; Roundy et al., 2018; Stam and Van de Ven, 2021; Wurth et al., 2022).

An entrepreneurial ecosystem is defined as a set of interdependent factors and actors that are governed in such a way that they enable productive entrepreneurship in a particular territory (Nicotra et al., 2018; Stam and Spigel, 2018; Stam, 2015). An ecosystem thus encompasses an interdependent set of actors and factors which can exist in different configurations. Entrepreneurial ecosystems enable productive entrepreneurship to emerge (Stam and Van de Ven, 2021; Leendertse et al., 2022) and can also moderate the effect of entrepreneurship on regional economic development (Audretsch and Belitski, 2021; Content et al., 2020; Szerb et al., 2019).

Adopting an entrepreneurial ecosystem approach holds the promise of facilitating the analysis of the strengths and weaknesses of economic systems at large, while taking into account the interdependencies between the elements of systems. To advance the academic debate and policy relevance of the entrepreneurial ecosystem approach, we test two rivalling causal logics that are currently dominant in the entrepreneurial ecosystem literature. The first *completeness* logic states that all relevant actors and factors (or elements) need to be present and the weakest link is the most important constraint (cf. Ács et al., 2014a). The second *substitutability* logic argues that elements are to some extent substitutable and hence there can be multiple configurations that lead to a high-performing entrepreneurial ecosystem (cf. Spigel, 2017).

This paper contributes to the literature by making a key step towards resolving this issue. We analyze entrepreneurial ecosystems of 273 regions across 28 countries in Europe with a harmonized dataset capturing all relevant entrepreneurial ecosystem elements and different measures of entrepreneurial outputs. The main question the paper addresses is: *Which entrepreneurial ecosystem configurations enable productive entrepreneurship?* The answer to this question reveals the importance of the two causal logics on entrepreneurial ecosystem performance: the completeness logic and the substitutability (or equifinality) logic. To measure the different elements that constitute an ecosystem, we build upon the entrepreneurial ecosystem framework of Stam and Van de Ven (2021). This framework integrates prior studies on the geography of entrepreneurship and economic growth and provides a complex systems approach to understanding the entrepreneurial economy (Stam and Van de Ven, 2021; Wurth et al., 2022).

To trace how the interdependencies between entrepreneurial ecosystem elements affect the levels of productive entrepreneurship in regions, we use Qualitative Comparative Analysis (QCA). QCA is a research method which explicitly allows for causal complexity and can be applied to derive configurations of elements that lead to a certain outcome (Schneider and Wagemann, 2012). The set-theoretic basis of this method means that elements are analyzed in groups (or configurations) instead of in isolation, thus taking into account the interaction between elements that is posited to be a key aspect of the entrepreneurial ecosystem concept (Stam and Spigel, 2018; Stam and Van de Ven, 2021). A few previous studies have applied this method to study entrepreneurial ecosystems (see e.g. Vedula and Fitza, 2019). We build on these studies by taking a broader view of the entrepreneurial ecosystem as proposed by Stam and Van de Ven (2021) and by considering cross-national variation with a sample of 273 regions across 28 European countries. Two separate analyses are performed to study differences in the configurations of high-performing ecosystems and very high-performing ecosystems, defined as regions being either in the top 25% or top 10% of entrepreneurship output in Europe. The performance of entrepreneurial ecosystems is measured with proxies for productive entrepreneurship (innovative startups and unicorn firms).

The findings indicate that different configurations of successful entrepreneurial ecosystems exist. High entrepreneurship outputs can be realized with a small variety of entrepreneurial ecosystem configurations. These varieties can be grouped into entrepreneurial ecosystems with strong human capital or knowledge combined with either strong leadership or strong formal institutions. When focusing on the highest levels of entrepreneurship output (top 10% of the regions), there is more convergence to a complete entrepreneurial ecosystem with all ecosystem elements strongly developed. However, also here we still find different

ecosystem configurations that produce strong entrepreneurial output while lacking strength in some of the elements. This finding is supported by the analysis of configurations of regions with unicorn firms. There is thus not one perfect configuration that all successful ecosystems exhibit. Nevertheless, the analysis of very high-performing ecosystems shows that just having a few ecosystem elements on a high level is not sufficient for becoming one of the top performing entrepreneurial regions in Europe.

The outline of the paper is as follows. First, the entrepreneurial ecosystem concept is introduced and the existing literature on entrepreneurial ecosystem configurations is shortly discussed. Second, the dataset used in this study is described and the QCA research method is discussed in more detail. Third, the main findings of the QCA are presented. Finally, in the last section the main findings are discussed, policy implications highlighted and some suggestions for further research are given.

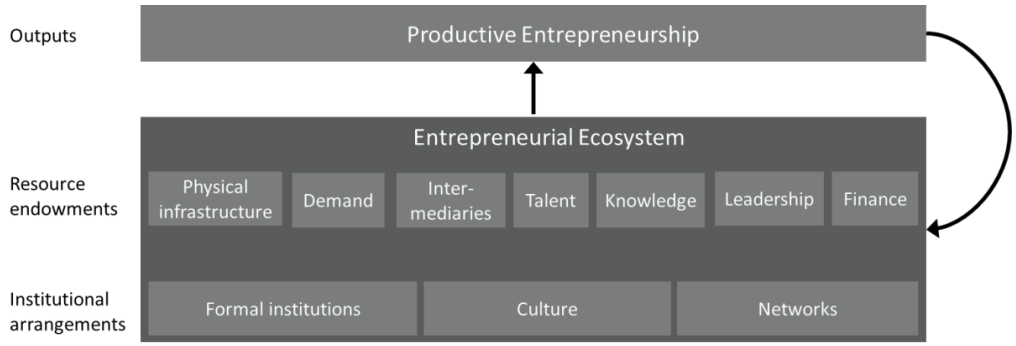
3.2 Literature

A recent attempt to explain the emergence and persistence of productive entrepreneurship is the development of the entrepreneurial ecosystem approach. The concept of entrepreneurial ecosystems has been known since the 2000s but has become increasingly popular in recent years (Acs et al., 2017; Cavallo et al., 2019; Malecki, 2018; Wurth et al., 2022). The definition of the entrepreneurial ecosystem used in this paper is the following: a set of interdependent factors and actors that are governed in such a way that they enable productive entrepreneurship in a particular territory (Stam and Spigel 2018; Stam 2015). Stam and Van de Ven (2021) visualize the entrepreneurial ecosystem framework with ten

different ecosystem elements, divided into resource endowments and institutional arrangements that enable productive entrepreneurship (see Figure 3.1).

Fig. 3.1

Elements and outputs of the entrepreneurial ecosystem (adapted from Stam and Van de Ven, 2021).



A distinctive characteristic of the entrepreneurial ecosystem concept is the systemic view it takes of entrepreneurship (Fredin and Lidén, 2020; Roundy et al., 2018). For example, it incorporates feedback effects that can be caused by phenomena such as entrepreneurial recycling (Mason and Harrison, 2006). Another systemic aspect is the interaction between elements; elements can reinforce each other or equally inhibit other elements to develop. Although the elements that make up the ecosystem have received a lot of research attention, relatively little is still known about how these elements interact (Alvedalen and Boschma, 2017). To advance our understanding of entrepreneurial economies it is essential to know how connections between elements are formed and develop over time, and what might be the impact on the performance of the ecosystem when one or several elements are underdeveloped. Currently, it is still quite common to give all elements an equal weight and assume these are equally important, however Corrente et al. (2019) show that this

assumption is not supported by empirical evidence in their sample of 24 European countries. Using expert evaluations of various ecosystem elements from the Global Entrepreneurship Monitor (GEM) database, they find that entrepreneurship culture, government programs to support businesses and market dynamism are the most important elements to explain differences in the number of high-growth startups.

There have been some attempts to take the interdependencies within an entrepreneurial ecosystem into account. One approach to do this is the penalty for bottleneck approach used by Ács et al. (2014a). They calculate an index to capture the quality of the entrepreneurial ecosystem at a national level (see Ács et al. (2014b) for a regional application). This index is composed of fourteen pillars which combine both individual level variables and institutional variables. The way they incorporate the interaction of elements in their index is by including a penalty for the weakest component. The penalty does not only depend on the score of the weakest component but also on the difference between the score of the weakest component and the scores of all the other components in the ecosystem. The assumption underlying this method is that components in an ecosystem are not substitutable and all components should reach a certain minimum value before an entrepreneurial ecosystem can be successful. The weakest link postulate does not deny partial substitutability amongst the different ecosystem components but holds that the elements should be balanced for efficient operation. This means that to achieve a high index score an ecosystem needs to have all elements at more or less the same level and above a minimum threshold. In fact, Ács et al. (2014a) thus implicitly assume that all these fourteen conditions are necessary for high levels of entrepreneurship and equally important; we refer to this as the *completeness* logic. It should be noted that whereas the completeness logic is a driving force behind this approach, the policy implications resulting from these analyses may still

differ widely for countries or regions, contingent on the strength of the elements and in particular the bottleneck element(s). This is indeed one of the main outcomes of Lafuente et al. (2022).

While Ács et al. (2014a) essentially propose the perfect entrepreneurial ecosystem to be one based on completeness, a qualitative case study by Spigel (2017) shows that entrepreneurial ecosystems can be successful with different types of configurations. According to Spigel (2017), depending on regional or even local idiosyncrasies, different elements may be more or less important to enable productive entrepreneurship. There is thus not necessarily one perfect entrepreneurial ecosystem, as the most productive configuration depends on specific local characteristics. Spigel (2017) compares the regions of Waterloo and Calgary in Canada to show two successful ecosystems with very different attributes. While Waterloo has very strong cultural, social and material attributes that are all densely connected, it misses a strong local market (corresponding to "Demand" in the Stam and Van de Ven (2021) framework). Calgary's ecosystem, on the other hand, mostly thrives on its strong local market, while it lacks strongly developed networks between entrepreneurs. Spigel (2017) thus proposes that different combinations of elements can be sufficient to enable high levels of technology entrepreneurship and that, for instance, one, two or three elements might be weak without incurring a high cost for entrepreneurial output; we refer to this as the *substitutability* logic. Hence, two logics – based on very distinct methodologies - present themselves when it comes to explaining and predicting the performance of entrepreneurial ecosystems: one that assumes that all elements need to be strongly present (completeness logic) and the weakest link is the most important constraint, and the other that argues that elements can be highly substitutable (substitutability logic) and there are different possible pathways to create a high-performing entrepreneurial ecosystem.

A research method well-suited to solve this debate is Qualitative Comparative Analysis (QCA) (Ragin and Rihoux, 2009). The QCA method is based on set theory and Boolean algebra, and specifically designed to look for different configurations that can produce a specific outcome, in this case productive entrepreneurship. It is particularly useful to study systems because it allows for causal complexity. QCA understands causality as configurational and identifies mechanisms rather than net effects, which answers how-questions better than statistical methods do (Rutten, 2019). Unlike results of conventional statistical methods, QCA results can exhibit multiple conjunctural causation, equifinality and causal asymmetry (Schneider and Wagemann, 2012). Multiple conjunctural causation means that several elements can combine to cause an outcome but may not produce it on its own. This takes into account how components within a system might interact to produce a certain outcome, referred to as interdependencies in the entrepreneurial ecosystem literature. Equifinality is based on the idea that there might be different 'paths' towards a final state, such as a successful ecosystem. So there can be more than one pathway (ecosystem configuration) to reach a certain outcome. Finally, causal asymmetry refers to the fact that the presence of an element or an outcome does not have to be the exact opposite of its absence. Although a bit abstract, this could mean in practice that when one has found a combination of elements (e.g., high levels of human capital and advanced physical infrastructure) that creates a successful ecosystem, it is not guaranteed that the exact opposite of this combination (low levels of human capital and very bad physical infrastructure) leads to a malfunctioning ecosystem. All these characteristics make QCA a very appropriate approach to study entrepreneurial ecosystems.

Recently, there has been some research that applied QCA to study entrepreneurial ecosystems. Vedula and Fitza (2019) study metropolitan areas in the US to find which

specific combinations of elements are needed to support early-stage startups and late-stage ventures. In their analysis they include five different ecosystem elements, corresponding to talent, knowledge, finance and culture in the Stam and Van de Ven (2021) framework. Even with this relatively low number of conditions, they find four configurations leading to early-stage startup success and even five configurations for late-stage ventures, with a key position for technical knowledge. Another study by Alves et al. (2021) looks at city ecosystems in the region of Sao Paulo in Brazil. This study considers a more extensive set of entrepreneurial ecosystem elements more similar to those used in our paper. However, the outcome they study is the success in getting support from a government program for innovative small enterprises, which is arguably not a direct measure of productive entrepreneurship. The authors find four different ecosystem configurations that lead to a large number of grants from the government. Muñoz, Kibler, Mandakovic, and Amorós (2020) study regional ecosystems in Chile with the use of Global Entrepreneurship Monitor data. They use evaluations of local experts to look at combinations of narrated attributes (in contrast to measured attributes) that enable entrepreneurship. While they find multiple combinations that result in high entrepreneurial activity, there are only two configurations leading to entrepreneurship with high growth ambitions which both include market dynamism as a key condition.

The results of these studies suggest that there are multiple recipes for a high-performing entrepreneurial ecosystem in these contexts, with some elements appearing as more critical in these configurations. A recent study by Lafuente et al. (2022) using a linear programming method to analyze country level data from the Global Entrepreneurship Index (GEI) also supports this idea by showing that the best way to improve an ecosystem differs by country and specifically that the importance of elements may differ. This suggests a compromise

between the two opposing logics from the literature discussed above; some ecosystem elements may be substitutable, but others are essential and need to be well developed. This paper aims at exploring the validity of such a compromise by revealing ecosystem configurations in a large and highly varied sample of successful entrepreneurial regions with a broad set of conditions covering the essential aspects of the entrepreneurial ecosystem. To obtain a detailed understanding of the mechanisms, different definitions of entrepreneurial outputs are used.

3.3 Data

3.3.1 Sample

The entrepreneurial ecosystem literature does not define clear boundaries of an ecosystem. As Malecki (2018) notes some plausible possibilities are to take an area with a 50km or 100km radius, as this would for example cover the area in which workers can commute. In most countries this would basically overlap with a region or a very big city. Such a regional level of analysis takes into account the local nature of entrepreneurship. The geographical unit in Europe that most closely resembles the regional demarcation just discussed is the NUTS 2 classification. NUTS 2 regions are defined based on existing administrative boundaries in a country and population size, which in a NUTS 2 region varies between 800,000 and 3 million people (European Commission, 2018). While within some countries better regional units may be available, it is important to choose a spatial unit that can reasonably and consistently be compared across different countries. Therefore, the NUTS 2 level is the best option given the current data availability.

Within Europe 281 NUTS 2 regions are defined within the 27 member states and the United Kingdom, of which 273 regions are used in this study.[17] Two inner London regions (UKI3 and UKI4) are merged because these are located next to each other and were not discerned in the firm data. The total sample thus consists of 272 observations across 28 countries, covering almost the whole population of interest. Since not all regions are of the same size, all variables are corrected for population size.

3.3.2 Conditions

The entrepreneurial ecosystem model of Stam and Van de Ven (2021) consists of ten elements. All of these elements are measured by statistical indicators, as shown in Table 3.1 and described in detail in Table II.A1 in the Appendix (see also Chapter 2 for a detailed description of the construction of the database). The measures are constructed by combining data from existing statistical sources and obtaining new data using web scraping techniques. Most measures of the entrepreneurial ecosystem data are based on indicators from very specialized datasets, such as the Quality of Government survey. Other elements are measured using specific indicators of more general datasets, to measure infrastructure we for example rely on the accessibility indicator from the Regional Competitiveness Index (Leendertse et al., 2022).

Several criteria were considered when creating measures for the entrepreneurial ecosystem elements. These were accuracy, credibility, and comparability of data sources (Leendertse

[17] For an overview of the NUTS 2 regions see https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:02003R1059-20180118&qid=1519136585935.
We omit FRY1-5, PT20, PT30, ES63, ES64, ES70 (overseas regions not located near Europe) and FI20 (due to missing data).

et al., 2022). In short, the indicator should accurately capture what we are trying to measure, be from a reliable data source and be available for all European regions. These criteria occasionally conflicted with each other as in some cases it was optimal to use multiple indicators from an accuracy perspective, but these were not available from reliable sources (credibility) or not available for all regions (comparability). In addition, our aim was to create a measure with the lowest number of indicators to prevent unnecessary complexity.

Several of these indicators combine a general measure, such as percentage of population that received tertiary education, with a measure that is entrepreneurship specific, such as entrepreneurial skills training. In addition, several times national and regional data are combined to create a more robust measure, although every element contains at least one regional level indicator. The data collection and choices regarding indicators are more extensively described in Chapter 2. Each element is treated as an input variable in the QCA, yielding a QCA with ten conditions (see Appendix II.B for a discussion of the methodological implications).

Most of the entrepreneurial ecosystem data we use is from the 2013-2018 period. Even though this means we only perform QCA for this specific period, available evidence suggests that these values only change slowly, and our findings are thus likely to be robust over a longer period of time. Several studies have reported a large persistence in entrepreneurial performance (Andersson and Koster, 2011; Fritsch and Wyrwich, 2014) and most ecosystem elements, such as institutions and education, are likely to change relatively little in the short run. Nevertheless, we acknowledge that by adopting a comparative static approach to the analysis of entrepreneurial ecosystems, we may miss out on intertemporal effects.

Table 3.1

Operationalization of the indicators of entrepreneurial ecosystem elements and output.

Elements	**Description**	**Empirical indicators**	**Data source**
Formal institutions	The rules of the game in society	Two composite indicators measuring the overall quality of government (consisting of scores for corruption, accountability, and impartiality) and the ease of doing business	Quality of Government Survey (QOG) and the World Bank Doing Business Report
Entrepreneurship culture	The degree to which entrepreneurship is valued in a region	A composite measure capturing the regional entrepreneurial culture, consisting of entrepreneurial motivation, cultural and social norms, importance to be innovative, and trust in others	Global Entrepreneurship Monitor (GEM) and European Social Survey (ESS)
Networks	The connectedness of businesses for new value creation	Percentage of SMEs that engage in innovative collaborations as a percentage of all SMEs in the business population	Regional Innovation Scoreboard (RIS)
Physical infrastructure	Transportation infrastructure and digital infrastructure	Four components in which the transportation infrastructure is measured as the accessibility by road, accessibility by railway and number of passenger flights and digital infrastructure is	Regional Competitiveness Index (RCI)

		measured by the percentage of households with access to internet	
Finance	The availability of venture capital and access to finance	Two components: The average amount of venture capital per capita and the percentage of SMEs that is credit constrained	Invest Europe and European Investment Bank (EIB)
Leadership	The presence of actors taking a leadership role in the ecosystem	The number of coordinators on H2020 innovation projects per capita	Community Research and Development Information Service (CORDIS)
Talent	The prevalence of individuals with high levels of human capital, both in terms of formal education and skills	Four components: The percentage of the population with tertiary education, the percentage of the working population engaged in lifelong learning, the percentage of the population with an entrepreneurship education, the percentage of the population with e-skills	Eurostat and the Global Entrepreneurship Monitor (GEM)
New knowledge	Investments in new knowledge	Intramural R&D expenditure as a percentage of Gross Regional Product	Eurostat
Demand	Potential market demand	Three components: disposable income per capita, potential market size	Regional Competitiveness Index (RCI)

		expressed in GRP, potential market size in population. All relative to EU average.	
Intermediate services	The supply and accessibility of intermediate business services	Two components: the percentage of employment in knowledge-intensive market services and the number of incubators/accelerators per capita	Eurostat and Crunchbase
Output	Entrepreneurial output	The number of Crunchbase firms founded in the past five years per capita	Crunchbase
	Unicorn output	The absolute number of unicorns in the region founded in the last ten years	CB Insights and Dealroom

3.3.3 Output

The output of entrepreneurial ecosystems is productive entrepreneurship. In this study we operationalize productive entrepreneurship with two measures: 31,236 innovative startups (registered in Crunchbase, less than 5 years old) and 49 unicorn firms (young private firms with a valuation of more than $1 billion, registered in CB Insights). While these proxies do not perfectly measure the productive entrepreneurship concept, we consider these the best measures currently available. It is also similar to measures used in previous studies which have tried to capture closely related concepts, such as Schumpeterian or high quality entrepreneurship (see Guzman and Stern 2020; Leppänen, McKenny, and Short 2019).

Data on innovative startups was scraped from Crunchbase, an online database that collects information on all promising new firms, mainly with the goal of informing potential

investors who pay to access the data. The data is collected from investors and a community of contributors, it is moreover checked with the use of artificial intelligence (Crunchbase, 2020). The investment data of Crunchbase (i.e., firm funding) has also been compared with other data sources, including OECD data, which shows very similar patterns and thus confirms its validity as a measure of innovative startups (Dalle et al., 2017). Crunchbase mainly includes companies which are venture capital oriented and it is difficult to conclusively confirm that it covers new firms equally across countries.[18] Nevertheless, it is currently the most comprehensive database for innovative startups and several studies have previously used Crunchbase to collect data on innovative companies (see e.g., Block et al., 2015). The firms in Crunchbase were matched to NUTS 2 regions with geocoding using the location of the company headquarters (Crunchbase, 2019). The analysis only includes firms founded in the last five years, covering 2015-2019, and corrects the number of firms for population size.[19]

Data on the presence of unicorn firms was also collected for all NUTS 2 regions. This was used as an alternative output measure. The results of the analysis with unicorn firms support the main findings and are reported in Appendix II.G.

[18] In Chapter 2 the Crunchbase data is compared with new firm data. The percentage of new firms included in Crunchbase ranges from 0.003% to 1.5% per region. These differences seem substantial but could very well correspond to a real difference in the percentage of new firms that aim for high growth.
[19] A similar exercise was done with data from Dealroom (Dealroom, 2021), this gave a similar number of innovative firms and a distribution across regions which was highly correlated (0.841) with the Crunchbase firm distribution (see Chapter 2).

3.4 Methodology

The research method used to explore the configurations of entrepreneurial ecosystems in Europe is Qualitative Comparative Analysis (QCA). As discussed in section 3.2, this method is well suited to capture the causal complexity inherent to entrepreneurial ecosystems. Performing a QCA involves various steps and decisions by the researcher which are described below (for a more detailed overview see Leppänen et al. 2019).

3.4.1 Calibration

As QCA is a set-theoretic method, it is based on analyzing the membership of cases in various conditions and the outcome (respectively the condition sets and outcome set). In this study, the conditions are the ten elements of the Stam and Van de Ven (2021) framework and the outcome is productive entrepreneurship. For each region one needs to assess whether it is a member of each of the conditions and the outcome, and to what degree. A fuzzy set QCA is applied to allow for differences in the degree of membership instead of using a dichotomy of 0 and 1 membership. To calibrate the membership scores, we used quartiles as thresholds (for a detailed explanation of the calibration see Appendix II.B). The analysis was done with the software R using the packages QCA (Dusa, 2019) and SetMethods (Oana et al., 2020). The R script is available upon request.

The aim of the QCA analysis is to find out what determines membership in the highest quartile of the distribution of Crunchbase firms. However, this outcome category is still quite broad (almost 70 regions) and is not limited to the absolute top performers among the European regions. Therefore, a second analysis is conducted with a different calibration of

membership in the outcome set. Specifically, the thresholds used are as follows: 50th percentile for exclusion, 75th for crossover and 90th for inclusion. This allows us to study the set of very high-performing ecosystems, as only regions with a number of Crunchbase firms in the top ten percent of the distribution in Europe are considered full members of the outcome set.

In summary, the main analysis consists of two parts. First, an analysis of the solutions for high levels of entrepreneurship output, defined as membership in the top 25% of Crunchbase firm output. Second, an analysis of the solutions for very high levels of entrepreneurship output, defined as being a member of the top 10% of the Crunchbase firm distribution.

3.4.2 Necessary and sufficient conditions

The main aim of QCA is to find necessary and sufficient relationships between the conditions and the outcome (Schneider and Wagemann, 2012). A *sufficient* relationship means that whenever the condition is present the outcome will also be present. In other words, the condition implies the outcome. A *necessary* relationship is the mirror image: whenever the outcome is present the condition will also be present, hence the outcome implies the condition. Finding sufficient conditions is often seen as the key part of the QCA and involves several steps. In the next section, the process of testing for sufficiency is described in more detail. The results of the necessary condition analysis are presented in Appendix II.C.

3.4.3 Solutions

With 10 conditions there are 1024 possible configurations (2^{10}), in which every configuration combines the presence and absence of conditions in a unique way.[20] The so-called truth table lists all these possible configurations and creates an overview of the regions that fit each particular configuration. For every region in a configuration the outcome is analyzed and if the presence of the outcome is consistent with at least 80% of the regions, the configuration is considered to be a sufficient condition for the outcome. This consistency threshold of 0.8 is the one that is commonly used in the literature (Schneider and Wagemann, 2012). We only consider configurations with at least four regions, as we are interested in studying general patterns. To make sure the results do not depend on the choice of these thresholds, a sensitivity analysis is conducted in which different threshold values are applied (see Appendix II.H). The truth tables showing all configurations with at least four regions are presented in the Appendix (Table II.D1 and II.D2).

The logical minimization of the truth table results in one or more solutions that are sufficient for the outcome. To summarize and present the solutions the format proposed by Fiss (2011) is employed, which distinguishes between core and peripheral conditions in a solution. Two parameters of fit are calculated, the consistency and coverage. The consistency measure was briefly mentioned before and captures how much of the cases actually exhibit a specific subset relation such as sufficiency. The coverage is a measure of how much of the outcome

[20] Based on our sample of 273 regions, only a small part of the possible configurations can be observed. This is known as limited diversity and further aggravated by the observation that elements tend to appear in certain patterns (Fiss, 2007). In other words, some combinations of elements may never be observed even in a very large sample. Since we are interested in understanding empirically relevant entrepreneurial ecosystems this does not pose a problem for our analysis.

is explained by a specific condition or solution. It thus conveys how many of the regions, which are members of the outcome set, are covered by that condition or solution. In addition to the consistency and coverage, the unique coverage can be calculated for each solution, which is the part of the outcome set covered by that particular solution while not being covered by any of the other solutions.

3.5 Results

3.5.1 Configurations for high levels of entrepreneurship output

Which entrepreneurial ecosystem configurations enable productive entrepreneurship? To answer this question, we empirically trace the importance of the two causal logics on entrepreneurial ecosystem performance: the completeness logic and the substitutability logic (equifinality). Table 3.2 summarizes the configurations sufficient for high levels of entrepreneurship output (top 25% innovative startup regions), according to the method proposed by Fiss (2011). There is both first order (across type) and second order (within type) equifinality (i.e., different possible paths to reach the outcome), as shown by the presence of two overall solutions and the different variations (also called neutral permutations) of these solutions. Solution 1a and 1b, and 2a and 2b are variations of the same type because the core conditions, indicated by the large circles, are the same. The high consistency scores and proportional reduction in inconsistency (PRI) show the strength of the evidence for the sufficient relation.[21] The high raw and unique coverage indicate that

[21] PRI measures to what extent the set X is a subset of the outcome set Y instead of the negated outcome set ~Y. When the PRI is low this indicates a simultaneous subset relation which implies a logical contradiction (Schneider and Wagemann, 2012).

the solutions are also empirically relevant and cover quite some part of the regions in the outcome set.

Table 3.2

Solutions for top 25% innovative startup regions

	Talent-Leadership	**Talent-Institutions**	**Knowledge-Leadership**	**Knowledge-Institutions**
	1a	1b	2a	2b
Formal institutions		●		●
Culture		●		●
Networks		●		●
Physical infrastructure			●	●
Finance		●		●
Leadership	●		●	
Talent	●	●		●
Knowledge			●	●
Demand	⊗	⊗	●	
Intermediate services		●	●	●
Consistency	0.899	0.924	0.938	0.948
PRI	0.854	0.880	0.922	0.930
Raw coverage	0.290	0.180	0.394	0.285

Unique coverage	0.124	0.025	0.150	0.027
Number of regions	12	12	35	29
Overall solution consistency	0.904			
Overall solution coverage	0.648			

Notes: Black circles are present conditions (●)*, white circles with a cross are absent conditions* (⊗)*. Large circles indicate core conditions and small circles peripheral conditions. The absence of a circle indicates indifference for that condition. Solutions are grouped by their core conditions. All parameters are calculated with the intermediate solution term.*

The membership of specific regions in each configuration is plotted on a map in Figure 3.2 (on page 104), note that this map only includes those regions that fit one of the configurations. Regions that have high entrepreneurship output and a different combination of ecosystem elements are not shown (e.g., Catalonia in Spain). For an overview of all regions with high entrepreneurship output and their membership in configurations, see Table II.E1 in the Appendix. Since there are several regions with high membership in most or even all ecosystem elements, there are various regions which are a member of multiple configurations. Especially the regions in different variations of the same solution (1a & 1b, 2a & 2b) overlap to some extent.

When studying the elements which constitute the different configurations, one can identify four types of entrepreneurial ecosystems grouped in two main solutions. These four types can be identified based on their main driver – Talent for the first solution, and Knowledge (new knowledge production and intermediate (knowledge-intensive) services) for the

second – and whether they depend on Leadership or Institutions (formal institutions, culture and networks combined).

Talent and knowledge are important drivers of entrepreneurship since new knowledge can be a source of entrepreneurial opportunities only to be recognized by individuals with the required human capital (Qian et al., 2013). Perhaps surprisingly knowledge and talent are not observed together in most of the configurations, even though some research suggests they are complementary (e.g., Abel and Deitz 2012). This could be related to the relatively free flow of knowledge, which would mean that knowledge is less place bound than some of the other ecosystem elements and regions can benefit from knowledge produced elsewhere. The absence of talent in the knowledge-leadership configuration is similarly somewhat counterintuitive. However, the combination of high knowledge production and strong knowledge-intensive business services might mean that entrepreneurs in these ecosystems outsource tasks which require high levels of human capital to a few specialized firms.

Strongly developed institutions are not required in all configurations, seemingly contradicting the work of Baumol (1990) and the economic growth literature (e.g., Acemoglu et al., 2005). However, it is important to realize that European institutions are quite well developed in general and a region scoring below the European median might still possess the minimum level of institutions (e.g., basic property right protection) needed for productive entrepreneurship. Interestingly, in the configurations lacking the presence of strong institutional arrangements a high level of leadership is required, suggesting that strong leadership seems to substitute to some degree for institutions (cf., Porras-Paez and Schmutzler, 2019).

The first configuration, the Talent-Leadership ecosystem, is based on the presence of talent and the absence of demand, combined with strong leadership. Figure 3.2 shows that regions in this configuration are located a bit more in the periphery, such as Scotland and northern Finland. This explains why market demand in these regions is relatively low. While not having a very strong regional market, all of these regions do have a well-educated labor force. Estonia as well as Finnish and Danish regions are members of this configuration, which matches well with their outstanding education system. The lack of regional demand is thus compensated by a well-developed human capital base combined with strong leadership.

The second configuration, Talent-Institutions, is quite similar but combines strong talent with well-developed institutional arrangements, finance and intermediate services. The regions in this configuration are all located in the northern part of Europe and include northern Sweden and south-west England. These regions lack a strong regional market but have a lot of the other elements of a strong ecosystem which enable entrepreneurship. Businesses in these regions are likely to focus on producing for the global market or neighboring regions.

The third configuration, Knowledge-Leadership, shows an ecosystem based on knowledge, demand and intermediate services combined with good infrastructure and leadership. The key distinction with the other configurations is the presence of high demand in the region. Many of the regions in this configuration are metropolitan areas that are well-known innovation hotspots, including London, Edinburgh, Paris, Stockholm, Helsinki and Hamburg.

Most elements are present in the fourth configuration, Knowledge-Institutions, with knowledge and intermediate services as core conditions. This is the only configuration in which demand does not have to be present or absent. The Knowledge-Institutions ecosystem configuration is the most well-rounded, with both strong institutional arrangements and resource endowments. Nevertheless, not all ten elements need to be present in order for a region to be a member of this configuration. Members of this configuration include many capital cities and regions bordering capital cities, such as southern England and the Greater Amsterdam region. Most of the regions in this configuration are also part of the Knowledge-Leadership configuration, as evidenced by the low unique coverage.

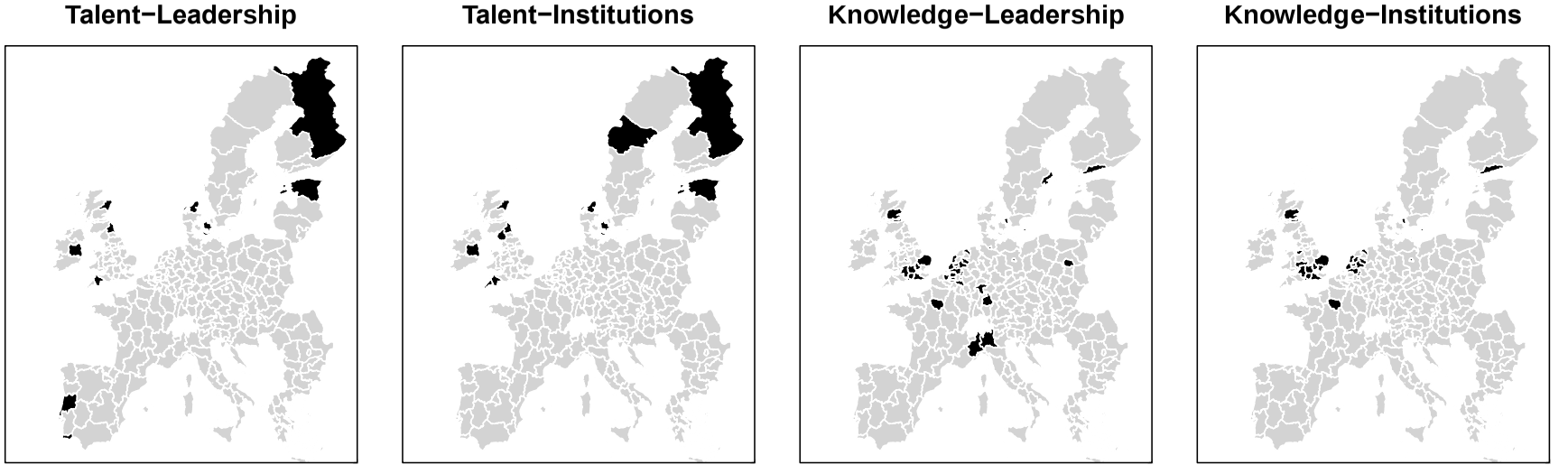
When analyzing some of the main characteristics of the regions in the different configurations a few things are remarkable (see Tables II.F1-F4 in the Appendix). The regions in the Talent-Institutions configurations have the smallest population and lowest population density, followed by the regions in the Talent-Leadership configuration. Both of these also show a GDP per capita which is close to the European average. The regions in the knowledge-driven configurations are on the other hand very densely populated, confirming the observation that these regions are often more urban areas. In addition, the GDP per capita in these regions is a lot higher than the European average.

The values for overall solution consistency (0.904 with a common threshold value of 0.8) and solution coverage (almost 65% of cases are explained) are high, showcasing the strength of the model. The four different configurations thus provide empirical support for the presence of different configurations of successful entrepreneurial ecosystems in Europe. These configurations are all sufficient for entrepreneurship output in the top 25% of Europe, showing that it is possible to have a well-functioning ecosystem without high performance

on all ten elements. The explicit absence of demand in the two Talent configurations even seems to directly contradict completeness logic underlying the 'penalty for bottleneck' technique in Ács et al., 2014a. One might argue though that the group of high-performing ecosystems included in this analysis is too broad and that we can only learn from the exceptionally successful ecosystems, which is what we turn to next.

Fig. 3.2

Map of high-performing entrepreneurial ecosystem configurations in Europe.



Notes: Regions in black are member of a particular configuration and member of the outcome set (top 25% innovative startup regions).

3.5.2 Configurations for very high entrepreneurship output levels

Table 3.3 shows the configurations that are sufficient for very high entrepreneurial performance measured as having a number of Crunchbase firms among the top ten percent in Europe. There is only one sufficient configuration with all elements present and most of these elements are core conditions. This can thus be characterized as a complete ecosystem. However, the frequency threshold of four regions is quite high, because the number of regions in the outcome set is now lower (28 regions) with this more restrictive definition of success. When studying the truth table (Table II.D2) it becomes clear that only one configuration passes this frequency threshold. When this threshold is lowered to for example three or two cases, more variety becomes visible as there are several other configurations which consistently show the outcome. Table II.H1 in the Appendix shows the solutions for the analysis with a frequency threshold of three.

Table 3.3

Solutions for top 10% innovative startup regions

	Complete
	1
Formal institutions	●
Culture	●
Networks	●
Physical infrastructure	●
Finance	●
Leadership	●
Talent	●
Knowledge	●
Demand	●
Intermediate services	●
Consistency	0.819
PRI	0.687
Raw coverage	0.347
Unique coverage	0.347
Number of regions	22
Overall solution consistency	0.819
Overall solution coverage	0.347

See notes on next page.

Notes: Black circles are present conditions (●), white circles with a cross are absent conditions (⊗). Large circles indicate core conditions and small circles peripheral conditions. The absence of a circle indicates indifference for that condition. Solutions are grouped by their core conditions. All parameters are calculated with the intermediate solution term.

While the solution consistency is still above the commonly used threshold of 0.8 (Schneider and Wagemann, 2012), it is lower than the solution consistency for top 25% Crunchbase firms. The PRI takes on a value around 0.7, which is again somewhat lower but still acceptable. The cause of this lower PRI is that some regions that are a member of this configuration are not a member of the outcome set (while they were before with the lower threshold). However, there is still convincing evidence that the set of members of configuration 1 is a non-simultaneous subset of regions in the top 10% of Crunchbase firms. The relatively low coverage indicates that this configuration only explains part of the outcome set, again indicating that there are various regions in the top 10% that do not fit this configuration.

The regions which are a member of the complete configuration are a subset of the regions in the Knowledge ecosystem configuration (2a & 2b) of the analysis of top 25% Crunchbase firms. The group of regions in the configurations lacking demand thus completely disappeared. This indicates that while it is possible to become quite successful with several elements lacking, it is very hard to get to the top of entrepreneurial ecosystems in Europe. However, the truth tables with lower frequency thresholds (available upon request) reveal that some regions are able to become part of this group with a few elements underdeveloped. Thus, while a strong complete ecosystem is the most common way to entrepreneurial success, it is not an absolute requirement and there are examples of several exceptions.

3.6 Conclusions

This study analyzed the interdependence of entrepreneurial ecosystem elements in configurations of high-performing entrepreneurial ecosystems, answering the question of how entrepreneurial ecosystem elements combine to enable high levels of productive entrepreneurship. These analyses provided a test of two distinct causal logics on entrepreneurial ecosystem success: the completeness entrepreneurial ecosystem logic and the substitutability entrepreneurial ecosystem logic, suggesting that there are multiple configurations that lead to entrepreneurial ecosystem success. To perform this test a large dataset was used covering all ten elements of the Stam and Van de Ven (2021) framework and several entrepreneurship output measures. Regions in all European countries were included in the sample to provide a large amount of variation in entrepreneurial ecosystem elements, both within and across countries. QCA was applied because this method specifically allows for interactions between elements (multiple conjunctural causation) and multiple pathways (in this case configurations) to reach the same outcome (equifinality).

The results of the QCA indicated that there are different types of successful entrepreneurial ecosystems in Europe. There were four different configurations for high levels of entrepreneurship output: two of these were based on strong talent combined with either strong leadership or institutions, the other two configurations combined strong knowledge and intermediate services with either leadership or institutions. When looking at the absolute top performing ecosystems in Europe, the results indicated only one sufficient configuration, with all elements strongly developed. However, additional analyses showed there were several regions in this exclusive group that managed without having one or two elements at a high level. The analysis using unicorn firms supported this finding. There is

thus not one perfect configuration that all successful entrepreneurial ecosystems exhibit, instead several entrepreneurial economies find a way to function without all entrepreneurial ecosystem elements at a high level.

Our findings support a more nuanced understanding of entrepreneurial ecosystems and propose a combination of the completeness logic and the substitutability (or equifinality) logic. The assumption that all elements are equally important and need to be present for any amount of entrepreneurial success was not strongly supported by the empirical evidence, although it was applicable to some extent for regions with the highest levels of entrepreneurial output. While the results of the QCA for the top 25% regions correspond with previous studies (Alves et al., 2021; Muñoz et al., 2020; Vedula and Fitza, 2019) finding multiple configurations that enable entrepreneurship (substitutability logic), we find evidence that the highest performing entrepreneurial ecosystems need to be quite well-rounded (completeness logic).

3.6.1 Future research

Future research can improve on this study by creating or integrating more regional data. The drawback of doing regional analyses is the constraints it poses on data availability. For most measures this could be solved by combining multiple indicators or data sources, but sometimes national data had to be combined with regional data. This reduces the variability in the data and could hide some important patterns. Another possible concern is the choice of indicators for the ecosystem elements and if these indicators correctly capture the elements. Future research can improve the measurement of indicators for several elements, especially leadership and networks. Leadership is measured in this study with the

prevalence of coordinators of Horizon 2020 projects, which are EU-funded public-private partnerships for innovation projects. While this might be a good measure of leadership of collective action for knowledge and innovation, it might not be a perfect measure of the leadership of an entrepreneurial ecosystem. Feldman and Zoller (2012) argue that leadership is provided by what they call dealmakers; experienced entrepreneurial actors who link other actors in an ecosystem and define entrepreneurial networks. Others emphasize place-based leadership for realizing collective action in and for the region (Stam, 2020). To measure this, one would however have to collect network data in every regional ecosystem.

An entrepreneurial ecosystem is not a closed system, and future research should also take into account inter-ecosystem linkages. One example is the possible spillover effect of neighboring regions. Entrepreneurs living close to regions with highly developed entrepreneurial ecosystems might benefit from these (Pijnenburg and Kholodilin, 2014), which is also known as the borrowed size effect (Phelps et al., 2001). For example, entrepreneurs might be able to use intermediate services and venture capital from an adjacent region. In the current analysis there were no strong indications of this, for example, it was not the case that all talent-based ecosystems are clearly clustered around a big city. However, it would be relevant to formally analyze the possibility that regions may benefit from well-developed ecosystem elements in neighboring regions, as this could explain why regions are able to function well without having some elements on a very high level themselves. In contrast, better developed neighboring or well-connected entrepreneurial ecosystems can also lure entrepreneurial talent away, and this may lead to relatively low levels of entrepreneurship output in the region of origin (Mazzoni et al., 2022). The entrepreneurial ecosystem approach emphasizes intra-ecosystem connections (e.g. within entrepreneurial communities: Feld & Hathaway 2020), but should also take into account

inter-ecosystem connections. Inter-ecosystem linkages over longer distances ('pipelines') enable long-distance flows of knowledge, talent and capital that might explain the accumulation of these resources in a few places globally. This also necessitates more network data, and better ways to analyze this to uncover the effects on entrepreneurship outputs, and to inform policy interventions.

To better understand the functioning of the different types of ecosystems the QCA identified, it would be useful to perform in-depth case studies and compare regions in different ecosystem categories. The results of this study can be used to systematically select case studies and learn from those that confirm or contradict the current theory. As all elements of the framework are deemed to be important for entrepreneurship, we could learn from analyzing regions which seem to be able to function without some of them and investigate potential substitution effects. For example, our results suggest that strong formal institutions is not a necessary condition for high entrepreneurship output and is not required in some of the configurations. Strong social norms or leadership may be able to substitute for well-developed formal institutions. In a similar vein, regions capitalizing on the global economy may demonstrate high levels of entrepreneurial performance in a region without strong regional demand. Results of such studies could help to finetune the current theory of which elements are necessary for an entrepreneurial ecosystem and which elements may be helpful but less essential.

Finally, our comparative static approach to the analysis of entrepreneurial ecosystems also helps to pave the way for more dynamic approaches. Now that we observe initial evidence for multiple pathways in a cross-national setting, more longitudinal data collection would be needed to better explore changes over time and dynamic interplays between for example

neighboring regions and cross-border collaborations. This may be achieved by more traditional dynamic panel data techniques allowing for spatial autocorrelation, or by analyzing specific targeted entrepreneurial ecosystem transitions over time. This allows us to trace the paths of entrepreneurial ecosystem development: how evolution from one configuration to another takes place, and virtuous and vicious cycles of development.

3.6.2 Policy implications

Our findings stress the need to adapt policy to local circumstances and encourages a holistic approach to entrepreneurship policy. The findings of the study showed that different types of ecosystems may co-exist and that having all elements on a high level is not a precondition for high levels of productive entrepreneurship. This is good news for regions which lack elements that are particularly hard to change, such as institutions or local demand. Nevertheless, the analysis of very high-performing ecosystems indicated that almost all ecosystem elements need to be strongly developed to enable extremely high entrepreneurship output. Therefore, a holistic view is warranted to stimulate regional entrepreneurship, as developing only a few elements of the entrepreneurial ecosystem is unlikely to enable great entrepreneurial success.

Our analyses imply that there are multiple configurations to achieve high entrepreneurial output levels. This suggests that policies for improving entrepreneurial ecosystems should start with a diagnosis of the current strengths and especially weaknesses of the entrepreneurial ecosystem, benchmarking themselves to comparable regions (cf. Rodrik 2010). It is important to use the entrepreneurial ecosystem framework to create tailor-made context-specific policies, instead of implementing a fashionable policy, to improve the

regional entrepreneurial ecosystem. Using the entrepreneurial ecosystem approach along these lines can help every region to build a stronger entrepreneurial economy.

Chapter 4

The impact of growth: Stakeholder value creation by high-growth firms

Written together with Jan Jacob Vogelaar

This chapter is currently being prepared for submission to Small Business Economics.

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4.1 Introduction

Over the past decades, we have witnessed how the focus of policymakers has shifted from entrepreneurship in general to growth-oriented entrepreneurship. Policymakers have been particularly interested in high-growth firms[22] (Coad et al., 2022; Mason & Brown, 2013): a relatively small group of firms found to contribute extraordinarily to employment and economic growth (Haltiwanger et al., 2017; Henrekson & Johansson, 2010). Putting high-growth firms at the center of policy attention is, however, not without controversy.

Scholars have questioned the mere focus on growth, arguing that high-growth firms are extreme cases (Aldrich & Ruef, 2018; Kuckertz et al., 2023; Kuratko & Audretsch, 2022) and stressing that scholarly efforts should instead be redirected to understanding the ordinary aspects of entrepreneurship (Aldrich & Ruef, 2018). More fundamentally, an emphasis on growth oriented entrepreneurship has been criticized for being non-inclusive in terms of value creation (Breznitz, 2021; Kim & Kim, 2022; Kuckertz et al., 2023). Kuckertz et al. (2023) for instance argue that the excessive valuation of unicorns (extreme cases of high-growth entrepreneurship) is no evidence of the value those firms create for society at large. Breznitz (2021) discusses how dedicated government efforts transformed the lagging economy of Israel in the 1960s into one of the most innovative ones worldwide in the 1990s but the high rates of growth-oriented, mostly venture capital backed, companies resulted in a staggering increase in inequality.

Such fundamental critiques invoke questions about the desirable 'directions' and 'types' of entrepreneurship (Baumol, 1990; Mazzucato, 2018) and how high-growth firms fit this

[22] High-growth firms are usually defined as firms with at least 10 employees that grow at least 20% in revenues or number of employees for at least three consecutive years (OECD, 2008a).

paradigm (Shepherd & Patzelt, 2022). While there are various studies on the societal role of (large-sized) corporations (e.g. Carroll, 1999) and social and sustainable enterprises, including 'B corps' (e.g. Hockerts & Wüstenhagen, 2010; Saebi et al., 2018; Stubbs, 2017; Zahra et al., 2009), few studies have empirically investigated how (often still medium-sized) high-growth firms create or destroy value beyond financial value (Neumann, 2021). This is surprising, because despite the founded critiques, high-growth firms are likely to become the incumbents of the future. From this perspective, high-growth firms can be considered potential 'agents of change' that shape the future business environment and even society.

This paper aims to address this gap, by exploring how high-growth firms create value for their stakeholders. While utility derived from the consumption of products and services is traditionally considered a central value creation mechanism for firms, this paper concentrates on the broader concept of stakeholder value creation. We adopt a micro-level perspective to study mechanisms through which high-growth firms create or destroy value for their stakeholders. We ground our study in the broader literature on corporate social responsibility and conceptualize value along the lines of Ali and Cottle's (2021) stakeholder capability framework, combining insights from stakeholder theory (Freeman, 1984) and the capability approach (Robeyns, 2005; Sen, 1999). Our research question is twofold: through which mechanisms do high-growth firms create and destroy value for their stakeholders and what role does firm growth play in this process? Explicating the context of growth is particularly relevant as high-growth firms find themselves in a dynamic phase where they frequently need to make strategic decisions (Coad et al., 2014). As a consequence of the high-growth, micro-level stakeholder effects may be more pronounced. Moreover, some scholars suggest that rapid scaling may come at a cost (Kuckertz et al., 2023; Srikanth et

al., 2021), while the benefits are likely to be concentrated in the hands of owners and other shareholders (Shepherd & Patzelt, 2022).

To answer our research question, we conducted semi-structured interviews with 23 CEOs and founders of high-growth firms in the Netherlands. These elite interviews provide unique insights into the choices decision makers within high-growth firms face and how, from their perspective, high-growth firms create and destroy value for their stakeholders. This was guided by the idea that it is necessary to first provide an overview of mechanisms, before investigating these more in-depth. We expected founders and CEOs to be best able to reflect on relationships with a wide variety of stakeholders.

Our analysis reveals the multifaceted nature of the relationship between high-growth firms and their stakeholders. While high-growth firms create value by expanding the capability sets of their stakeholders, our research shows that not all effects are positive. The rapid growth within these firms causes some unique mechanisms to emerge and can amplify more general positive and negative effects on stakeholders. We find that the value creation mechanisms of firms can be traced back to certain firm attributes, most importantly the firm's mission and the interconnected motivation for growth. Building on this notion, we propose three types of high-growth firms: profit-driven high-growth firms, conscious high-growth firms and mission-driven high-growth firms.

We conclude by discussing the implications of our findings for theory and practice. Building on the finding that growth, if directed well, can amplify social value creation, we posit that despite founded critiques high-growth firms remain relevant study objects. More specifically, we argue that mission-driven and conscious high-growth firms may be well

positioned to counter some of the critiques that high-growth firms are non-inclusive in terms of value creation. For policymakers our findings raise the question whether a generic approach aimed to foster high-growth entrepreneurship is still appropriate when creating social value is the goal of entrepreneurship policy. As our empirically derived typology illustrates, some high-growth firms may fit this social value perspective better than others. The typology might provide cues for governments that aim to invest in entrepreneurship for economic and social returns.

4.2 Theoretical background

Contrasting Friedman's (1970) argument that the social responsibility of business is to increase its profits, scholars increasingly question the predominant focus of the entrepreneurship and management literature on financial value creation (e.g. Kuckertz et al., 2023). Following this shift, management and entrepreneurship scholars have theorized about practices that balance social and financial value creation (e.g. Aronson & Henriques, 2022; Carroll, 1999; Freeman et al., 2007; Porter & Kramer, 2011; Saebi et al., 2018). In the following, some of the main concepts related to social value creation by firms and entrepreneurs are discussed and summarized in Table 4.1. As other scholars have emphasized (Alter, 2007; Austin et al., 2006; Zahra et al., 2009), note that such conceptualizations should not be considered strictly separate but considered a continuum. Table 4.1 shows that the existing literature has paid relatively little attention to firm growth. The second part of this section discusses how social value in this paper is understood along the lines of the capability approach.

Table 4.1

A hybrid spectrum of conceptualizations of social value creation by firms (adapted from Alter, 2007).

	Social enterprise	**Business practicing CSV**	**Business practicing CSR**	**For-profit firm**
Dominant motive	Mission	Shared value	Profits	Profits
Main stakeholder	Beneficiaries	Combination	Shareholder	Shareholder
Role of firm growth in literature	Mostly concerned with scaling impact, less attention for firm growth	Mostly concerned with incumbents, little attention for firm growth	Mostly concerned with incumbents, little attention for firm growth	Firm growth as a means to increase profits
Type of value created	Hybrid: profits as means to achieve mission	Hybrid: social and financial value are aligned	Hybrid: financial value, complemented with social value programs	Financial value
Key references	Austin et al. (2006), Santos (2012), Zahra et al. (2009)	Porter and Kramer (2011)	Carroll (1999)	Friedman (1970)

4.2.1 Firm practices aimed at social value creation

Corporate social responsibility (CSR) efforts, defined as *"policies and practices of corporations that reflect business responsibility for some of the wider societal good"* (Matten & Moon, 2008, p. 405), are perhaps one of the most noticeable practices of firms aimed at social value creation. The growing attention for CSR in practice and research,

which is hitherto mostly concerned with large incumbent firms (Vázquez-Carrasco & López-Pérez, 2013), reflects the idea that firms are embedded in society, implying that the decisions of firms matter for societal wellbeing (Carroll, 1999). While a lot of firms have adopted CSR policies, research has also shown that CSR comes in many forms ranging from 'do-good-policies' to 'do-no-harm-policies' (Crilly et al., 2016). Consequently, scholars have questioned the genuineness of CSR efforts (Banerjee, 2008) and suggested they are merely meant to improve the reputation of firms (Porter & Kramer, 2011). Moreover, scholars have argued that CSR efforts are too often unaligned with the real interests and prevailing business practices of firms and hence hard to maintain in the long run (Porter & Kramer, 2011; Yuan et al., 2011).

In response to these critiques, Porter and Kramer (2011) coined the concept of creating shared value (CSV), proposing that financial and social value creation can be aligned. While adopting firm practices that benefit stakeholders (instead of only shareholders) may be part of CSR as well, the notion of shared value is different in some respects. Most importantly, Porter and Kramer (2011) argue that CSV should be the raison d'être of the firm (Latapí Agudelo et al., 2019) and, if done well, can result in both social value creation for stakeholders and a competitive advantage.

The CSV literature builds on the insights of stakeholder theory (Strand & Freeman, 2015; Freeman, 1984), which tries to generate a more comprehensive picture of all actors involved with a firm and how a firm generates value for them (Busch et al., 2018). Stakeholders that are traditionally considered are employees, customers, investors, business partners and community members (Schaltegger et al., 2019), but in line with a sustainability outlook scholars have argued for considering future generations as well (Busch et al., 2018).

Stakeholder theory states that separating the business sphere from the ethics sphere is both undesirable and unrealistic because firm decisions have implications beyond the firm itself. Furthermore, the narrative of competition and winning, which is closely tied to narrow approaches to capitalism, is deemed unrealistic in practice: *"Not every interaction is a zero-sum game and not every interaction has a win-win solution. We should do our best to look for the win-win before jumping to other sub-optimal solutions."* (Freeman et al., 2007, p. 312). Instead of prioritizing one stakeholder over other stakeholders or trading off stakeholder interests, firms should look for possibilities of joint value creation (Freeman, 2010).

While adopting a stakeholder lens may be helpful in optimizing value creation by firms, it should be acknowledged that identification and consultation of stakeholders in firm decisions does not automatically translate into a positive impact on those stakeholders (Banerjee, 2008). Arguably, Porter and Kramer's (2011) shared value approach eludes this critique by emphasizing the mutual interests between firms and their stakeholders. While theoretically appealing, the promises of the shared value approach are not without controversy. For example, there is limited empirical evidence for the effectiveness of the shared value approach (Aronson & Henriques, 2022; Dembek et al., 2016) and, relatedly, scholars have argued that the concept fails in dealing with the real-world trade-offs firms face between financial and social value (Crane et al., 2014).

The growing literatures on social and sustainable entrepreneurship (e.g. Austin et al., 2006; Hockerts & Wüstenhagen, 2010; Saebi et al., 2018; Zahra et al., 2009) shed light on these real-world trade-offs. Social entrepreneurs have the explicit goal 'to do good' (Saebi et al., 2018) and consider financial profits a means to a social end. The pursuit of both social and

financial objectives sets these subclasses of entrepreneurship apart from conventional profit-oriented entrepreneurs (Austin et al., 2006). In contrast to the CSV literature, the literature on social entrepreneurship has documented well how this 'hybrid nature' in practice comes with continuous challenges to balance those, sometimes competing, objectives (Doherty et al., 2014; Ebrahim et al., 2014; Saebi et al., 2018). While the relationship between commercial entrepreneurship and social value is little researched (Neumann, 2021), social entrepreneurship research provides insight into the mechanisms through which entrepreneurs with the intention to 'do good', and their communities (Montgomery et al., 2012), create value for society (Ebrahim et al., 2014).

Among other things, social entrepreneurship can address social problems in a financially sustainable way and foster industrial change by challenging status-quo-practices (Hockerts & Wüstenhagen, 2010). Several types of social entrepreneurship can be distinguished. Typologies have been proposed based on the type of opportunities the entrepreneur exploits or the mission and activities of the firm. Zahra et al. (2009) have developed a typology of social entrepreneurs based on how they identify opportunities and act on them. These opportunities can range from rather local to large scale opportunities that have potential to alter the social system (Zahra et al., 2009). Alter (2007) on the other hand focuses on the mission of the firm, which can be oriented towards financial value creation or social value creation but may also be somewhere in between as exemplified by Table 4.1. Alter (2007) further extends this typology by looking at whether the activities of the firm are integrated with the mission or are external to the mission and serve merely to create the financial means to achieve the social mission.

Compared to the commercial entrepreneurship literature (Bosma & Stam, 2012; Henrekson & Johansson, 2010; Stam et al., 2009), firm growth has received less attention in the social entrepreneurship literature (Shepherd & Patzelt, 2022). A large body of social entrepreneurship research is concerned with what Zahra et al. (2009) have labeled 'social bricoleurs': small social enterprises, started with a social mission that is specific to the local context, that, in the end, often remain small. Scaling impact, in contrast, has received a lot of scholarly attention. Firm growth is however not considered a necessity to scale impact and may, in fact, have negative repercussions for the social impact of the social enterprise (Austin et al., 2006). Yet, scholars do recognize that in certain instances firm growth can be beneficial to optimize the social impact of the venture. A valuable perspective in this respect is provided by Hockertz and Wüstenhagen (2010) who theorize about 'high-growth Davids': entrepreneurs who combine an explicit aim to create social or environmental value with the ambition to grow and gain significant market share.

4.2.2 Operationalization of social value

As pointed out by Ranville and Barros (2022), in studies on the relationship between firms and social value creation it often remains implicit what is considered social value. This is problematic as: *"(…) 'social' is a value-loaded concept."* (Ranville & Barros, 2022, p. 407). Put differently, social value implies some underlying normative theory on what can be considered beneficial for stakeholders or society in general. To define social value we build on the capability theory, which can be placed in the liberal egalitarianism tradition (Ranville & Barros, 2022). The capability theory was developed by Sen (1999) and later operationalized to measure societal progress in the influential Stiglitz, Sen and Fitoussi report (2009).

Essentially, the capability approach is about the extent to which people have the ability to live a life they deem worth living (Robeyns, 2005). The capability approach distinguishes between what people can do (capabilities) and what they actually do (functionings) (Robeyns, 2017). A functioning is a doing or being, where a doing refers to an activity undertaken by an individual and a being to a certain state of an individual. Getting an education or travelling are examples of doings, while examples of beings are being healthy or having shelter. A capability is a person's freedom to achieve a functioning. For example, whether people can be employed if desired. Thus, according to Sen (1999), wellbeing is not simply a sum of objective opportunities. Rather, what matters is how these opportunities can or cannot be utilized in line with the subjective preferences of individuals.

To apply the capability theory to value creation by firms, it is useful to think through the lens of stakeholder capabilities proposed by Ali and Cottle (2021). In this approach, value created by firms is measured through the enhancement or degradation of the capabilities of stakeholders of the firm. Examples include possibilities for personal development offered to employees or pollution of the living environment of the surrounding community. The stakeholder capability framework provides a lens to view how firms create and destroy value for their stakeholders. Building on the influential Human Development Index and earlier work of Nussbaum (2003) among others, Ali and Cottle (2021) identify five dimensions of capabilities that entrepreneurship can shape: economic (related to earning, saving and spending money), psychological (related to feeling satisfied and being at peace), social (related to associating and connecting with others), intellectual (related to acquiring new knowledge and skills) and physiological (related to having a sound health and bodily integrity). As can be gauged from this description, the borders between the different dimensions are diffuse. We utilize the concept of stakeholder capabilities to understand

through which mechanisms high-growth firms create value by expanding or degrading the capability sets of stakeholders. In line with Ali and Cottle's approach (2021), our analysis concentrates on stakeholder groups instead of individuals.

4.3 Methodology

4.3.1 Sample and data collection

To explore through which mechanisms high-growth firms create value for their stakeholders, we conducted interviews with founders and CEOs of high-growth firms. Our sample consisted of 23 high-growth firms[23] in the Netherlands selected from a list of the 250 fastest growing firms in the Netherlands.[24,25] The sample was limited to Dutch firms to assure similar contextual conditions for all firms. In the Netherlands, policies and regulations affecting entrepreneurship are mostly determined at the national level.

In line with the finding that high-growth firms come in all shapes and sizes (Coad et al., 2014; Henrekson & Johansson, 2010), purposeful sampling was employed to get a varied sample in terms of sector, age, and location of the firm (see Table 4.2).[26] While the sizes of the firms differed markedly, none of the firms can be considered a big company (>500 employees) and none of them were publicly listed. As our research aim was to understand

[23] One of the firms we interviewed was dropped from the sample because during the interview it became clear the firm did not fit our definition of a high-growth firm.
[24] This list is compiled on an annual basis by the Erasmus Centre for Entrepreneurship (2021). For this study, we used the 2021 annual report on the 250 fastest growing firms in the Netherlands.
[25] Using this list as a sampling frame means we only sample from high-growth firms that have survived. This means that firms that went bankrupt or discontinued for other reasons are not included in this study, these firms might have unique value creation and destruction mechanisms.
[26] To access business elites, we relied, where possible, on the network of the university and our own professional networks. Out of the 49 business elites we reached out to, 24 accepted, 7 declined and 18 did not respond to our request. As it is widely recognized how difficult it can be to access elite respondents like CEOs (Ma et al., 2021; Solarino & Aguinis, 2021), this is considered a reasonable response rate.

how high-growth firms create value, we purposefully included two social enterprises (R6 and R7). The social enterprises were identified through their association with Social Enterprise NL, the Dutch social entrepreneurship membership body. In the interviews it became clear that a few other high-growth firms in our sample, that were not associated with this organization, identified as a social enterprise too. The non-random sampling strategy fitted the nature of the study, since the goal was not to generate a representative sample, but rather to get an overview of the variety of mechanisms through which high-growth firms impact their stakeholders (Van Burg et al., 2022).

We decided to concentrate our sample on *"key decision makers within high-growth firms with extensive and exclusive information and the ability to influence important firm outcomes, either alone or jointly with others"* (adapted from Aguinis and Solarino (2019, p. 1293) to fit our research context). In practice, this meant that we interviewed founders and CEOs.[27] The focus on key decision makers was motivated by two reasons. Firstly, as is well documented in the literature on elite interviewing (Ma et al., 2021; Solarino & Aguinis, 2021), we expected them to have exclusive information about the operations and strategic decision-making within the firm. Secondly and relatedly, we expected them to be most capable of reflecting on relationships with a wide variety of stakeholders. As a result, our analyses and results should be interpreted from the viewpoint of those key decision makers.

In semi-structured interviews, which lasted around one hour on average, we explored the relationship of high-growth firms with their stakeholders through the lens of key decision makers. The interviews were organized around a number of topics. Our topic list was

[27] One interview was conducted with a senior business development executive who was not the founder nor the CEO of the firm.

informed by the stakeholder capability approach (Ali & Cottle, 2021) and covered broad topics like the stakeholders of the firm and the type of engagement with those stakeholders. Respondents were explicitly asked to reflect on both the positive and negative effects they perceived to have on their stakeholders and the role firm growth played. While the topic list ensured a certain level of consistency between the interviews, it left enough room for respondents to bring up topics they deemed important (Bryman, 2016). For each interview, the topic list was tailored to the context of the respondent by informing it with available news articles and company documents.

Table 4.2

Overview of high-growth firms in sample.

Firm	Sector	Founding year	HQ location (Dutch province level)
R1	Security	2016	Flevoland
R2	Recruitment	2007	Noord-Holland
R3	Marketing	2007	Noord-Brabant
R4	Business and information services	2013	Utrecht
R5	Manufacturing	2011	Utrecht
R6	Food	2006	Noord-Holland
R7	Facility management	2015	Noord-Holland
R8	ICT, hosting and telecom	2004	Overijssel
R9	Manufacturing	2012	Noord-Brabant
R10	Finance	2015	Zuid-Holland
R11	Environment	1998	Zuid-Holland
R12	Construction	2010	Gelderland
R13	Consulting	2007	Utrecht
R14	Education	2009	Noord-Brabant
R15	Energy	2011	Utrecht
R16	Enterprise software	2009	Zuid-Holland

R17	Enterprise software	2010	Gelderland
R18	Mobility	2016	Noord-Brabant
R19	Manufacturing	1998	Gelderland
R20	Marketing and media	2013	Zuid-Holland
R21	Health, pharma and biotech	2013	Noord-Brabant
R22	Leisure and travel	2007	Utrecht
R23	Leisure and travel	2009	Noord-Brabant
Total	18 Sectors present in sample	Range: 1998-2016	7/12 Provinces present in sample

Notes: Interviews were conducted from November 2021 to October 2022. Most interviews were conducted via video calls, while some were conducted face-to-face. Despite our sincere efforts, all respondents were men. This gender imbalance is reflective of the broader research population (in the Top 250 of high-growth firms only 5% of the companies had at least one woman founder (Erasmus Centre for Entrepreneurship, 2021)). We reached out to four women in leadership positions within high-growth firms. Unfortunately, none of them wished to participate in the study.

4.3.2 Analytical approach

The analysis was iterative in nature and consisted of roughly two stages that took place partially parallel. The first stage consisted of developing the coding framework and coding the interviews. After the first twelve interviews were transcribed, we close read the transcripts and identified the emerging themes. Among others, the objective of the firm, the alignment on this objective with stakeholders and the motivation for firm growth were identified as central themes. Building on these emerging themes and combining these with insights derived from the stakeholder capability framework, an initial coding framework was developed. In the initial coding framework, the stakeholder groups discussed in the Ali and Cottle (2021) paper were included. The initial coding framework, that was both data and theory informed, was useful to identify potential value creation mechanisms per

stakeholder and important firm characteristics. Throughout the coding process codes were added if necessary. When all interviews had been transcribed, all interviews were coded utilizing the final coding framework. To enhance the trustworthiness, the interviews were coded by one of the authors and then, following a two pairs of eyes principle, reviewed by the other who coded additional sections if necessary (Thomas, 2006). In the final coding framework, the dimensions of capabilities were also added. The attribution of mechanisms to dimensions was based on the conceptualization of Ali and Cottle (2021), but since the dimensions cannot be strictly separated, it remains subjective to some degree.

The second stage of our analysis concerned determining patterns in the data. It soon became clear that the high-growth firms in our sample could be differentiated based on certain characteristics. As will be presented in the results section, the objective of the firm, the depth of engagement with stakeholders and the perceived role of firm growth were, among others, found to be important differentiating characteristics among firms. Next, we developed an overview table in which we summarized the characteristics for each firm in our sample. Building on this overview we developed an initial typology of high-growth firms from a stakeholder value perspective. These preliminary types of high-growth firms were validated and adjusted based on the subsequent interviews until we had reached theoretical saturation (van Rijnsoever, 2017).

4.4 Results

4.4.1 High-growth firms and capabilities

The interview data provided insight into the mechanisms through which high-growth firms create or destroy value for their stakeholders by expanding or degrading their capability sets. Most stakeholders mentioned by respondents were in line with the dominant stakeholders of the firm in the literature (Freeman, 1984): employees, clients, shareholders, suppliers and the local community. Some respondents also explicitly mentioned planet Earth and the government, which are in this section included under the 'community and the environment' category. Following the framework proposed by Ali and Cottle (2021), the value creation mechanisms that emerged from the interviews are categorized along the lines of five dimensions of stakeholder capabilities: economic, psychological, social, intellectual and physiological. Table 4.3 summarizes the most important mechanisms for each stakeholder from the viewpoint of key decision makers within high-growth firms.

Table 4.3 shows that the mechanisms through which high-growth firms create or destroy value for their stakeholders are many and diverse. From the perspective of the respondents, value creation by high-growth firms is not limited to economic value creation but encompasses a variety of dimensions, such as contributing to the local community or employee wellbeing. While almost all dimensions were discussed in the context of all stakeholders, the empty cells in Table 4.3 reflect that some dimensions for some stakeholders were potentially less relevant from the viewpoint of our respondents or simply beyond their scope.

In its diversity, what stands out is that the direction of the mechanisms is not exclusively positive. High-growth firms both positively and negatively shape the capability sets of their stakeholders. Upon closer inspection, many of the value destruction mechanisms seem to be connected to the unique high-growth environment in these firms (denoted with an 'U' in Table 4.3). Respondents highlighted that rapid growth can, among other things, go hand in hand with a decrease in social cohesion within the organization, less stable product or service quality and late payments for suppliers. Many of these mechanisms have to do with limited resources of firms, which becomes a constraint in periods of rapid growth. As a respondent explained:

> "*So there in [the local community] you need to be able to invest attention, time and energy. And when you are barely keeping up because you are growing so fast or when all of your financial means are invested in your growth, then you are not able to do that." (R14).*

Furthermore, the rapid growth of the firm often involved significant changes in terms of company strategy and culture, sometimes at the cost of stakeholders. The explanation of a respondent about how employees who had been working for the company since the start had to be laid off is exemplary in this regard:

> "*Another disadvantage is that some people cannot stay with the company, people who have been there from the start. And that is very sad because they gave everything for the business and when the company grows and it requires different skills then not everyone can grow with the company." (R10).*

In a similar vein, while some suppliers obviously benefitted from the increasing demand for their products, not all suppliers could keep up with the growth pace of the high-growth firm: *"But some of our suppliers, for that reason we had to let go of one supplier because he could not keep up with our growth." (R12).*

Nevertheless, the rapid growth environment presented opportunities as well. Many respondents emphasized the unique, yet often challenging, work environment at high-growth firms for employees. According to multiple respondents, this created a sense of adventure among employees: *"So I believe in general that people who work for a high-growth startup that they are often happier there because there is just a certain vibe when you grow. Something different than in a stable firm." (R10).* Many respondents emphasized how this rapid growth continuously provided employees with new opportunities like working internationally or taking on more challenging tasks.

In addition to unique value creation and destruction mechanisms related to rapid growth, the interview data also showed that growth can amplify mechanisms that are likely to be found among firms that do not experience rapid growth as well. Put differently, amplified mechanisms refer to mechanisms that may be found in any firm but become more pronounced as firms grow (denoted with an 'A' in Table 4.3). Some evident examples of amplified value creation mechanisms are found in the economic capability column of Table 4.3. As firms grow they have a more significant impact on their community, by generating more tax revenues and creating more jobs. Since various firms also donated part of their profit to societal goals this became more substantial as they grew. Another respondent argued that the firm had more room to invest in non-core activities such as making customers aware of their environmental responsibility:

> "*And that we have really been trying to take an active role in that in recent years, especially towards our guests, so we also try to incorporate a bit of education towards our guests. No, that has increased in recent years because as we grow, we also have more capacity, so we can focus on and address more of those kinds of things." (R23).*

Other stakeholders also experienced beneficial effects from the amplified mechanisms. Associated suppliers may see an increase in sales and shareholders benefit from an increase in shareholder value. In addition, firm growth may grant more consumers access to the products or services provided by high-growth firms. One respondent for instance elaborated on how the device his firm developed could produce a low-cost substitute for prosthetics, increasing accessibility to prosthetics worldwide. Employees also often benefitted, not only financially through bonuses or employee participation, but also from other initiatives such as more investment in education.

At the same time, negative effects may be amplified by firm growth, such as pollution resulting from the production or delivery of products or services and work-related stress among employees. Respondents acknowledged, that as they grow their firm, negative repercussions will increase as well. As one respondent reflected: *"That also means that we are replicating all those quite dirty processes from the semiconductor industry. The more it grows, the more there will be an environmental impact as well." (R9).*

In summary, Table 4.3 provides a comprehensive overview of the potential value creation mechanisms divided into growth amplifying or growth specific and classified as having a positive or negative effect. The sheer number of mechanisms shows the complexity of value

creation by high-growth firms. While nearly all mechanisms were mentioned by multiple respondents, the data also reflected that some mechanisms were more pronounced among particular subsets of firms. Further investigation signaled that certain firm attributes shaped the prominence of value creation mechanisms. This resulted in the typology of high-growth firms introduced in the next section.

Table 4.3

Value creation mechanisms for stakeholders by high-growth firms from a decision maker perspective.

	Economic capabilities	**Psychological capabilities**	**Social capabilities**	**Intellectual capabilities**	**Physiological capabilities**
Clients	• Higher quality products or services (A; +) • Better access to products or services (A; +) • Less stable quality of product or service in periods of rapid growth (U; -) • Business models that align interests of firm and consumer (+)	• Good customer experience (+) • Less attention for customers in periods of rapid growth (U; -) • Offering customers the opportunity to make social or sustainable choices (+)	• Building long-term relationships (+) • Frequently changing contact points in periods of rapid growth (U; -) • Optimizing for the mass at the cost of individual preferences (A; +/-)	• Educating customers (A; +) • Transparency of impact of firm (+) • Releasing innovations open source (A; +)	
Community and environment	• Donating money to societal projects (A; +) • Creating jobs (A; +)	• Creating meaningful jobs for the community (A; +)	• Building long-term relationships (+) • Engaging and crediting the user	• Sharing knowledge or experience with societal projects (A; +)	• Reducing the climate footprint of the firm (+) • Pollution resulting from producing or

	Economic capabilities	Psychological capabilities	Social capabilities	Intellectual capabilities	Physiological capabilities
	• Paying taxes (A; +) • Employing disadvantaged groups (A; +) • Preferring local suppliers (A; +) • Competition for scarce resources such as talent (A; -) • Losing attention for community in periods of rapid growth (U; -)	• Creating a sense of pride of firm achievement (A; +)	community (A; +) • Developing the local entrepreneurial ecosystem (A; +)	• Participating in research projects with knowledge institutes (+) • Providing educational opportunities and internships (A; +) • Advocating for and developing policies with governments and civil society organizations (A; +/-) • Mentoring and inspiring other entrepreneurs (A; +)	delivering product or service (A; -)
Shareholders	• Generating shareholder value (A; +)	• Providing an opportunity for meaningful investment (A; +)	• Building a shareholder community (+) • Building long-term relationships (+)		

	Economic capabilities	Psychological capabilities	Social capabilities	Intellectual capabilities	Physiological capabilities
			• Alignment on firm goals (+) • Conflicts about firm goals (A; -)		
Suppliers	• Generating higher sales (A; +) • Assuring better prices (A; +) • Opening up new markets for suppliers (A; +) • Paying suppliers on time (+) • Paying suppliers late in periods of rapid growth (U; -) • Increasing dependency of supplier (A; -) • Scaling too fast for supplier to keep up (U; -)		• Building long-term relationships (+)	• Working together to improve product or service (+) • Demanding suppliers to innovate or meet certain quality standards (+) • Educating suppliers about sustainability or working conditions (+)	• Improving the working conditions of suppliers (+)

	Economic capabilities	**Psychological capabilities**	**Social capabilities**	**Intellectual capabilities**	**Physiological capabilities**
Team	• Paying salaries (+) • Providing bonuses and employee participation schemes (A; +) • Providing stable and secure employment (+) • Firing employees that no longer fit the organization (U; -)	• Providing meaningful work (A; +) • Providing an adventurous work environment (U; +) • Valuing and crediting employees (A; +) • Offering autonomy and responsibility (A; +) • High work pressure (A; -) • Changing job demands (A; +/-) • Bureaucratizatio n of organization processes (A; +/-) • Giving employees too	• Organizing social events and clubs at work (+) • Less social cohesion in periods of rapid growth (U; -) • High levels of employee turnover (A; -) • Changing company culture (A; +/-) • Formalizing internal communication (A; +/-) • Giving employees a voice in firm decisions (+)	• Challenging work environment (A; +/-) • New career opportunities for employees (A; +) • Educational opportunities (A; +) • Hiring inexperienced managers (U; -) • Being less selective in hiring (U; -)	• Promoting employee health and well-being (+) • Providing employees with a pleasant and healthy work environment (+) • Stress and burnouts (A; -)

	Economic capabilities	Psychological capabilities	Social capabilities	Intellectual capabilities	Physiological capabilities
		much responsibility (A; -) • Uncertainty, chaotic work environment (U; -)			

Notes: 'A' and 'U' respectively indicate mechanisms that may be amplified by high growth or unique to a high-growth environment. The '+', '-', and '+/-' represent the direction of the relationship, i.e. whether the mechanism expands or degrades the capability sets of the stakeholders. Note that the boundaries of the capability dimensions are not clear-cut. The same goes for the classification 'A' and 'U'. The categorization of mechanisms reflects our interpretation.

4.4.2 A typology of high-growth firms

The value creation mechanisms mentioned by the respondents varied considerably among firms. While the stakeholder groups discussed with the respondents were largely similar, the importance of the different stakeholders and the depth of the interactions with those stakeholders differed markedly between firms. Both were closely connected to the objective of the firm, which indicated what the key decision makers within high-growth firms perceived to be the most important value their firm created. Understanding the objectives of firms also sheds light on the role of growth in the value creation mechanisms of firms, as the objective shaped the motivation for firm growth.

We identified three broad categories or types of high-growth firms as shown in Table 4.4. As discussed in the next section, the three main types we distinguished range from profit-oriented firms, here called 'profit-driven high-growth firms' to firms for which the societal mission is the dominant objective, 'mission-driven high-growth firms'. 'Conscious high-growth firms', that stood out due to their awareness for a wide set of stakeholders, make up the final type of high-growth firms. This classification is insightful as it summarizes some of the central aspects concerning the potential value creation of high-growth firms for their stakeholders. The types of high-growth firms are discussed below. Table III.A1 in the Appendix displays some illustrative quotes for each type with respect to their main characteristics.

Table 4.4

A typology of high-growth firms from a stakeholder value creation perspective.

	Mission-driven high-growth firm	**Conscious high-growth firm**	**Profit-driven high-growth firm**
Objective	Societal mission, profit as necessary condition	Profit and secondary societal or product-market mission	Profit
Motivation for firm growth	Serves to achieve societal mission, by gaining market share and inspiring competitors	Serves to make profit and may contribute to a secondary societal or product-market mission	Serves to make profit
Dominant stakeholder(s)	Dependent on societal mission	Various stakeholders	Shareholders
Type of engagement with stakeholders	Active if contributing to societal mission	Actively seeking the win-win with wide range of stakeholders	Active if contributing to commercial goals
Illustrative value creation mechanisms and trade-offs	Positive impact on beneficiaries, sometimes at the cost of other stakeholders	Active contribution to (local) CSR-initiatives, not necessarily related to the main activities of the firm	Financial value creation for shareholders, potentially resulting in tensions with other stakeholders
Number of firms in sample	6	10	7

4.4.2.1 Mission-driven high-growth firm

Six firms in our sample stood out due to their prominent social orientation. This subset of high-growth firms concentrated on achieving a particular societal mission that was deeply ingrained in every aspect of the firm. In contrast to most other firms in our sample, financial profits were merely considered a necessary condition to achieve the mission of the firm. The depth of the interaction with stakeholders was closely tied to the mission of the firm, often there was one dominant stakeholder that was central to the firm's mission. As an illustration, one mission-driven high-growth firm had the explicit goal to improve the lives of their suppliers. This focus logically resulted in above average engagement with the firm's

suppliers. For others, depending on the mission, planet Earth or employees were considered important stakeholders. The engagement of mission-driven high-growth firms with other stakeholders could be described as somewhat opportunistic. As one founder highlighted, his ultimate stakeholder is planet Earth and his clients are simply the channel through which he can create value for planet Earth: *"The customer is actually a means, if you look at it very simply. Because, our goal is to make it easy for that customer to treat the earth a little better." (R15).*

For mission-driven high-growth firms, high growth is instrumental in achieving their mission. Scaling their firm is considered a way to maximize their impact. The interview data highlighted that scaling may have a dual purpose. Besides scaling to reach a larger clientele, mission-driven high-growth firms scale to demonstrate to other businesses that it is possible to combine sustainable financial growth with a social or sustainable business model. As one respondent put it:

> *"And that may sound naive and arrogant, but I truly believe that by following that strategy, by creating awareness of the problem, leading by example in a scalable way, and ensuring that others also feel that responsibility and join us, we can make a difference." (R6).*

The presence of a mission among this subset of firms seems to offer something to stakeholders that other firms in our sample can only offer to a lesser extent. Multiple respondents stressed how the presence of a clear societal mission can motivate stakeholders. From the perspective of the founders and CEOs, it for instance provides employees and shareholders with a sense of meaning for their work and investment respectively. In line

with this, multiple respondents stressed the importance of sharing a vision with their shareholders. This meant that they had to find shareholders who are also more interested in making societal impact instead of direct financial returns. For those entrepreneurs, having the 'right shareholders' who embraced this mission was essential to achieving it.

The interviews also indicated that to achieve their mission some mission-driven high-growth firms actively engaged with policymakers to advocate for more ambitious social standards. By changing the institutional context, mission-driven high-growth firms could influence their competitors to act differently, ultimately resulting in value creation for their beneficiary stakeholder. For example, one respondent explained how he tried to change the rules of public procurement:

> *"And there are five questions being asked, and I have been involved in shaping these questions, and they are about social return, social impact, climate, control, and collaboration. Not a word about cleaning. And that is an example where a government agency, a department, takes responsibility, and I hope that it serves as a starting signal for all the other parties that are managing public funds to ask a different question. And that's how we will also make those parties feel the impact." (R7).*

The focus on a clear societal mission may have negative repercussions too. The interview accounts reflected that fixation on the mission can overshadow attention for the effects of the firm on other stakeholders. For example, several respondents explained that employees are willing to work very hard for this mission, potentially at the cost of the wellbeing of the employee:

"On the negative side, it can sometimes be tough. So when we have peaks in our workload, in a small organization you sometimes have to put in a little extra effort, but I think people have less trouble with that because there is a purpose behind it. So, I think people work quite hard here, but it's not necessarily perceived as hard work." (R15).

4.4.2.2 Profit-driven high-growth firm

The second type that emerged from our data is the profit-driven high-growth firm. Here commercial objectives are dominant. These firms fit a more traditional idea of the function of the firm (Friedman, 1970), which is limited to the production of products and services in a profitable way. Most of these firms do not have a societal mission. In some cases, the firms did state a societal mission on their websites, but the executives within those firms recognized those statements were little internalized or mostly served marketing purposes. When founders and CEOs of profit-driven high-growth firms were asked about their contributions to the community, many of them emphasized their contribution to job creation and tax revenue generation.

In line with the orientation towards financial objectives, shareholders are the dominant stakeholders for this subset of high-growth firms. The growth of the firm is also motivated in this light, as it is a means to create financial value for shareholders. Besides considering growth an essential ingredient for commercial success, the CEOs and founders of profit-driven high-growth firms often enjoyed entrepreneurship for its own sake and considered firm growth an indication of personal success. Multiple respondents within profit-driven

high-growth firms in our sample did not necessarily feel a strong connection to the product or service of their firm, but mainly enjoyed the process of successfully scaling a firm:

> "*As an entrepreneur, you simply have a company and as an entrepreneur you see opportunities and you want to seize them in the right way. Actually, when I came in touch with [firm name], I didn't know the product at all, I didn't know that market at all, but I had read half a paragraph and thought 'this is beautiful'." (R12).*

While the rapid growth of the firm had obvious financial benefits for shareholders, the respondents recognized that this could come at the cost of other stakeholders. In periods of rapid growth, for example, firms may become hard to manage and work pressure among employees increases. As one of the respondents explained: *"Growth is certainly not good for everyone and certainly not easy for everyone. It is good to realize that, and as an ambitious owner, you do not always think about it, but yes, you learn that over the years." (R22).* The interview data also reflected the potential tension between the financial interests of shareholders and employees. This is well illustrated by the experience of the CEO of a high-growth firm that was recently sold. He regretted the way the fruits of firm success were divided, because a small shareholder base made huge financial gains while most employees did not benefit:

> *"The employees work and the shareholders take the money. That's sometimes quite unfair in my opinion. Especially in this case, where the shareholders have earned an enormous amount of money. And it all goes to people who actually don't need it. (...) And then I think, man, you [the investor] didn't do anything. Except, of course, providing the money, and you take the lion's share. And then you look at the team*

that works here every day and works hard every day, getting up at five o'clock, getting in the truck, and so on, and they can't even get a month's salary as a thank you for the work they've done. That's incomprehensible to me." (R12).

4.4.2.3 Conscious high-growth firm

The final subset of high-growth firms that emerged from our analysis were more traditional in the sense that commercial objectives were dominant. However, these firms distinguished themselves by being rather aware of the effects of firm decisions on a wide set of stakeholders. These conscious high-growth firms noticed the influence they had on the different stakeholder groups, actively sought ways to have a positive impact and tried to mitigate negative impacts where possible. While the societal contributions of these firms were often less clear for their employees compared to mission-driven firms, conscious high-growth firms tried to find ways to elicit feelings of contributing to a meaningful goal often related to the product or service of the firm. The founder of a fast-growing IT-firm elaborated on his effort to create a purposeful work environment by introducing a product-market mission:

"A company can contribute to this by giving a purpose, which we also have, and that is 'only the best' for our customers, employees, and stakeholders. With this, I actually mean that if you really do the best you can every day, fight hard for it, you will go home with a better feeling than if you just did your work. If you do everything you can, strive for the best, then you are fighting for something and if you fight for something, I dare say you will be happier." (R8).

To some extent, the founders and CEOs of conscious high-growth firms perceived growth in a similar manner as those of profit-driven high-growth firms. For all respondents of conscious high-growth firms, growth was to a greater or lesser extent a means to achieve a financial end. Besides that, some emphasized how growth contributed to the realization of their secondary societal or product-market mission, such as improving the quality of education. In the interviews with CEOs of these firms, when discussing growth, many stressed the superior quality of their product. In fact, some respondents went as far as to say that growth followed almost automatically from this. As one respondent illustrated:

> *"And constantly working on actually optimizing the web and improving the things we do, trying to make a positive impact. That's what we're very focused on. It has always been our driving force, and so far, it has gone well. (..) Yes, if I'm being completely honest, we have never really focused on profit. It just came along. It was a result of what we did." (R17).*

In contrast to the profit-driven and mission-driven high-growth firms, it is less straightforward to identify dominant stakeholders for conscious high-growth firms. While employees were often considered the most important stakeholder, conscious high-growth firms distinguished themselves by taking into account a wide variety of stakeholders and actively seeking to balance the interests of different stakeholder groups. One founder, for instance, explained how his firm actively engaged with their suppliers to achieve certain standards concerning working conditions or sustainability, others actively engaged their user-community. The founder of a high-growth firm active in the manufacturing sector, for example, emphasized the role their user community had played in the firm's success:

> *"So the success of [firm name] has become a bit the success of the community as well, so they were also proud of it. So we involved them and when we took over something that someone had come up with and it became part of the [firm name] product, we gave recognition for that." (R5).*

In line with their broad stakeholder focus, all conscious high-growth firms in our sample engaged in CSR activities of some sort. This included a wide range of activities that were not necessarily related to the main activities of the firm. Some offered their products or services pro bono for the local community or provided (financial) support to initiatives of the local community. Others contributed to their environment in other ways, for example two firms offered jobs to job seekers facing barriers to employment. Another firm provided their employees with days off work which they could use for volunteering activities. Conscious high-growth firms were also aware of their environmental impact and actively tried to reduce this.

4.5 Discussion

The aim of this study was to understand the societal value of high-growth firms beyond their contribution to economic growth and employment (Haltiwanger et al., 2017; Henrekson & Johansson, 2010). Adopting a stakeholder capability perspective (Ali & Cottle, 2021), the paper studied how high-growth firms create and destroy value for their stakeholders and what role firm growth plays in this process. Interviews with 23 founders and CEOs of high-growth firms provided insight into the mechanisms through which those firms expand and degrade the capabilities of their stakeholders. From our empirical analysis we have derived two propositions. The propositions reflect the main contributions of this paper to the extant

literature on high-growth firms. Jointly, the propositions shed light on how high-growth firms create value by expanding or degrading the capability sets of stakeholders.

Proposition 1. *Rapid firm growth amplifies conventional value creation mechanisms and creates unique growth-related value creation mechanisms.*

The paper's findings mark the role of firm growth in value creation and destruction for stakeholders. The findings suggest that firm growth amplifies conventional value creation and destruction mechanisms of high-growth firms. As high-growth firms grow, conventional value creation mechanisms like job creation and sales generation for suppliers are augmented. In addition, some unique growth-related value creation mechanisms seem inherent to the rapid growth high-growth firms experience. Those mechanisms include unique career opportunities for employees, but also constraints on resources of the firm and an uncertain fast-changing work environment.

The analysis reveals how firm growth may both, and sometimes simultaneously, create and destroy value for stakeholders by expanding and degrading their capabilities respectively. On the one hand, this corresponds with the arguments of other scholars that rapid firm growth is not necessarily good for all stakeholders involved (Kuckertz et al., 2023; Srikanth et al., 2021). At the same time, the multifaceted nature of the mechanisms implies that firm growth may amplify social value creation too. This inevitably raises the question under what conditions growth is most beneficial from a stakeholder perspective. Some respondents hinted at the idea that growth needs to be manageable in order to decrease potential negative effects. While it was beyond the scope of this study to investigate the effect of the pace of

growth, future research could investigate at what pace and under what conditions growth offers most benefits to the stakeholders of the firm.

Proposition 2. *The objective of high-growth firms shapes their value creation for stakeholders through their stakeholder focus and the depth of their stakeholder engagement.*

The analysis shows that high-growth firms make up a rather heterogeneous group from a stakeholder value creation perspective. Certain firm attributes shape how high-growth firms expand or degrade the capability sets of stakeholder groups. As is apparent from the typology of high-growth firms (Table 4.4), the importance of certain stakeholders and the engagement with those stakeholders differs from firm to firm and is shaped by the objective of the firm. Deep engagement with one stakeholder may come at the cost of other stakeholders. For both mission-driven high-growth firms and profit-driven high-growth firms, the attention for the beneficiary of the mission and the shareholders respectively, sometimes came at the cost of other stakeholders. The finding that mission-driven firms may overlook stakeholders beyond their beneficiaries resonates with other studies on sustainable and social enterprises (Dempsey & Sanders, 2010; York et al., 2016) and adds to a larger literature on social entrepreneurship that has established the complexity of balancing social and financial value creation (Doherty et al., 2014; Ebrahim et al., 2014; Saebi et al., 2018). In their inductive study on environmental entrepreneurship York, O'Neil and Sarasvathy (2016, p. 697), for example, find: *"Surprisingly, environmental entrepreneurs with an ecological dominant identity took a more exclusionary approach towards stakeholders."*

The analysis also shows that the motivation for firm growth is closely associated with the objective of the firm. Especially for mission-driven and profit-driven high-growth firms, growth is instrumental in achieving their respective social and financial objectives. The accounts of mission-driven high-growth firms highlight that growth is both a way to increase their market share and a way to signal to competitors that alternative business models are economically feasible. This corresponds with the idea proposed by Hockerts and Wüstenhagen (2010) of how 'emerging Davids' try to transform an industry.

In conclusion, this paper reveals the multifaceted nature of value creation and destruction by high-growth firms and provides insight into the attributes of firms shaping value creation. First, we find that the rapid growth firms experience can be a driver of some unique growth-related value creation mechanisms and serves as an amplifier of conventional value creation mechanisms. Second, the typology of high-growth firms points towards the heterogeneity among high-growth firms from a stakeholder value perspective. The notions that some high-growth firms may be positioned better than others to create social value and that firm growth can amplify value creation, suggests that firm growth, if directed well, can augment stakeholder value creation.

4.5.1 Implications for theory

One particular concern that has been raised about growth-oriented firms is their non-inclusiveness in terms of value creation (Breznitz, 2021; Kim & Kim, 2022; Kuckertz et al., 2023) by prioritizing the interests of shareholders at the cost of others (Shepherd & Patzelt, 2022). This paper concurs that those stakeholder trade-offs exist. Nevertheless, the emerging typology of high-growth firms presented here sketches a more nuanced picture of

value creation by high-growth firms. High-growth firms are not only diverse in terms of age and sectors as previous research has suggested (Coad et al., 2014; Henrekson & Johansson, 2010), they form a diverse group from a social value perspective as well. The typology may serve as a starting point for scholarship on how high-growth firms can contribute to a more inclusive capitalism that better respects the needs of stakeholders beyond the shareholders of firms (cf. Stiglitz et al., 2009).

The profit-driven firms distinguished in the typology adhere to Friedman's (1970) conceptualization of the firm that fits a traditional investor capitalism paradigm (Freeman et al., 2007). The mission-driven and conscious high-growth firm, in contrast, strive for creating value beyond shareholder value and may be well-positioned to address some of the pitfalls of contemporary capitalism. In the tradition of stakeholder theory (Freeman et al., 2007) and the shared value concept (Porter & Kramer, 2011), conscious high-growth firms seek to enhance the capabilities of a wide range of stakeholders and actively seek for a win-win where possible. The accounts of decision makers within conscious high-growth firms demonstrate their wider conception of the social responsibility of the firm, entailing a variety of stakeholders and multiple dimensions of wellbeing (Sen, 1999).

Mission-driven high-growth firms instrumentalize rapid firm growth to achieve a societal mission. Their focus on firm growth as a means for value creation is what sets this subset of high-growth firms apart from most social enterprises, which are sometimes unable to scale due to their local nature and, generally speaking, tend to be more concerned with scaling impact than scaling the firm (Shepherd & Patzelt, 2022). At the same time, mission-driven high-growth firms contrast the dominant image of high-growth firms in the entrepreneurship literature as being exclusively focused on financial value creation

(Kuckertz et al., 2023). Due to their rapid growth, mission-driven high-growth firms might be ideally positioned to create a lot of value for a specific stakeholder in a relatively short time frame. However, because of their dominant mission focus they pay less attention to other stakeholders. Their fixation on value creation for a specific stakeholder corresponds to what DiVito and Bohnsack (2017) in the context of sustainable entrepreneurship have referred to as 'singular decision making profiles': sustainable entrepreneurs with a nested prioritization logic and a hyperfocus on the sustainability dimension.

The practices of conscious and mission-driven high-growth firms embody a central debate in the business ethics literature about the desirability of prioritizing certain stakeholders (Freeman, 2010; Friedman, 1970; Porter & Kramer, 2011). Yet, we would be cautious in favoring conscious high-growth firms over mission-driven firms or vice versa. As a matter of fact, the two may be complementary. The former might be better positioned to address the concern of growth-oriented firms being non-inclusive in terms of value creation. The latter, however, might be more successful in creating large amounts of value for specific stakeholder groups that are considered especially important, such as planet Earth. In this respect, while high-growth firms are indeed relatively unique cases (Aldrich & Ruef, 2018; Kuckertz et al., 2023; Kuratko & Audretsch, 2022), they arguably remain relevant study objects as they have large potential for social value creation.

4.5.2 Limitations

The findings of this study should be seen in the light of some limitations, which also provide avenues for future research. Firstly, we solely relied on the statements of founders and CEOs of high-growth firms for our analysis. Key decision makers within high-growth firms may

be overly optimistic about the value creation of their firm (Tansey, 2007) or be genuinely unaware of the impact their firm has on certain stakeholder groups. Social desirability bias poses a related concern (Zerbe & Paulhus, 1987). Despite the anonymity that was guaranteed to the respondents, it remains possible that respondents gave answers to please the interviewers or were hesitant to share mechanisms through which their firms negatively affected stakeholders.

While the statements of respondents were not validated with other stakeholders of the firm, we strived for triangulation by informing the topic list with available news articles and company documents prior to the interview. Furthermore, in this explorative study we were especially interested in the perspectives of key decision makers, as they have a large influence on strategic firm decisions and could provide us with the best possible overview of the activities and the stakeholder interactions of the firm. Future studies will need to validate these value creation and destruction mechanisms with other stakeholders and could shed more light on some of the dark sides of high-growth entrepreneurship that are potentially overlooked in this paper.

The fact that our sample was limited to high-growth firms in the Netherlands poses a second limitation. Like many European countries, but in contrast to Anglo-Saxon countries, the Netherlands is known for its Rhine model of governance (Albert, 1992), favoring a stakeholder approach of firms over a shareholder approach. It deserves further research to explore to what extent the findings in this paper hold in other countries. Studying value creation by high-growth firms in other institutional contexts, departing from the typology suggested in this paper, would be a relevant direction for future research.

A final limitation of the study is that high-growth firms were studied at one point in time. As a consequence, the analysis does not answer the question whether, and under what conditions, high-growth firms can change types as they grow. A few respondents mentioned the history of the firm and sometimes discussed how objectives had changed during their growth but we did not investigate this in depth. The social entrepreneurship literature on mission drift (e.g. Ebrahim et al., 2014) could provide a productive starting point for future studies addressing this issue.

4.5.3 Implications for policy

The promise of the extraordinary positive economic effects of high-growth firms inspired policymakers worldwide to introduce policies to nurture high-growth entrepreneurship (Coad et al., 2022; Mason & Brown, 2013; Shane, 2009; Terjesen et al., 2016). As our typology displays, from a stakeholder value perspective high-growth firms appear to make up a rather heterogenous group. Effects on stakeholders cover many different dimensions and can be both positive and negative. For policymakers it is critical to understand that the relationship between high-growth firms and social value creation cannot be taken for granted. Our findings underline the idea that entrepreneurship is not neutral, but has a 'direction' (Baumol, 1990; Mazzucato, 2018). This raises the question whether targeting high-growth firms in general is good entrepreneurship policy (Shane, 2009) or whether high-growth firms that contribute to particular societal missions and dimensions of well-being should be prioritized.

As we have argued, more research is needed about the wider impacts of high-growth firms and how the importance of different stakeholders should be weighed. Nevertheless, more

empirical research is unlikely to solve this puzzle entirely. What good entrepreneurship policy is remains to some extent a normative question, shaped by dominant institutions and norms in society that change over time (for a discussion in the venture capital policy sphere see Klingler-Vidra (2018)). Moreover, while the stakeholder capability framework is helpful for policymakers to consider the broader impacts of (high-growth) entrepreneurship (Ali & Cottle, 2021), its measurement inevitably asks for choices about what dimensions to include (Stiglitz et al., 2009).

Before policy conclusions can be made, we first need to trace the multidimensional social impact of high-growth firms more carefully. As noted earlier, we do not yet know to what extent the objectives of key decision makers within high-growth firms are also realized: a social orientation of high-growth firms does not guarantee social impact, while a profit orientation does not exclude social impact. This paper provides a first step in understanding the multidimensional value of high-growth firms for society. Advancing this debate requires a continuous conversation between policymakers, academics and entrepreneurs.

Chapter 5

Conclusion and discussion

5.1 Summary

In this dissertation I investigated the entrepreneurial ecosystem concept using empirical data. The entrepreneurial ecosystem concerns the interaction between entrepreneurs and their (local, regional, national) environment. Since entrepreneurship is an important driver of economic growth and holds potential to further societal progress in general, it is relevant to study how the environment can enable entrepreneurship to emerge. Better developed entrepreneurial ecosystems, what I refer to as high quality, enable higher levels of productive entrepreneurship. To answer my main research question, I had three sub questions which were addressed in three separate chapters. I will shortly discuss the answers to each sub question.

Research question 1: *How can we measure the quality of entrepreneurial ecosystems in Europe?*

In Chapter 2 we assembled a dataset to measure the quality of ecosystems for 273 regions in Europe. We used statistical data and web-scraped data to create indicators for each of the ten elements in the ecosystem framework created by Stam and Van de Ven (2021). We selected indicators based on a measure being credible, accurate and comparable, subject to the limits of the best data currently available at the regional level. To create one overall measure of ecosystem quality, data of the ten elements were combined in an entrepreneurial ecosystem index, which we composed in several ways. This index was, in a cross-sectional setting, significantly correlated to entrepreneurial outputs as measured with Crunchbase listed firms and unicorns. The index was also more highly correlated to entrepreneurship outputs than related measures such as GDP or the regional competitiveness index.

Additional analyses demonstrated that the interdependencies between ecosystem elements are particularly strong and the regional variation within countries is substantial. Robustness checks showed these results were not sensitive to changing various choices regarding the index composition.

Research question 2: *Which entrepreneurial ecosystem configurations enable productive entrepreneurship?*

In Chapter 3 we used the dataset assembled in Chapter 2 for a Qualitative Comparative Analysis (QCA). This method is used to structurally analyze cases and find combinations of elements that almost always co-occur with the outcome. In our study we analyzed the entrepreneurial ecosystems of 273 regions in Europe to see for which combination of ecosystem elements, so-called configurations, high entrepreneurial output was observed. While case studies suggested that regions may perform well with different configurations (e.g. Spigel, 2017), most of the previous entrepreneurial ecosystem literature was based on the idea that ecosystems need to have all elements on a high level to function well (e.g. Acs et al., 2014). The aim of this study was to test this assumption empirically in the setting of the European Union. The results show that regions can attain relatively high levels of entrepreneurial output with a set of different configurations, these configurations either combined knowledge or talent with institutions or leadership. These results thus point to the importance of having a source of entrepreneurial opportunities, supplied by either the production of innovation or the availability of highly educated personnel. In addition, some form of governance is needed to guide the ecosystem, which can be provided by formal institutions or the more informal institution of leadership.

When analyzing the regions with the highest entrepreneurship output, the QCA only shows one consistent configuration with all elements present. This provides support to the conjecture that *all* of the ecosystem elements contribute to entrepreneurship and ecosystems function at the highest level when the whole ecosystem is well-developed. However, even at this level we observe some exceptions of regions performing very well with not all ecosystem elements developed. Similar exceptions are identified when we analyze regions with unicorn firms. The results thus show that there is regional diversity in entrepreneurial ecosystems and regions can perform fairly well with different configurations. At the same time, a well-rounded ecosystem is most likely to produce the highest amount of entrepreneurship.

Research question 3: *Through which mechanisms do high-growth firms create and destroy value for their stakeholders and what role does firm growth play in this process?*

In Chapter 4 we turned to the link between the output and outcome of the entrepreneurial ecosystem. While previously most research focused on economic growth, more scholars and policymakers are now aware that this cannot be equated with societal progress. Therefore, we investigated in this chapter how entrepreneurship contributes to societal wellbeing. We focused on high-growth firms since these are commonly considered the most important output of the entrepreneurial ecosystem and receive a lot of attention from policymakers. To understand how these firms contribute to societal wellbeing, we employed the stakeholder capability framework developed by Ali and Cottle (2021), based on the capabilities theory of Amartya Sen (1999). This framework enabled us to create a complete picture of the potential effects of high-growth firms on wellbeing, as it includes all the parties the firm interacts with and different dimensions of wellbeing. Our aim in this chapter

was to understand how high-growth firms can create or destroy value for their stakeholders. The research was exploratory in nature and designed to create an overview of the potential mechanisms of value creation and destruction. The unique characteristic of high-growth firms is the very rapid growth they experience and we therefore gave special attention to the role of firm growth.

The 23 interviews with the founders and CEOs of high-growth firms in the Netherlands illustrated many possible value creation mechanisms. The value high-growth firms create for their stakeholders is diverse and affects various dimensions of capabilities. There are also multiple examples of mechanisms that destroy value for stakeholders and these often seem to be related to the rapid growth environment. The value created differed substantially between firms and we could distinguish different firm types with respect to stakeholder value creation. These included firms almost solely focused on profit, profit-driven high-growth firms, firms with a clear societal mission, mission-driven high-growth firms, and firms which are a combination of these two with attention for a broad range of stakeholders, conscious high-growth firms. High-growth firms are thus a heterogeneous group and all of these firm types face different trade-offs between stakeholders. However, when these trade-offs are managed well these firms have the potential to create substantial social value.

5.2 Overall findings

The main aim of the dissertation was to better understand the mechanisms in the entrepreneurial ecosystem framework, specifically interdependencies between ecosystem elements, the emergence of entrepreneurship within the ecosystem and the link between

entrepreneurial outputs and societal wellbeing. In this way I tried to answer the following main research question:

Main research question: *How can we improve our understanding of the mechanisms in the entrepreneurial ecosystem framework, specifically the interdependencies between elements, the emergence of entrepreneurial output and the contribution of this output to societal wellbeing?*

The dataset we built in Chapter 2 shows it is possible to use quantitative data to construct reliable measures of the quality of entrepreneurial ecosystems. Many useful data sources are readily available and we complemented this with data obtained by web-scraping. The biggest challenge was to get comparable data on the regional level, but it was possible to find relevant data for almost all NUTS 2 regions in Europe. The correlations between ecosystem elements were very high, which underlines the importance of complex systems theory as a foundation of the entrepreneurial ecosystem concept. The interactions between elements in the entrepreneurial ecosystem are important to include in any study and elements should not be supposed to act in isolation.

To investigate the connection between the entrepreneurial ecosystem and entrepreneurial output in more detail we used QCA in Chapter 3. This combines the two concepts of interdependencies and emergence in the entrepreneurial ecosystem theory. The configurations for high levels of entrepreneurship output were driven by the elements of knowledge, talent, leadership and institutions. This suggests that some elements may be more important than others in the ecosystem. While some ecosystem elements may be required to enable any entrepreneurship, others might be good to have but less essential.

The idea that there might be 'core' ecosystem elements is starting to be explored in the literature by weighting the elements (Corrente et al., 2019) or even letting the weights of elements depend on the specific region (Lafuente et al., 2022). New methods of data analysis, especially in the field of machine learning, could further our understanding of how elements within the ecosystem interact. For example, machine learning models, such as the random forest, could help to determine the importance of different ecosystem elements for generating productive entrepreneurship while allowing for interdependencies.

To study emergence of productive entrepreneurship in the ecosystem, we used data on innovative startups and unicorns in Chapters 2 and 3. These data were web-scraped from Crunchbase, Dealroom and CB Insights and geocoded to the respective NUTS 2 region. While we argued this is the most relevant measure of productive entrepreneurship to date, we acknowledged it is not perfect. As we discussed in the introduction and Chapter 4, defining productive as contributing to economic growth seems rather limited. Growth in economic output (GDP) does not take into account any concerns surrounding sustainability, inclusion and wellbeing in a more general sense. In addition to this theoretical concern, measuring entrepreneurial output remains particularly challenging and most available data sources show biases in certain directions. Creating a better measure of entrepreneurial output will be an important challenge for future research.

Finally, we studied how entrepreneurship can contribute to societal wellbeing by investigating stakeholder value creation by high-growth firms. In contrast to the previous chapters, we collected qualitative data to study this connection. Using the stakeholder capability framework (Ali and Cottle, 2021) as our lens, we created an overview of value creation and destruction mechanisms for different stakeholders. The high-growth firms we

interviewed could be separated in various types based on certain firm characteristics. Each type created stakeholder value in different ways. This showed the heterogeneity of high-growth firms with respect to value creation. The diversity of high-growth firms suggests that firms might also have different needs for support from the entrepreneurial ecosystem. For example, the conscious and mission-driven high-growth firms needed investors that shared their vision and had a long-term perspective. This might not match the traditional VC investor with short term horizons. The needs for different types of resources in the ecosystem has recently been explored in the context of social and sustainable entrepreneurship (see e.g. Volkmann et al., 2021). This could have important consequences for how policymakers want to shape and develop the entrepreneurial ecosystem.

In Chapter 1, I introduced a framework based on Coleman's macro-micro-macro framework (Coleman, 1990) to connect the different chapters of this dissertation (see Figure 5.1). Summarizing our findings, we can say we established a strong link between the entrepreneurial ecosystem and the prevalence of entrepreneurship in Chapter 2, symbolized by the dotted arrow in the figure. In Chapter 3, we studied this link in more detail and understood some of the nuance of the connection between the ecosystem and entrepreneurial output. Specifically, this connection depends on the regional context and is strongest when an ecosystem is fully developed. At the micro level (arrow 2), we studied the relation between high-growth firms and stakeholder value creation in Chapter 4. Our results show this relation encompasses many different mechanisms. The relation is shaped by characteristics of the firm, such as the firm objective. While every high-growth firm creates economic welfare, their broader welfare contribution is thus more complex.

Understanding the different links in the framework brings us closer to connecting the entrepreneurial ecosystem to societal wellbeing at the macro level. However, this dissertation does not study all the relations shown in the framework. Specifically, I did not investigate arrows 1 and 3, relating to the micro-foundations of entrepreneurial ecosystems and societal wellbeing. To further improve the entrepreneurial ecosystem theory, it is important that these micro-foundations are studied in more detail (Roundy & Lyons, 2023; Roundy & Fayard, 2019).

While I do find support for the connection between ecosystems and entrepreneurial output (at the regional level) and between entrepreneurial output and wellbeing (at the firm level), the findings of the dissertation especially stress the complexity by showing the diversity of mechanisms behind the arrows. This diversity calls for a detailed understanding of the case in question, instead of a generalized understanding that can be applied to every region or firm. Although this presents a challenge for academics and policymakers, with the large amount of data available today it is getting easier to analyze specific regions or firms and design tailor-made policy interventions.

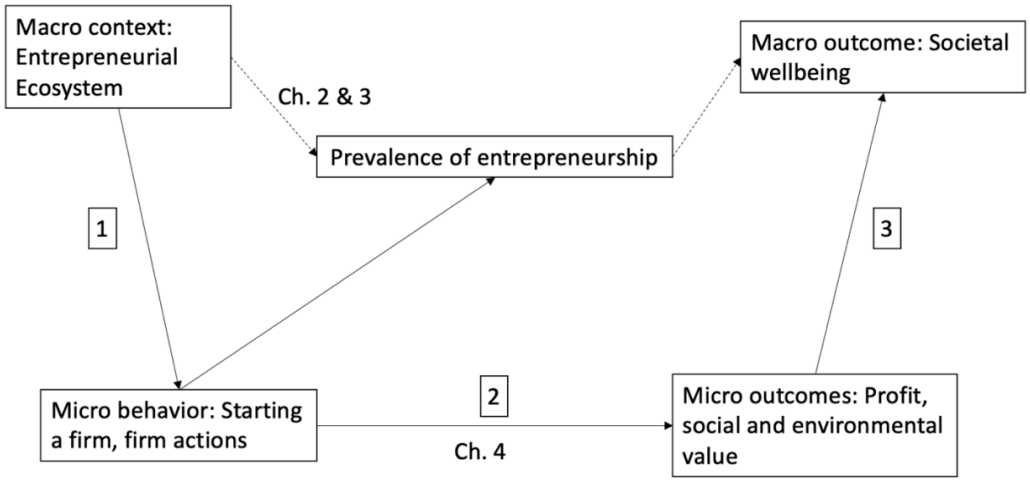

Fig. 5.1 Framework showing the connections between the different chapters.

5.3 Theoretical implications

The entrepreneurial ecosystem concept is still relatively new and there are various directions in which the field can be developed. This dissertation aimed to develop the theory with the use of empirical data and made several advancements in how we can understand mechanisms within the entrepreneurial ecosystem. However, many questions about mechanisms remain and require further empirical research. On a more abstract level the entrepreneurial ecosystem theory can still be developed in several ways, which requires both theoretical and empirical contributions.

When we consider the entrepreneurial ecosystem literature, it is not immediately clear that the entrepreneurial ecosystem concept itself can be considered a theory. While it is a novel concept with several frameworks attached, the literature clearly builds on various existing theories from fields such as economic geography (Acs et al., 2017). One might therefore

argue that the entrepreneurial ecosystem is not necessarily a new theory on its own but a novel combination of existing theories in a framework centered on entrepreneurship. Some might even argue that it is merely a tool for policymakers, as evidenced by its emergence in the practitioner's field and continued popularity among policymakers. The research in this dissertation has aimed to show that the entrepreneurial ecosystem framework can be considered more than just a tool. Combining the concept with empirical data generates several valuable insights on regional economic development. While I think it is thus worthwhile to study entrepreneurial ecosystems, it is important to acknowledge the close ties to several other theories (Qian & Acs, 2023) and not be too exclusionary in defining the boundaries of the entrepreneurial ecosystem field. The combination of the entrepreneurial ecosystem literature with other literatures concerning regional development, such as innovation systems or clusters, provides the opportunity for important synergies that can improve our understanding of how regions can flourish. As Qian and Acs (2023) argue, all of these approaches can be considered part of the third wave of regional development models, focusing on regional capacity building. Related concepts such as clusters and innovation systems share an understanding of elements which are considered essential for regional economic development, such as knowledge and institutions. We should therefore learn from and interact with these different literature streams in related literatures, as these can provide complementary insights.

In Chapter 4 we explored the link between entrepreneurial output and societal wellbeing. Research in this area is still scarce and it is challenging to conceptualize and measure wellbeing. In our study we decided to employ the stakeholder capabilities theory (Ali & Cottle, 2021) to trace the wellbeing impacts of high-growth firms. In another short conceptual piece, we explored the potential of the capabilities theory to better understand

the wellbeing impact of entrepreneurship (Vogelaar et al., 2023). Both studies show the connection between entrepreneurship and wellbeing is complex and multifaceted. While the capabilities theory can be used to study the wellbeing impact of entrepreneurship, the broad and agnostic nature of the theory can also make it untraceable. In addition, the theory is in principle focused on the wellbeing of the individual and it is not always clear how this can be aggregated to higher levels. To operationalize the theory it is therefore needed to make several normative choices, for example by choosing specific capabilities (e.g. intellectual) or specific stakeholder groups to focus on. To inform such choices we need a good overview of the capabilities and stakeholders affected by entrepreneurs, for which the results in Chapter 4 provide a first step.

The dataset created in Chapter 2 is cross-sectional. Although for some indicators we combine several years of data, we only have one observation for each region. While this gives a first important insight into the state of the entrepreneurial ecosystem, it cannot tell us how ecosystems develop over time. There are various potential temporal dynamics which have been developed in theoretical articles or case studies (e.g. Spigel and Harrison, 2018), to validate these we need longitudinal data on many entrepreneurial ecosystems. This would enable the study of ecosystem evolution and change but also resilience to different types of shocks. Developing these insights is important for policymakers as they try to develop their entrepreneurial ecosystem over time and respond to various shocks such as the COVID crisis.

An even more challenging but also important task is to get a better understanding of causality within entrepreneurial ecosystems. We have seen in Chapter 2 and 3 that there are strong interdependencies within ecosystems, combined with feedback loops between

entrepreneurship outputs and ecosystem elements this makes it hard to untangle effects. There are various ways to address these challenges, mostly by applying quasi-experimental methods or even randomized controlled trials (RCTs) (Duflo & Banerjee, 2017). However, most of these methods are aimed at understanding the effect of micro-level interventions on clearly defined output variables. Since the entrepreneurial ecosystem is a concept on a more macro level, we cannot use these methods to study the whole entrepreneurial ecosystem at once. Instead these methods can be used to better understand specific elements of the entrepreneurial ecosystem, either in isolation, in relation to other elements or in relation to entrepreneurial output. Combining these insights with good longitudinal data and methods such as QCA can then help us to understand how the different elements in the ecosystem work together. With the many policy interventions aimed at fostering entrepreneurship, it might be possible to find a setting or even to get involved in an intervention aimed at a specific element or set of elements from the start and trace how this in turn affects other parts of the ecosystem or ecosystem output.

This dissertation has focused on the context of the European Union, adding to the existing body of knowledge which was more US-centric. The European context is more diverse than the US as it includes many different countries with different institutional backgrounds and income levels. In Chapter 3 we saw how in these divergent contexts we can find different types of ecosystems that function relatively well. For example, in regions with lower institutional quality, entrepreneurial leadership could substitute to some extent for the missing coordination from formal institutions. However, this diversity is still somewhat limited as all EU countries have relatively well-functioning institutions and fall at least in the middle-income category. Since the entrepreneurial ecosystem framework is meant to improve our understanding of the emergence of productive entrepreneurship and

consequently economic growth (or wellbeing), it seems of paramount importance to extend the literature to non-Western contexts. There is still little research on how entrepreneurial ecosystems might work in Africa, while more work has been done in Latin America and Asia (see e.g. Alves et al. 2021 and Shi & Shi 2022). Since the conditions in low-income countries are fundamentally different, an important question is if the current entrepreneurial ecosystem framework can be usefully applied there or if a whole new framework needs to be developed.

5.4 Policy implications

The use of empirical data is an important advancement in making the entrepreneurial ecosystem concept more relevant and useful for policymakers. In this dissertation I showed various applications of both qualitative and quantitative data. When designing and monitoring policy interventions both types of data are needed. Quantitative data can give an overview of the state of the ecosystem to show where interventions might be needed and measure the effect after implementation of new policies. Qualitative data enable us to understand the specifics of the entrepreneurial ecosystem, which can help to design better policy but also to better understand the reasons behind observed effects.[28] Only with a combination of different types of data can we really understand the state of an entrepreneurial ecosystem. While the dataset built and analyzed in Chapters 2 and 3 thus provides an important first step for ecosystem analysis, it should be complemented with more specific regional knowledge to generate a complete picture of an entrepreneurial ecosystem.

[28] The evaluation of the Techleap program in the Netherlands (Van den Toren et al., 2023) is a good example of how different data sources can be combined to get a complete picture of the impact of a policy intervention.

The analysis in Chapter 2 also showed the strong connections between ecosystem elements. This asks for a holistic policy design taking into account the whole ecosystem. Just targeting one ecosystem element may not be effective or have unintended consequences on other ecosystem elements. On the other hand, when targeting a set of elements it might be possible to create positive feedback loops. In a detailed case study of six European regions (Schrijvers et al., 2024), we show that some regions managed to develop strong entrepreneurial ecosystems with policy interventions which addressed multiple ecosystem elements at the same time. For example, in Oulu the business support organization established incubators and funding opportunities for startups during the downfall of Nokia, in addition the organization created links with existing ecosystem actors (such as the university) and provided direction, i.e. leadership, to the ecosystem in terms of sectoral development (Dhondt et al., 2022). To determine whether a policy intervention is successful, it is again important to monitor changes in the entrepreneurial ecosystem with quantitative indicators and qualitative data.

The results of Chapter 3 stress the importance of regional diversity. Regions in the European Union differ markedly on various characteristics and so do their entrepreneurial ecosystems. The QCA shows that a variety of entrepreneurial ecosystems can be reasonably successful in producing entrepreneurial output. This means that regions are to some extent able to adapt their ecosystem to their weaknesses and strengths. For example, the analysis showed that regions without a strong internal market could focus on producing for export. In our detailed case study we found other examples of this, for example the region of Sofia relied heavily on entrepreneurial leadership to steer their ecosystem while trying to circumvent the malfunctioning formal institutions (Schrijvers et al., 2024). Regions should therefore design policy adapted to their local circumstances. One way to do this is by trying to learn from

regions with similar characteristics which have strong entrepreneurial ecosystems. Nevertheless, the results of Chapter 3 also showed a complete ecosystem is generally needed for the best entrepreneurial performance as measured with Crunchbase listed firms and unicorns, again supporting the need for a holistic view on ecosystem policy.

Many entrepreneurship policies have the goal of stimulating high-growth firms or scale-ups (Mason and Brown, 2014), based on the idea that these firms are especially important for the economy. At the same time a shift in policymaking is taking place resulting in policymakers paying more attention to other aspects of wellbeing, such as quality of the living environment or work-life balance. Recently, several terms such as societal missions, inclusive societies or sustainability transformations have been gaining traction among policymakers (see e.g. European Commission, 2019b; Larrue, 2021; Mazzucato, 2021). These developments are to some extent mirrored in business with the rise of concepts such as ESG investing, triple bottom-line or B corps (e.g. Boffo and Patalano, 2020; Kim et al., 2016). Despite this increase in awareness, in the entrepreneurship literature most studies are still focused on traditional success indicators such as job creation. In Chapter 4, we studied high-growth firms and how they contribute to the wellbeing of their stakeholders. Our results show a variety of mechanisms, both positive and negative. High-growth firms turned out to be very diverse with respect to social value creation. While for some firms this was the main goal, for others this did not go further than a CSR strategy mainly used for marketing purposes.

This heterogeneity is important to consider when designing policy to support high-growth firms. If the goal of policymakers is to further societal wellbeing, not all high-growth firms may be equally instrumental in doing so. It might therefore be important to distinguish

between high-growth firms based on certain characteristics, such as their main objective. Another way to distinguish between high-growth firms is to consider their stakeholder focus. All firms faced trade-offs between stakeholders and firms dealt with these in different ways. If policymakers decide that a certain stakeholder, such as employees, deserves special attention they might be able to target firms based on this, for example by analyzing data on employee happiness and retention. These trade-offs mean however that normative choices are needed, as there is not one type of high-growth firm that performs better than the others on all dimensions for all stakeholders. In addition to developing an ecosystem that supports specific types of high-growth firms, policymakers could consider other interventions. For example, legal instruments could be developed to support employee ownership or a specific legal class could be created for companies with both financial and social goals. Policymakers might even go as far as obliging companies to take into account certain stakeholders. Such a policy proposal is currently being developed at the EU level but has been met with a lot of resistance from companies (van Lonkhuyzen & van de Wiel, 2023).

All in all, the entrepreneurial ecosystem concept is a useful policy tool, especially when combined with empirical data. Although it is not a simple concept to work with, considering aspects such as interdependencies and feedback effects, it holds great promise for stimulating regional development. When designing policy, it is important to carefully consider what the envisaged output and outcomes of the ecosystem are. Different outcomes (e.g. sustainability) likely require different types of entrepreneurial output (e.g. sustainable enterprises) and the type of output determines what kind of support is needed from the ecosystem.

5.5 Limitations and future research

Since research based on empirical, and especially quantitative, data on entrepreneurial ecosystems is still relatively scarce, this dissertation investigated how data can be used to develop the entrepreneurial ecosystem concept. However, the studies are not without limitations and there are still ample of opportunities for future research in this field.

While we attempted to create indicators for all ecosystem elements in Chapter 2, measurement of entrepreneurial ecosystems remains challenging. This is partly the case because of the limited availability of data on the regional level and even more so on smaller geographical levels (e.g. a city), which might be more closely aligned with the relevant area of the entrepreneurial ecosystem. Moreover, some elements of the entrepreneurial ecosystem are especially hard to capture. For example, it is difficult to accurately measure the elements of networks and leadership, since these are social structures and one would ideally create measures based on surveys or perhaps social media data. Doing so for all regions in Europe does present quite a challenge, but new developments in the field of web-scraping might prove useful. As alluded to earlier, there is also no perfect measure of entrepreneurial output yet. The databases we used are likely not covering the business population in every country to the same degree and may be biased towards firms funded with venture-capital. Recently, some advances in measuring high-growth firms at the regional level have been made for the European Union (see e.g. Coad et al., 2023). Having more reliable data on entrepreneurial outputs could help to study the performance of entrepreneurial ecosystems in more detail.

With the collected data we composed an index to have one measure of ecosystem quality. We did so in different ways but the methods we employed were relatively simple. More complex methods of index making are available which might more accurately capture the systemic nature of entrepreneurial ecosystems (see e.g. Greco et al., 2019; OECD, 2008b). Further research could refine the entrepreneurial ecosystem index by using weighting of different elements or allowing for a certain degree of substitutability between elements.

Several methods were used to study interdependencies within entrepreneurial ecosystems. The very high correlations between elements showed that this is an important aspect of entrepreneurial ecosystems. This and other complex system aspects, such as feedback effects, make it difficult to use standard econometric methods to study entrepreneurial ecosystems. QCA does allow for strong correlations and goes some way towards solving this problem. However, the results of QCA cannot be interpreted as causal and we should therefore be careful in extrapolating these. Because of the statistical difficulties, many causal mechanisms in entrepreneurial ecosystems remain understudied (Wurth et al., 2022). Future research should address this with better longitudinal data and quasi-experimental research methods, such as a regression discontinuity design or difference-in-differences, or RCTs focused on specific ecosystem elements.

The connection between entrepreneurial outputs and societal wellbeing is important and sometimes taken for granted, but there is limited research in this area. Although there is a large literature on corporate social responsibility and social entrepreneurship, these two streams do not relate to startups and scale-ups which are too small to have a dedicated CSR policy and have no explicit social mission. Chapter 4 aimed to address this gap by giving some first exploratory evidence on high-growth firms. While this provides important

insights on potential mechanisms of value creation, the study is limited by the exclusive focus on CEOs and a relatively small sample that only covers the Netherlands. The research in this chapter is meant as a first step and the results should be verified in other contexts and with other stakeholders. Ideally, once these mechanisms are confirmed it would be good to create quantitative measures to capture the wellbeing impact of firms. Based on the performance on these measures, policymakers could better target policy interventions and decide which type of firms they want to support. While we focused on high-growth firms, it is also relevant to study the impact of other types of entrepreneurship. Although high-growth firms could have a large impact because of their fast growth, other types of firms might have distinct advantages in addressing specific societal problems.

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Appendices

I. Appendix chapter 2

Appendix I.A

Description of data

Table I.A1

Description of indicators and data sources

Element	Indicators	Measurement and description	Source	Geographical level	Year
Formal institutions	Quality of Governance indicators for Corruption, Impartiality, and Quality and accountability	Average of z-score for the three indicators (Corruption, Impartiality, and Quality and accountability) based on survey answers	Quality of Government Index	NUTS 2 NUTS 1 for BE, DE, EL, SE, and UK Country for IE and LT	2017
Formal institutions	Ease of doing business index	Index based on several dimensions: starting a business, dealing with permits,	World Bank Doing Business Report	Country	2015

		registering property, credit access, protecting investors, taxes, trade, contract enforcement and closing a business			
Entrepreneurship culture	Entrepreneurial motivation	Percentage of early stage entrepreneurs motivated by a desire to improve their income or a desire for independence	Global Entrepreneurship Monitor	Country	2014
Entrepreneurship culture	Cultural and social norms	The extent to which social and cultural norms encourage or allow actions leading to new business methods or activities that can potentially increase personal wealth and income. Rating: 1=highly insufficient, 5=highly sufficient	Global Entrepreneurship Monitor	Country	2014
Entrepreneurship culture	Innovative and creative	Percentage of respondents that agree to: it is important to think of new ideas and be creative	European Social Survey	NUTS 2 NUTS 1 for DE, UK	2008-2016

				Missing for FRM0, ITF2, LU00, MT00, PT20, PT30	
Entrepreneurship culture	Trust	Survey question on scale 0-1: Most people can be trusted	European Social Survey	NUTS 2 NUTS 1 for DE, UK Missing for FRM0, ITF2, LU00, MT00, PT20, PT30	2008-2016
Entrepreneurship culture robustness	Birth of new firms	Number of new firms per capita	Eurostat, OECD and national statistics offices	NUTS 2 NUTS 1 for DE and UK Country for EL	2010-2016
Networks	Innovative SMEs collaborating with others	Percentage of innovative SMEs in SME business population collaborating with others	RIS & EIS (for countries which are a	NUTS 2 NUTS 1 for BE, UK, FR, and AT	2016

			NUTS 2 region) (also available in RCI)		
Physical Infrastructure	Accessibility via road	Population accessible within 1h30 by road, as share of the population in a neighbourhood of 120 km radius	DG Regio (RCI)	NUTS 2	2016
Physical Infrastructure	Accessibility via rail	Population accessible within 1h30 by rail (using optimal connections), as share of the population in a neighborhood of 120 km radius	DG Regio (RCI)	NUTS 2	2014
Physical Infrastructure	Number of passenger flights	Daily number of passenger flights accessible in 90 min drive	Eurostat / Eurogeographics / National Statistical Institutes (RCI)	NUTS 2	2016
Physical Infrastructure	Household access to internet	Percentage of households with access to internet	Eurostat (RCI)	NUTS 2	2018

Finance	Venture capital	The average amount of venture capital for the last five years per capita	Invest Europe	NUTS 2	2014-2019
Finance	Credit constrained SMEs	Percentage of SMEs that is credit constrained because they either were rejected for loans or received less, or were discouraged to apply because it was too expensive or they expected to be turned down.	Investment Survey European Investment Bank	Country	2018
Leadership	The presence of actors taking a leadership role in the ecosystem	The number of coordinators on H2020 innovation projects per capita	CORDIS (Community Research and Development Information Service)	NUTS 2	2014-2019
Talent	Tertiary education	Percentage of total population that completed tertiary education	Eurostat	NUTS 2 NUTS 1 for BE, DE, and UK	2013

Talent	Lifelong learning	Percentage of population aged 25-64 participating in education and training	Eurostat	NUTS 2 NUTS 1 for BE, DE, and UK	2013
Talent	Business and entrepreneurship education	The extent to which training in creating or managing SMEs is incorporated within the education and training system The extent to which training in creating or managing SMEs is incorporated within the education and training system. Rating: 1=highly insufficient, 5=highly sufficient	Global Entrepreneurship Monitor	Country	2014
Talent	E-skills	Percentage of individuals in active population with high levels of e-skills	Eurostat	Country	2014
New knowledge	R&D expenditure	Intramural R&D expenditure as percentage of Gross Regional Product	Eurostat	NUTS 2	2015

Demand	Disposable income per capita	Net adjusted disposable household income in PPCS per capita (index EU average=100)	Eurostat	NUTS 2	2014
Demand	Potential market size in GRP	Index GRP PPS (EU population-weighted average=100)	Eurostat	NUTS 2	2016
Demand	Potential market size in population	Index population (EU average=100)	Eurostat	NUTS 2	2018
Intermediate services	Incubators	Percentage of incubators in total business population	Own data	NUTS 2	2019
Intermediate services	Knowledge intensive services	Percentage employment in knowledge-intensive market services	Eurostat	NUTS 2	2018
Productive entrepreneurship	Innovative new firms	Number of new firms registered in Crunchbase in the last five years per capita	Crunchbase	NUTS 2	2019

Productive entrepreneurship	High-value new firms (unicorns)	Absolute number of entrepreneurial firms valued above $1 billion founded in the last ten years	CB Insights & Dealroom	NUTS 2	2019

Appendix I.B

Methods

Table I.B1

Correlation table

	Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate	EE index add	EE index log	Crunchbase output
Culture	0.781****												
Networks	0.606****	0.457****											
Physical infrastructure	0.623****	0.596****	0.520****										
Finance	0.684****	0.657****	0.531****	0.761****									
Leadership	0.302****	0.329****	0.390****	0.461****	0.420****								
Talent	0.809****	0.693****	0.686****	0.586****	0.677****	0.455****							
Knowledge	0.463****	0.465****	0.406****	0.565****	0.633****	0.581****	0.452****						
Demand	0.469****	0.453****	0.439****	0.842****	0.661****	0.345****	0.348****	0.572****					
Intermediate	0.319****	0.359****	0.445****	0.592****	0.493****	0.653****	0.480****	0.441****	0.447****				
EE index add	0.796****	0.755****	0.729****	0.832****	0.836****	0.625****	0.802****	0.676****	0.699****	0.675****			
EE index log	0.801****	0.751****	0.709****	0.859****	0.856****	0.624****	0.805****	0.710****	0.736****	0.676****	0.985****		
Crunchbase output	0.461****	0.402****	0.469****	0.551****	0.497****	0.742****	0.617****	0.462****	0.359****	0.782****	0.696****	0.695****	
Unicorn output	0.170**	0.214***	0.127*	0.307****	0.364****	0.363****	0.269****	0.205****	0.258****	0.370****	0.351****	0.362****	0.401****

Note: *p<0.05; **p<0.01; ***p<0.001; ****p<0.0001

Fig. I.B1

Pairwise scatter plot of output and index with clusters of regions

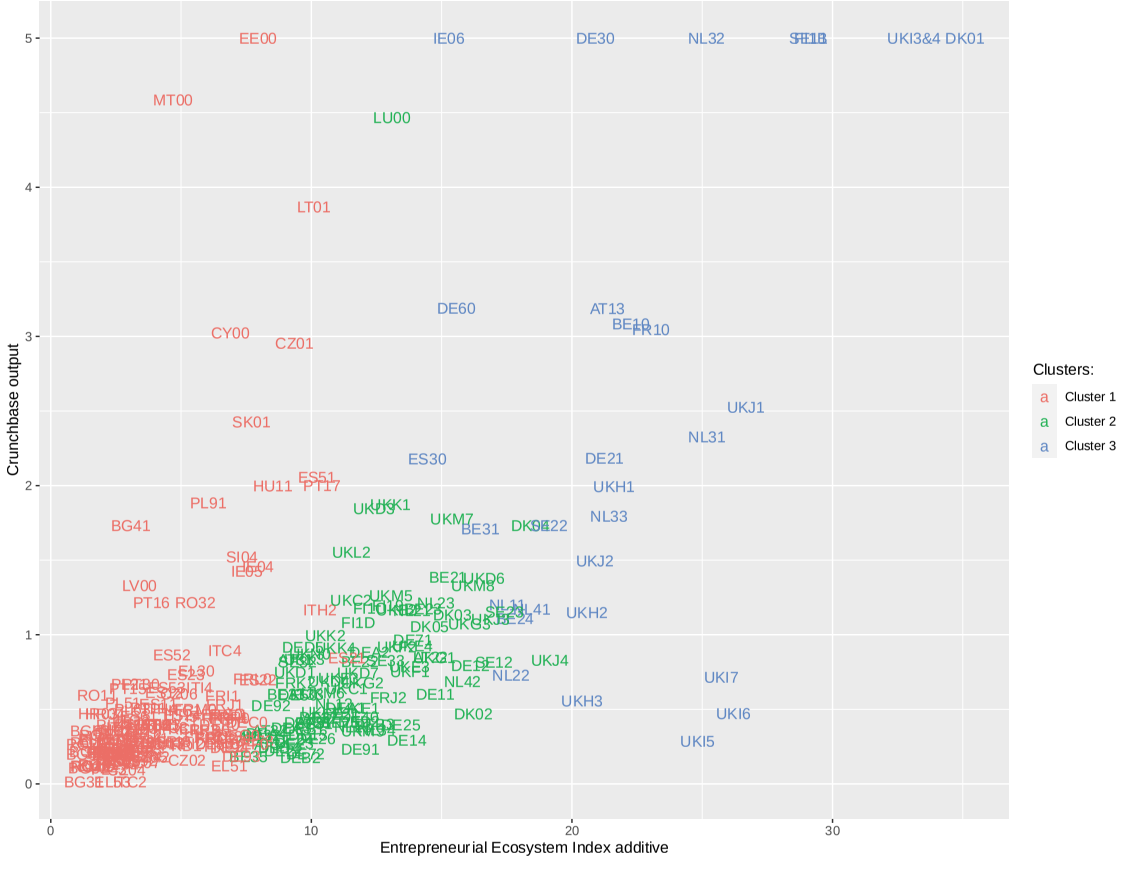

Table I.B2

Regression results of the additive and logarithmic index on the Crunchbase output variable including non-linear effects

	Crunchbase output			
	(1)	(2)	(3)	(4)
EE index additive	0.097***	0.013		
	(0.013)	(0.025)		
EE index additive squared		0.003***		
		(0.001)		
EE index logarithmic			0.076***	0.148***
			(0.009)	(0.024)
EE index logarithmic squared				0.006***
				(0.001)
Observations	272	272	272	272
R^2	0.378	0.415	0.283	0.385
Adjusted R^2	0.376	0.410	0.280	0.380
F Statistic	164.043*** (df = 1; 270)	95.339*** (df = 2; 269)	106.371*** (df = 1; 270)	84.062*** (df = 2; 269)

Notes: Clustered standard errors at country level in parentheses. * p<0.05 ** p<0.01 *** p<0.001

Table I.B3

Piecewise regression results of the additive and logarithmic index on the Dealroom output variable

	Dealroom output	
	(1)	(2)
EE index additive	0.057***	
	(0.015)	
Difference slope EE index additive	0.163***	
	(0.031)	
EE index log		0.042***
		(0.010)
Difference slope EE index log		0.544***
		(0.099)
Constant	0.239***	0.980***
	(0.079)	(0.136)
Observations	272	272
R2	0.447	0.477
Adjusted R2	0.441	0.472
F Statistic	72.262***(df=3;268)	81.605***(df=3;268)

Notes: Clustered standard errors at country level in parentheses.

* p<0.05 ** p<0.01 *** p<0.001

Table I.B4

Regression results of the additive and logarithmic index on the unicorn output variable.

This is an overdispersed count variable and hence we used a quasipoisson regression.

	Unicorn output	
	(1)	(2)
EE index additive	0.195***	
	(0.032)	
EE index logarithmic		0.358***
		(0.069)
Constant	-4.713***	-2.055***
	(0.645)	(0.393)
Observations	271	271
Dispersion parameter	0.959	0.924
R^2	0.240	0.274

Notes: Clustered standard errors at country level in parentheses.

*p<0.05; **p<0.01; ***p<0.001

Appendix I.C

Index robustness

As a first robustness test we do not execute any of the modifications outlined in section 2.3.16. This robustness test actually results in a higher R2 of 0.62 (Table I.C1). However, the results are now strongly influenced by the extreme values measured in several regions that we discussed in section 2.3.16. Therefore, we performed a second robustness test which follows the approach outlined in the methodology section but instead removes those regions with a value more than four standard deviations from the mean. This concerned Inner London (as a result of a high number of incubators, leadership, and Crunchbase firms), Braunschweig (as a result of the high R&D intensity) in Germany, and Hovedstaden (as a result of leadership) in Denmark (Table I.C2). Since we prefer not to discard observations of which the data is reliably measured, we also performed the regression with all observations after transforming the data. We transformed the data using the Tukey transformation (Tukey, 1957) for all the variables with a huge range of variation (standard deviations above 4), instead of only the output variable as we did in the main analysis (Table I.C3). The result of this transformation is a distribution of data which is close to a normal distribution, thus reducing the standard deviations from the variables with extreme values. Fourth, we used a categorical approach to create each of the index elements and the output by using quantiles to give each element a score from 1-10. The index then has a minimum value of 10 and maximum value of 100 (Table I.C4).

Furthermore, as discussed in section 2.4.3 we find that many of the top performing regions are regions in which a capital city is located (see Figure 2.4). To test whether the explanatory power of our index holds after controlling for the influence of capital cities on the output variable we run the regressions with a capital city indicator added, which is a dummy

variable indicating whether a region contains a capital city (no = 0, yes = 1). The results are displayed in Table I.C5 and indeed show that capital regions perform significantly better than non-capital regions ($p<0.001$). Nevertheless, the effect of the Entrepreneurial Ecosystem Index remains significant ($p<0.001$) and only shows a small decrease in coefficients. Next, we also performed a regression using the principal components discussed in section 2.4.1. This method does not build on the assumption that all ecosystem elements have equal weights and for PC1 we find highly similar outcomes as for our index (Table I.C6). Finally, we perform a regression in which we control for the GRP per capita, which is one of the existing measures we compared our index with in section 2.4.6. The results show that the regression with the index significantly outperforms the regression with only the GRP (Table I.C7). It is important to note that the GRP of a region is already included in our measure for demand. Nevertheless, it is only a small part of our index measure and we considered it important to test the robustness of our index when we control for economic development. In sum, the findings of all seven robustness tests are consistent with those presented in the main analysis, indicating the robustness of our chosen approach of calculating our index.

Table I.C1

Regression with no transformation of extreme values

	Crunchbase output	
	(1)	(2)
EE index additive	0.525***	
	(0.065)	
EE index logarithmic		0.504***
		(0.100)
Constant	-4.240***	6.636***
	(0.577)	(1.175)
Observations	272	272
R^2	0.619	0.049
Adjusted R^2	0.619	0.045
F Statistic	438.82*** (df = 1; 270)	13.85*** (df = 1; 270)

Notes: Clustered standard errors at country level in parentheses.

*p<0.05; **p<0.01; ***p<0.001

Table I.C2

Regression excluding observations with extreme values

	Crunchbase output	
	(1)	(2)
EE index additive	0.051***	
	(0.017)	
EE index logarithmic		0.035**
		(0.011)
Constant	-0.108	0.559***
	(0.115)	(0.119)
Observations	269	269
R^2	0.152	0.089
Adjusted R^2	0.149	0.086
F Statistic	47.77*** (df = 1; 267)	26.19*** (df = 1; 267)

Notes: Clustered standard errors at country level in parentheses.

*p<0.05; **p<0.01; ***p<0.001

Table I.C3

Regression including Tukey transformation to variables with extreme values

	Crunchbase output	
	(1)	(2)
EE index additive	0.096***	
	(0.004)	
EE index logarithmic		0.071***
		(0.005)
Constant	-0.066	1.210***
	(0.060)	(0.052)
Observations	272	272
R^2	0.383	0.266
Adjusted R^2	0.381	0.264
F Statistic	167.87*** (df = 1; 270)	98.03*** (df = 1; 270)

Notes: Clustered standard errors at country level in parentheses.

*p<0.05; **p<0.01; ***p<0.001

Table I.C4

Regression with categorical calculation of the index

	Crunchbase output
	(1)
Categorical Index	0.092***
	(0.007)
Constant	0.471
	(0.413)
Observations	272
R^2	0.477
Adjusted R^2	0.475
F Statistic	245.98*** (df = 1; 270)

Notes: Clustered standard errors at country level in parentheses.

*p<0.05; **p<0.01; ***p<0.001

Table I.C5

Regression with dummies for capital cities

	Crunchbase output	
	(1)	(2)
EE index additive	0.078***	
	(0.009)	
EE index logarithmic		0.059***
		(0.006)
Capital city	0.930**	1.141***
	(0.274)	(0.283)
Constant	0.039	1.065***
	(0.100)	(0.092)
Observations	272	272
R^2	0.456	0.410
Adjusted R^2	0.452	0.406
F Statistic	112.89*** (df = 2; 269)	93.53*** (df = 2; 269)

Notes: Clustered standard errors at country level in parentheses.

*p<0.05; **p<0.01; ***p<0.001

Table I.C6

Regression with principal components

	Crunchbase output		
	(1)	(2)	(3)
Principal Component 1	0.289***	0.289***	0.289***
	(0.043)	(0.025)	(0.025)
Principal Component 2		0.394***	0.394***
		(0.001)	(0.001)
Principal Component 3			0.133***
			(0.009)
Constant	0.852***	0.852***	0.852***
	(0.092)	(0.025)	(0.025)
Observations	272	272	272
R^2	0.360	0.551	0.572
Adjusted R^2	0.357	0.548	0.567
F Statistic	151.61*** (df = 1; 270)	165.122*** (df = 2; 269)	119.46*** (df = 3; 268)

Notes: Clustered standard errors at country level in parentheses.

** p<0.05 ** p<0.01 *** p<0.001*

Table I.C7

Regression with GRP as a control variable

	Crunchbase output		
	(1)	(2)	(3)
EE index additive		0.074***	
		(0.018)	
EE index logarithmic			0.043***
			(0.014)
GRP per capita	0.015***	0.006**	0.009***
	(0.002)	(0.004)	(0.004)
Constant	-0.607***	-0.379	0.271
	(0.181)	(0.194)	(0.356)
Observations	273	271	271
R^2	0.281	0.400	0.326
Adjusted R^2	0.279	0.396	0.321
F Statistic	106.17*** (df = 1; 271)	89.362*** (df = 2; 268)	64.81*** (df = 2; 268)

Notes: Clustered standard errors at country level in parentheses.

$^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

II. Appendix chapter 3

Appendix II.A

Data description

Table II.A1

Description of indicators and data sources

Element	Indicators	Measurement and description	Source	Geographical level	Year
Formal institutions	Quality of Governance indicators for Corruption, Impartiality, and Quality and accountability	Average of z-score for the three indicators (Corruption, Impartiality, and Quality and accountability) based on survey answers	Quality of Government Index	NUTS 2 NUTS 1 for BE, DE, EL, SE, and UK Country for IE and LT	2017

Formal institutions	Ease of doing business index	Index based on several dimensions: starting a business, dealing with permits, registering property, credit access, protecting investors, taxes, trade, contract enforcement and closing a business	World Bank Doing Business Report	Country	2015
Entrepreneurship culture	Entrepreneurial motivation	Percentage of early-stage entrepreneurs motivated by a desire to improve their income or a desire for independence	Global Entrepreneurship Monitor	Country	2014
Entrepreneurship culture	Cultural and social norms	The extent to which social and cultural norms encourage or allow actions leading to new business methods or activities that can potentially increase personal wealth and income. Rating: 1=highly insufficient, 5=highly sufficient	Global Entrepreneurship Monitor	Country	2014
Entrepreneurship culture	Innovative and creative	Survey question on scale 0-5: it is important to think of new ideas and be creative	European Social Survey	NUTS 2 NUTS 1 for DE, UK	2008-2016

				Missing for FRM0, ITF2, LU00, MT00, PT20, PT30	
Entrepreneurship culture	Trust	Survey question on scale 0-10: Most people can be trusted	European Social Survey	NUTS 2 NUTS 1 for DE, UK Missing for FRM0, ITF2, LU00, MT00, PT20, PT30	2008-2016
Networks	Innovative SMEs collaborating with others	Percentage of innovative SMEs in SME business population collaborating with others	RIS & EIS (for countries which are a NUTS 2 region) (also available in RCI)	NUTS 2 NUTS 1 for BE, UK, FR, and AT	2016

Physical Infrastructure	Accessibility via road	Population accessible within 1h30 by road, as share of the population in a neighborhood of 120 km radius	DG Regio (RCI)	NUTS 2	2016
Physical Infrastructure	Accessibility via rail	Population accessible within 1h30 by rail (using optimal connections), as share of the population in a neighborhood of 120 km radius	DG Regio (RCI)	NUTS 2	2014
Physical Infrastructure	Number of passenger flights	Daily number of passenger flights accessible in 90 min drive	Eurostat / Eurogeographics / National Statistical Institutes (RCI)	NUTS 2	2016
Physical Infrastructure	Household access to internet	Percentage of households with access to internet	Eurostat (RCI)	NUTS 2	2018
Finance	Venture capital	The average amount of venture capital for the last five years per capita	Invest Europe	NUTS 2	2014-2019

Finance	Credit constrained SMEs	Percentage of SMEs that is credit constrained because they either were rejected for loans or received less, or were discouraged to apply because it was too expensive or they expected to be turned down.	Investment Survey European Investment Bank	Country	2018
Leadership	The presence of actors taking a leadership role in the ecosystem	The number of coordinators on H2020 innovation projects per capita	CORDIS (Community Research and Development Information Service)	NUTS 2	2014-2019
Talent	Tertiary education	Percentage of total population that completed tertiary education	Eurostat	NUTS 2 NUTS 1 for BE, DE, and UK	2013

Talent	Lifelong learning	Percentage of population aged 25-64 participating in education and training	Eurostat	NUTS 2 NUTS 1 for BE, DE, and UK	2013
Talent	Business and entrepreneurship education	The extent to which training in creating or managing SMEs is incorporated within the education and training system. Rating: 1=highly insufficient, 5=highly sufficient	Global Entrepreneurship Monitor	Country	2014
Talent	E-skills	Percentage of individuals in active population with high levels of e-skills	Eurostat	Country	2014
New knowledge	R&D expenditure	Intramural R&D expenditure as percentage of Gross Regional Product	Eurostat	NUTS 2	2015
Demand	Disposable income per capita	Net adjusted disposable household income in PPCS per capita (index EU average=100)	Eurostat	NUTS 2	2014
Demand	Potential market size in GRP	Index GRP PPS (EU population-weighted average=100)	Eurostat	NUTS 2	2016

Demand	Potential market size in population	Index population (EU average=100)	Eurostat	NUTS 2	2018
Intermediate services	Incubators	Number of incubators per capita	Crunchbase	NUTS 2	2019
Intermediate services	Knowledge intensive services	Percentage employment in knowledge-intensive market services	Eurostat	NUTS 2	2018
Productive entrepreneurship	Innovative new firms	Number of new firms registered in Crunchbase in the last five years per capita	Crunchbase	NUTS 2	2019
Productive entrepreneurship	High-value new firms (unicorns)	Absolute number of entrepreneurial firms valued above $1 billion founded in the last ten years	CB Insights & Dealroom	NUTS 2	2019

Table II.A2

Descriptive statistics

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Formal institutions	272	0.992	0.803	0.098	0.311	1.680	3.497
Culture	272	0.985	1.070	0.026	0.321	1.170	5.000
Networks	272	0.984	1.147	0.117	0.262	1.213	5.000
Physical infrastructure	272	0.907	1.060	0.058	0.276	1.043	5.000
Finance	272	0.993	0.823	0.053	0.386	1.365	5.000
Leadership	272	0.704	1.112	0.181	0.207	0.534	5.000
Talent	272	0.960	0.958	0.072	0.241	1.322	5.000
Knowledge	272	0.724	1.032	0.109	0.220	0.644	5.000
Demand	272	1.003	0.932	0.032	0.334	1.430	4.761
Intermediate	272	0.682	0.984	0.082	0.205	0.597	5.000
Unicorn	272	0.180	1.052	0	0	0	15
Crunchbase output	272	0.852	1.020	0.014	0.287	0.920	5.000

Appendix II.B

Conditions

We use the ten ecosystem elements as conditions (input variables) for the QCA. Even though this number of conditions is higher than usual and makes the solution space relatively complex, it still falls within the methodologically sound range (see Marx, Cambre and Rihoux 2013). It is not uncommon in large-N studies to perform QCA with a relatively high number of conditions (see e.g. Gilbert and Campbell (2015) and Meuer et al. (2015)). All ten elements of the framework are included as conceptually they are all important for explaining entrepreneurial outcomes. Moreover, the systemic nature of the entrepreneurial ecosystem necessitates to analyze these elements together to capture the interdependencies that have so far not been uncovered. While all of these elements are positively correlated, there are no clear higher order constructs which can be used to reduce the number of conditions.

Calibration

Calibrating membership scores requires setting an exclusion threshold, crossover point and inclusion threshold. These thresholds should ideally be chosen based on theoretical arguments or empirical findings in previous studies. However, the existing literature does not provide clear cutoff points based on either theory or empirics for what should be considered high and low scores of an element. As the data is mostly taken from studies conducted by the European Union, such as the Regional Ecosystem Scoreboard (Léon et al., 2016), which have only been recently initiated, it is also difficult to compare the data with historical averages or other countries. Therefore, in line with previous studies (Alves et al., 2021; Ault and Spicer, 2020; Fiss, 2011; Vedula and Fitza, 2019), sample statistics are used to determine the thresholds. More specifically, the 25^{th}, 50^{th} and 75^{th} percentile of

the sample distribution are respectively the exclusion, crossover and inclusion threshold.[29] These thresholds are used for both the outcome and conditions. The use of sample statistics to calculate the thresholds means that regions are assessed relative to each other. A region is thus only considered a member of a condition if it scores good on this element compared to the other regions in the sample. For an overview of the thresholds and other descriptive statistics of the data, see Table II.A2. A visual inspection of the calculated membership scores reveals that most scores are concentrated around 0 and 1. This has to do with the large variation in the data, which means that a lot of regions are actually quite far below or above the $25^{th}/75^{th}$ percentile. However, there is still a substantial group with scores between 0 and 1, which means the fuzzy calibration procedure does add meaningful information.

The use of sample statistics to determine the thresholds for the configuration of the QCA is not ideal, although quite common in current literature (see e.g. Ault and Spicer (2020)). It would be preferable to base thresholds on previous empirical evidence or theoretical arguments, to ensure cases are not compared relative to each other but relative to some external threshold. When more rounds of data become available, it would be possible to determine thresholds based on historical data.

[29] Another common method to determine the thresholds is to use the median and standard deviations. However, this is not feasible in this dataset. As explained in Chapter 2, the variation in the data is very large, mainly because the data distribution has a long right tail. This causes very high standard deviations and would thus translate into very low exclusion and high inclusion thresholds.

Appendix II.C

Necessary conditions

The results of the analysis of necessary conditions for both high-performing (top 25% Crunchbase firms) and very high-performing (top 10% Crunchbase firms) ecosystems are shown in Table II.C1. The conventional consistency threshold for necessary conditions is 0.9 (Schneider and Wagemann, 2012). There are two necessary conditions that pass the threshold for the very high-performing ecosystems (shown in bold): leadership and intermediate services. So whenever regions exhibit very high levels of entrepreneurship output they almost always (as consistency is not exactly 1) have a strong presence of leadership and intermediate services. The coverage, which measures the empirical relevance of the conditions, of these two elements is just above 0.5, showing it covers more than half of the outcome set. In general, all elements have high consistency scores which already provides some evidence that these elements are important, although not strictly necessary, for entrepreneurship. A similar analysis with the absence of conditions as input and another to find necessary conditions for the absence of (very) high levels of entrepreneurship output did not show any conditions that passed the 0.9 consistency threshold.

The results of the necessary condition analysis showed that leadership and intermediate services are central elements of successful entrepreneurial ecosystems. In earlier research, key roles were attributed to knowledge production, market dynamism and entrepreneurship culture (Corrente et al., 2019; Muñoz et al., 2020; Vedula and Fitza, 2019). We do not replicate this result in our paper, possibly because different ecosystem elements were included. The key positions of leadership and intermediate services in our analysis seem to resonate with the importance attributed to networks in entrepreneurial ecosystems and how

leaders and incubators can help to shape these (Knox and Arshed, 2021; Rocha et al., 2021; van Rijnsoever, 2020). This finding provides a first indication that some elements may be more important than others and it may pay off to focus on developing these first.

Table II.C1

Necessary conditions Crunchbase firms

	Top 25%		**Top 10%**	
Element	*Consistency*	*Coverage*	*Consistency*	*Coverage*
Formal institutions	0.699	0.681	0.744	0.399
Culture	0.666	0.671	0.720	0.400
Networks	0.690	0.710	0.739	0.419
Physical infrastructure	0.685	0.698	0.794	0.446
Finance	0.719	0.696	0.797	0.426
Leadership	0.788	0.800	**0.940**	**0.526**
Talent	0.770	0.737	0.822	0.433
Knowledge	0.679	0.685	0.781	0.435
Demand	0.643	0.648	0.709	0.394
Intermediate services	0.809	0.818	**0.964**	**0.537**

Note: conditions that pass the 0.9 consistency threshold are shown in bold.

Appendix II.D

Truth tables

Table II.D1

Truth table top 25% Crunchbase firms

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Crunchbase firms	N	Cons	PRI	Cases
1	1	1	1	1	1	1	1	1	1	1	22	0.969	0.958	DE30, DK01,FI1B,FR10,NL32,NL11,NL21, NL22, NL31, NL33, NL41, NL42, UKH2, UKI3&4,UKD7,UKG3,UKH1,UKJ1,UKJ2, UKJ3, UKK1, UKM7
1	1	1	1	1	1	1	0	0	1	1	4	0.958	0.914	DK02,IE06,UKC2,UKK4

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Crunchbase firms	N	Cons	PRI	Cases
1	1	1	0	1	1	1	1	0	1	1	4	0.957	0.925	DK05, EE00,FI1D,UKM5
0	0	1	1	1	1	0	1	1	1	1	5	0.932	0.871	BE24,BE31,BE21,BE23,BE33
1	1	0	1	1	1	1	1	1	1	1	4	0.927	0.864	DE11, DE60, DE71,SE11
1	1	1	0	1	0	1	0	0	1	1	4	0.880	0.691	SE31,SE32,UKD1,UKK3
1	1	1	1	1	0	1	1	1	1	1	7	0.877	0.744	NL23, UKH3, UKI5,UKI6,UKI7,UKD6,UKG1
0	0	0	1	0	1	0	1	1	1	1	4	0.856	0.684	ITC1,ITC3,ITI4,PL91
0	0	0	0	0	1	1	0	0	0	1	4	0.812	0.513	PT15,PT16,PT18,PT30
1	1	1	1	1	0	1	0	1	1	0	4	0.787	0.541	NL12, NL13, NL34, UKJ4

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Crunchbase firms	N	Cons	PRI	Cases
1	1	1	1	1	0	0	1	1	0	0	4	0.613	0.031	DE27, DEA5, DEB2, DED4
1	1	0	1	1	1	0	1	1	0	0	5	0.584	0.123	DE24, DE25, DE26, DEB3, DEG0
0	0	0	0	0	0	0	0	0	1	0	7	0.522	0.138	HR03,ITF1,ITF3,ITF4,ITG1,ITI3,PL63
0	0	0	0	0	0	0	1	0	0	0	4	0.481	0.094	CZ03,HU33,PL21,PL92
0	0	0	0	0	0	0	0	0	0	0	44	0.214	0.039	BG31, BG32, BG33, BG34, BG42, CZ04,CZ08,EL54,EL62,EL64, EL65,ES43,ES70,HR04,HU21,HU22, HU23, HU31,

														HU32,ITF2,ITF6,PL41,PL42,PL43,PL51,PL52,PL61,PL62,PL71,PL72,PL81,PL82,PL84,PT20,RO11,RO12,RO21,RO22,RO31,RO41,RO42,SK02,SK03,SK04

Table II.D2

Truth table top 10% Crunchbase firms

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Crunchbase firms	N	Cons	PRI	Cases
1	1	1	1	1	1	1	1	1	1	1	22	0.819	0.687	DE30, DK01, FI1B,FR10,NL32,NL11,NL21,NL22,NL31, NL33, NL41, NL42, UKH2, UKI3&4,UKD7,UKG3,UKH1,UKJ1,UKJ2, UKJ3, UKK1, UKM7
1	1	1	0	1	1	1	1	0	1	0	4	0.799	0.500	DK05, EE00,FI1D,UKM5
1	1	1	1	1	1	1	0	0	1	0	4	0.789	0.431	DK02,IE06,UKC2,UKK4

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Crunchbase firms	N	Cons	PRI	Cases
0	0	1	1	1	1	0	1	1	1	0	5	0.787	0.541	BE24,BE31,BE21,BE23,BE33
1	1	0	1	1	1	1	1	1	1	0	4	0.738	0.535	DE11, DE60, DE71,SE11
1	1	1	1	1	0	1	1	1	1	0	7	0.603	0.177	NL23, UKH3, UKI5, UKI6, UKI7, UKD6, UKG1
0	0	0	1	0	1	0	1	1	1	0	4	0.598	0.281	ITC1,ITC3,ITI4,PL91
1	1	1	0	1	0	1	0	0	1	0	4	0.529	0.005	SE31,SE32,UKD1,UKK3
1	1	1	1	1	0	1	0	1	1	0	4	0.505	0.05	NL12, NL13, NL34, UKJ4
0	0	0	0	0	1	1	0	0	0	0	4	0.43	0.07	PT15,PT16,PT18,PT30
1	1	1	1	1	0	0	1	1	0	0	4	0.314	0.000	DE27, DEA5, DEB2, DED4

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Crunchbase firms	N	Cons	PRI	Cases
1	1	0	1	1	1	0	1	1	0	0	5	0.304	0.001	DE24, DE25, DE26, DEB3, DEG0
0	0	0	0	0	0	0	0	0	1	0	7	0.258	0.045	HR03,ITF1,ITF3,ITF4,ITG1,ITI3,PL63
0	0	0	0	0	0	0	1	0	0	0	4	0.229	0.000	CZ03, HU33, PL21,PL92
0	0	0	0	0	0	0	0	0	0	0	44	0.068	0.001	BG31, BG32, BG33, BG34, BG42, CZ04,CZ08,EL54,EL62,EL64,EL65, ES43,ES70,HR04,HU21,HU22,HU23, HU31, HU32,ITF2,ITF6,PL41,PL42,

														PL43,PL51,PL52,PL61,PL62,PL71,PL72,PL81,PL82,PL84,PT20,RO11,RO12,RO21,RO22,RO31,RO41,RO42,SK02,SK03,SK04

Appendix II.E

Table II.E1

Overview of all regions in the top 25% Crunchbase output

Regions ranked according to Crunchbase output	**Membership in configurations**			
Top 25% (top 10% underlined)	**Talent-Leadership**	**Talent-Institutions**	**Knowledge-Leadership**	**Knowledge-Institutions**
DE30			X	X
DK01			X	X
EE00	X	X		
FI1B			X	X
IE06	X	X		
NL32			X	X
SE11			X	
UKI3&4			X	X
MT00				
LU00				
LT01				
DE60			X	
AT13				
BE10				
FR10			X	X
CY00				
CZ01				
UKJ1			X	X
SK01				
NL31			X	X
DE21				
ES30				
ES51				
PT17				
HU11				
UKH1			X	X
PL91			X	
UKK1			X	X
UKD3				
NL33			X	X
UKM7			X	X
SE22				

DK04				
BG41				
BE31			X	
UKL2				
SI04				
UKJ2			X	X
IE04				
IE05				
BE21			X	
UKD6				X
LV00				
UKM8				
UKM5	X	X		
UKC2	X	X		
PT16	X			
RO32				
NL23				X
NL11			X	X
FI19				
FI1C				
BE23			X	
NL41			X	X
UKE2				
ITH2				
NL21			X	X
SE23				
UKH2			X	X
DK03				
BE24			X	
UKJ3			X	X
FI1D	X	X		
UKG3			X	X
DK05	X	X		
UKK2				
DE71			X	
UKE4				

Appendix II.F

Post-hoc analysis of configurations

Table II.F1

Talent-Leadership

	Other (N=261)	Talent-Leadership (N=11)
Population		
Mean (SD)	1900 (1540)	1130 (697)
Median [Min, Max]	1520 [127, 12100]	1170 [256, 2310]
Density		
Mean (SD)	428 (1060)	127 (95.6)
Median [Min, Max]	134 [3.40, 10900]	89.5 [6.40, 320]
GDP per capita		
Mean (SD)	96.2 (35.7)	98.4 (36.9)
Median [Min, Max]	91.3 [29.4, 262]	84.1 [66.5, 185]

Notes: Population in thousands, density is persons per square kilometer, GDP in thousands of euros. All data refers to 2016 and was obtained from Eurostat. Only regions that are both in the configuration and the outcome set are included.

Table II.F2

Talent-Institutions

	Other (N=261)	Talent-Institutions (N=11)
Population		
Mean (SD)	1900 (1540)	988 (586)
Median [Min, Max]	1530 [127, 12100]	827 [371, 2310]
Density		
Mean (SD)	429 (1060)	104 (79.4)
Median [Min, Max]	134 [3.40, 10900]	76.0 [5.30, 260]
GDP per capita		
Mean (SD)	96.0 (35.8)	102 (35.2)
Median [Min, Max]	90.3 [29.4, 262]	89.4 [69.0, 185]

Notes: Population in thousands, density is persons per square kilometer, GDP in thousands of euros. All data refers to 2016 and was obtained from Eurostat. Only regions that are both in the configuration and the outcome set are included.

Table II.F3

Knowledge-Leadership

	Other (N=238)	Knowledge-Leadership (N=34)
Population		
Mean (SD)	1740 (1320)	2740 (2350)
Median [Min, Max]	1400 [127, 8400]	2130 [398, 12100]
Density		
Mean (SD)	317 (795)	1100 (1950)
Median [Min, Max]	117 [3.40, 7450]	506 [149, 10900]
GDP per capita		
Mean (SD)	91.0 (33.3)	133 (30.7)
Median [Min, Max]	85.4 [29.4, 262]	129 [80.7, 205]

Notes: Population in thousands, density is persons per square kilometer, GDP in thousands of euros. All data refers to 2016 and was obtained from Eurostat. Only regions that are both in the configuration and the outcome set are included.

Table II.F4

Knowledge-Institutions

	Other (N=244)	Knowledge-Institutions (N=28)
Population		
Mean (SD)	1810 (1430)	2350 (2090)
Median [Min, Max]	1460 [127, 10000]	1960 [404, 12100]
Density		
Mean (SD)	300 (722)	1420 (2240)
Median [Min, Max]	118 [3.40, 7450]	511 [149, 10900]
GDP per capita		
Mean (SD)	92.3 (34.4)	131 (28.1)
Median [Min, Max]	87.1 [29.4, 262]	128 [80.7, 177]

Notes: Population in thousands, density is persons per square kilometer, GDP in thousands of euros. All data refers to 2016 and was obtained from Eurostat. Only regions that are both in the configuration and the outcome set are included.

Appendix II.G

Unicorn Analysis

European unicorn firms are used as a second and slightly different measure of productive entrepreneurship. This provides a robustness test for the results with Crunchbase firms as output measure. Unicorn firms are private (not stock listed) companies with a valuation of more than $1 billion. The emergence of unicorn firms is very rare but is a great example of Schumpeterian entrepreneurship (Henrekson and Sanandaji, 2020). Moreover, a unicorn firm can be seen as a specific type of blockbuster entrepreneurship, which is important for an ecosystem as it can generate many positive externalities (Mason and Brown 2014). Nevertheless, the contribution of unicorns to economic output and growth has been debated (Aldrich and Ruef, 2018), and is likely to differ per type of unicorn. For example, unicorn firms with widespread employee stock options are more likely to act as a catalyst of entrepreneurial ecosystem development, than unicorn firms with concentrated ownership, or foreign ownership. Data was collected from CB Insights which keeps a list of current unicorn firms globally (CB Insights, 2020). As these are so rare, all firms that acquired unicorn status and were founded in the last ten years were included. The historical data was collected by scraping data from historical web pages of the internet archive and cross-checking this with Dealroom data (Dealroom, 2020).[30] The unicorn firms were matched to the NUTS 2 region where the headquarters of the firm are located.

Since unicorn firms are only present in a handful of regions, it is not meaningful to use percentiles to calibrate membership in this outcome set. Nevertheless, there is a large range (0-15) in the number of unicorns per region, which needs to be reflected in the analysis. To

[30] The data from Dealroom is very similar to the Crunchbase data. It was used because Dealroom keeps a list of all European unicorns.

allow for differences in degree of membership, a fuzzy set QCA is applied with 0 as the exclusion, 0.1 as the crossover and 1.1 as the inclusion threshold. These thresholds are set like this to ensure that only regions with more than one unicorn are considered full members of the outcome set and regions with one unicorn are partial members of the outcome set. Even with these low membership thresholds, the membership in the outcome set is very skewed which leads to several analytical problems (Schneider and Wagemann, 2012). While it is still possible to analyze necessary conditions for unicorn firms, it is not possible to find sufficient configurations (also called solutions). This is the case because almost every configuration with a unicorn region will also contain regions without a unicorn, therefore such a configuration does not pass the normally applied consistency threshold (see section 3.4.3 for explanation of this measure). The simultaneous membership of regions with and without the outcome in a configuration also presents problems with simultaneous subset relations. Therefore, for the unicorn firms only the necessary condition analysis is conducted and a short discussion of the configurations of regions with unicorn firms is provided.

Table II.G1 shows the analysis of necessary conditions. Four of the ten elements pass the consistency threshold of 0.9 (shown in bold) with some other elements, especially infrastructure, also being very close to 0.9. Almost all regions with one or more unicorns thus have a strong presence of finance, leadership, talent and intermediate services. The necessity of finance may not be surprising as this includes a measure of venture capital and unicorns are almost always backed by a venture capital investor. In the previous analyses, we saw that leadership and intermediate services are also elements necessary to produce a very high number of Crunchbase firms (see Table II.C1) and talent and intermediate services are core conditions in the sufficient configurations (see Table 3.2). These elements are thus characteristic for outstanding entrepreneurial ecosystems.

Table II.G1

Necessary conditions unicorns

Element	Consistency	Coverage
Formal institutions	0.814	0.177
Culture	0.857	0.192
Networks	0.764	0.175
Physical infrastructure	0.889	0.201
Finance	**0.913**	**0.197**
Leadership	**0.928**	**0.210**
Talent	**0.905**	**0.193**
Knowledge	0.824	0.185
Demand	0.870	0.195
Intermediate services	**0.928**	**0.209**

Note: conditions that pass the 0.9 consistency threshold are shown in bold.

There are twenty regions in Europe with at least one unicorn, an excerpt from the truth table presented below (Table II.G2) shows that these regions are a member of ten different configurations in total. This variation in configurations supports the earlier results. While the largest group of regions (9) has all elements on a high level, there are many regions that lack at least one element. Some regions such as Oberbayern in Germany and Catalonia in Spain even have multiple elements (2 and 3 respectively) missing but still produced respectively 3 and 2 unicorns in the last ten years. In sum, the analysis of unicorns indicates the robustness of the earlier results to a change in the outcome measure of productive entrepreneurship.

Table II.G2

Modified excerpt from truth table unicorns (only cases with unicorns included)

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Unicorns	N	Cases
1	1	1	1	1	1	1	1	1	1	32	9	DE30 (Berlin), NL41 (Noord-Brabant), UKH1 (East Anglia), UKJ2 (Surrey, East and West Sussex), NL32 (Noord-Holland), UKI3&4 (Inner London), UKK1 (Gloucestershire, Wiltshire, Bristol/Bath), FR10 (Ile-de-France), NL31 (Utrecht)
1	0	1	1	1	1	1	1	1	1	2	1	AT13 (Vienna)
1	1	0	1	1	1	1	1	1	1	4	2	SE11 (Stockholm), DE60 (Hamburg)
1	1	0	1	1	1	0	1	1	1	3	1	DE21 (Oberbayern)
1	1	1	1	1	1	1	0	0	1	2	1	IE06 (Eastern and Midland)
0	0	0	1	1	1	1	1	1	1	2	1	ES51 (Catalonia)
0	1	0	1	1	1	1	1	1	1	1	1	ES30 (Madrid)
0	1	1	1	1	1	1	0	1	1	1	1	LU00 (Luxembourg)
1	1	1	0	1	1	1	1	0	1	1	1	EE00 (Estonia)

Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand	Intermediate services	Unicorns	N	Cases
1	1	1	1	1	1	1	0	1	0	1	1	UKC1 (Tees Valley and Durham)

Appendix II.H

Sensitivity analysis

Decisions on specific parameters of the QCA analysis were based on theory or current best practice (Schneider and Wagemann, 2012). To make sure the results do not crucially depend on one particular decision, several sensitivity analyses have been conducted. For these robustness checks the frequency threshold, the consistency threshold and the calibration of the membership scores were varied.

In the main analysis the frequency threshold was set at four regions to study common configurations among regions, while not examining every existing configuration in Europe in detail. When one lowers this threshold the number of solutions increases sharply, as almost every specific ecosystem configuration is included in the logical minimization process. The opposite occurs when one raises the threshold to five regions. Nevertheless, the main result is not affected by changing the frequency threshold as the results still show different possible configurations for top 25% Crunchbase firms, which largely overlap with those shown in Table 3.2. When the frequency threshold is lowered for the analysis of top 10% Crunchbase firms, the number of configurations increases as discussed in the main text and shown in Table II.H1.

Varying the consistency threshold from 0.8 to 0.7 or 0.9 does similarly not cause major changes in the results. While the number of solutions and the specific permutations vary somewhat, this does not change the interpretation of the results. However, the configuration in which demand is absent is not very robust and disappears when the consistency threshold is changed. On the other hand, configurations with explicit absence of formal institutions

and culture appear with a low consistency threshold. Another interesting observation is that when the consistency threshold is set at 0.9 for top 10% Crunchbase firms, there is no configuration that passes this consistency level and can thus be said to be sufficient for very high entrepreneurship. This indicates that there are some regions with a strong presence of the elements but without the corresponding high levels of entrepreneurship output. While these are exceptional cases (including Gelderland and Limburg in the Netherlands and the Liverpool area in the UK), it would be interesting to study these regions and investigate what inhibits them from being successful.

The calibration that was used in the main analysis was based on the 25th, 50th and 75th percentile. Robustness analyses were performed with more and less strict thresholds for membership by varying the exclusion, crossover and inclusion thresholds, but the solutions remain qualitatively similar. The only remarkable change is that with thresholds at the 20th, 50th and 80th percentile the absence of formal institutions and culture appear while the absence of demand disappears from the solution. An interesting variation is to set the thresholds for membership in the conditions the same as those for the outcome of the very high-performing ecosystem analysis (exclusion 50th, cross-over 75th and inclusion 90th percentile). The membership sets of the conditions thus become very exclusive, while the thresholds for the outcome are kept at the quartile levels. This results in none of the regions being a member of all the elements anymore and five different configurations in the truth table for top 25% Crunchbase firms. The solution shows that the core elements are formal institutions, talent and intermediate services.

Table II.H1

Solutions for top 10% Crunchbase firms (frequency cutoff 3)

	Knowledge	**Demand**
	1	2
Formal institutions	●	●
Culture	⬤	⬤
Networks	⬤	⬤
Physical infrastructure	⬤	⬤
Finance	●	●
Leadership	⬤	⬤
Talent	⬤	⬤
Knowledge	⬤	
Demand		⬤
Intermediate services	●	●
Consistency	0.819	0.822
PRI	0.687	0.698
Raw coverage	0.391	0.392
Unique coverage	0.044	0.046
Number of regions	25	25
Overall solution consistency	0.822	
Overall solution coverage	0.436	

Notes: Black circles are present conditions (●), white circles with a cross are absent conditions (⊗). Large circles indicate core conditions and small circles peripheral conditions. The absence of a circle indicates indifference for that condition. Solutions are grouped by their core conditions. All parameters are calculated with the intermediate solution term.

III. Appendix chapter 4

Table III.A1

Exemplary quotes for the objective, motivation for firm growth and dominant stakeholder(s) for each high-growth firm type.

	Mission-driven high-growth firm	**Conscious high-growth firm**	**Profit-driven high-growth firm**
Objective	What is our mission as a company? To save at least 40,000 tons of CO2 over the next four years by pushing plastic packaging out of the market. So, it's very focused on sustainability. Everything in this company and all of our research is also focused on sustainability. The idea, for example, of adding plastic to [product] is almost sacrilegious, it's not allowed, that's not our culture. So we focus on using as many natural ingredients as possible in our process, so renewable raw materials. (R19). Because we want to bring as many vulnerable groups as possible	Always driven by the philosophy of wanting to do cool things. Making as much impact on the world as possible, you know 'high impact, happy people'. That's why you have this company, that's the reason. (R13). So we've grown like that and why? Because, in my opinion, we do the right thing and we simply say we want the best for our customers: 'only the best' is our mission. And if we have the 'only the best' mentality for our customers and our employees, then it's also 'only the best' for	Yes, I don't really believe in all that esoteric nonsense about what is the purpose of your company? (...). I simply don't believe in it. You have a company, and as an entrepreneur, you see opportunities, and you want to seize them in a good way. (R12). No, that is truly the culture and ambition. We literally have 'grow, grow, grow' written on our wall, you know. So, no, and that has also been my personal ambition all along, to become as big as possible, to grow, create scale, diversify

	Mission-driven high-growth firm	Conscious high-growth firm	Profit-driven high-growth firm
	towards sustainable employment. (R7).	the owner, for the shareholders in this case. (R8).	internationally, spread out. (R2).
Motivation for firm growth	There are two roads to the solution, aiming to become the market leader or go for cooperation and make sure multiple people join you. Well Tesla went for market leadership and we are really trying to win in the most important markets of the big players, to make sure our brand is known there and then they will decide to do the same thing, I hope we can pull off a kind of Trojan horse action. (R6). Because you see, we do want to make money, but making money is a means to make this company grow. It's not a goal in itself. The goal in itself is maximum sustainable conversion. (R15).	So growth is not my objective. Quality is my objective. And having a long-term relationship with our customers. So I would define growth as how many years my customers on average are with my company. And when that increases, then they still trust me and then other things will grow as well. (R21). So, growth, yes, is a very symbiotic, synergistic game between customer, [firm name], and employee, in which everyone is happy at the bottom line. (R4).	Yes, growth is very important, for different reasons. Of course you want to settle the financial side. So we want to buy out our shareholders or sell the company, you are invested because you want to sell the company or take out an investment and pay a yearly dividend to the shareholders. (R22). We don't do this because we want to make the world a safer place. Yes, we say that now as a marketing gimmick, but that's nonsense. We just want a company, we want to grow, because we can, because it's fun, and that's it. (R12).

	Mission-driven high-growth firm	**Conscious high-growth firm**	**Profit-driven high-growth firm**
Dominant stakeholder(s)	So you could say, who is my most important stakeholder? The Earth. If you look through it all, that's my most important stakeholder. And who comes next? Well, the customer. Because by helping that customer to become more sustainable, I'm helping the ultimate stakeholder, and of course, there are other stakeholders as well, but they are more means than ends, so to speak. (R15).	(…) we believe that as an entrepreneur, just as you are responsible for the environment, you also have a responsibility for the community in which you operate. So, we have sponsored the construction of a community center here, and we have also contributed significantly to local carnival and sports associations. We also sponsor smaller initiatives, such as living room initiatives for pensioners where they can craft together. We sponsor quite a lot. (R14).	The owners are the owners, I am one of them but there are other shareholders as well. They have of course once taken the risk and invested their money, so I do think they have a primary right. (R2).

Nederlandse samenvatting

Ondernemerschap is een belangrijke aanjager van economische groei. Ondernemers introduceren nieuwe innovaties in de markt, creëren nieuwe banen en verhogen de economische productiviteit. Daarnaast zijn er tegenwoordig steeds meer ondernemers die bijdragen aan oplossingen voor maatschappelijke problemen, zoals de duurzaamheidstransitie en sociale inclusie. Vanwege deze belangrijke positieve effecten is er veel interesse om beter te begrijpen hoe we ondernemerschap kunnen stimuleren. Aangezien ondernemers altijd gebonden zijn aan een specifieke plek is een ruimtelijk perspectief belangrijk. Ondernemers maken gebruik van verschillende middelen in hun omgeving en acteren in een specifieke context die wordt gevormd door bijvoorbeeld de regels en wetten van de overheid. Aan de andere kant kunnen ondernemers ook zelf invloed uitoefenen op hun omgeving en nieuwe middelen creëren. Om deze interactie tussen de omgeving en ondernemers beter te begrijpen en uiteindelijk een beter beeld te krijgen van hoe ondernemerschap ontstaat, is het concept van ecosystemen voor ondernemerschap ontwikkeld. Dit concept gebruikt de analogie van een biologisch ecosysteem om te begrijpen hoe verschillende actoren en hulpbronnen samenwerken om ondernemerschap mogelijk te maken.

Het concept, ecosystemen voor ondernemerschap, bestaat al een aantal jaren en is oorspronkelijk ontwikkeld in de praktijk en snel overgenomen door beleidmakers. Alhoewel het dus een geliefde metafoor is, mist er nog enige theoretische ontwikkeling en met name het begrip van de verschillende mechanismen in het ecosysteem. In de academische wereld wordt steeds meer onderzoek gedaan naar ecosystemen voor ondernemerschap, de afgelopen jaren was er vooral veel werk op theoretisch gebied en met kwalitatieve data. Wat nog grotendeels mist is onderzoek met kwantitatieve data, dat het mogelijk maakt om een

groot aantal ecosystemen te vergelijken en meer algemene conclusies te trekken over het functioneren van deze ecosystemen. Daarnaast is er tegenwoordig een discussie gaande over wat het doel moet zijn van ondernemerschapsbeleid en economisch beleid in het algemeen. Enkel het aanjagen van economische groei heeft negatieve bijwerkingen zoals een verhoogde uitstoot van CO2 of een toenemende ongelijkheid. Daarom is er steeds meer aandacht en steun binnen zowel de beleidswereld als de academische wereld om een breder begrip van welvaart te hanteren. Dit nieuwe begrip moet verschillende aspecten meenemen, zoals duurzaamheid en sociale inclusie. Alhoewel we weten dat ondernemerschap positief bijdraagt aan economische groei, is het niet direct duidelijk hoe het invloed heeft op deze andere aspecten. Aan de ene kant kan ondernemerschap bijvoorbeeld meer vervuiling genereren maar het kan ook nieuwe groene innovaties introduceren. Om de relatie tussen ondernemerschap en brede welvaart beter te begrijpen is meer onderzoek nodig.

Dit proefschrift heeft als doel om het functioneren van de verschillende mechanismen in het ecosysteem beter in kaart te brengen. In de eerste hoofdstukken wordt dit gedaan aan de hand van kwantitatieve data voor de Europese Unie. Het laatste hoofdstuk heeft een iets andere focus en kijkt naar de specifieke relatie tussen ondernemerschap en maatschappelijke vooruitgang (of brede welvaart). Aangezien deze relatie nog weinig is onderzocht, wordt hiervoor kwalitatieve data gebruikt en is de aard van dit hoofdstuk meer verkennend. Ik zal de belangrijkste bevindingen van elk hoofdstuk hieronder kort bespreken.

In hoofdstuk 2 hebben we een dataset samengesteld om de kwaliteit van ecosystemen van 273 regio's in Europa te meten. We gebruikten statistische gegevens uit bestaande bronnen en web-scraped data om indicatoren te creëren voor elk van de tien elementen in het ecosysteemraamwerk dat is opgesteld door Stam en Van de Ven (2021). We selecteerden indicatoren op basis van geloofwaardigheid, nauwkeurigheid en vergelijkbaarheid, binnen

de huidige beschikbare data op regionaal niveau. Om één algemene maatstaf voor de kwaliteit van het ecosysteem te creëren, werden de gegevens van de tien elementen gecombineerd in een index, die we op verschillende manieren samenstelden. Deze index was in een cross-sectionele analyse significant gecorreleerd met de output van het ecosysteem die werd gemeten met innovatieve startups uit Crunchbase en 'unicorns', private bedrijven met een waardering boven de 1 miljard dollar. De index was ook sterker gecorreleerd aan ondernemerschapsoutput (i.e. innovatieve startups) dan gerelateerde maatstaven zoals het bruto binnenlands product (BBP) of de regionale concurrentiekracht index (RCI). Aanvullende analyses lieten zien dat de onderlinge afhankelijkheid tussen ecosysteemelementen bijzonder sterk is en dat de regionale variatie binnen landen substantieel is. Robuustheidscontroles toonden aan dat deze resultaten niet gevoelig waren voor het veranderen van verschillende keuzes met betrekking tot de samenstelling van de index.

In hoofdstuk 3 hebben we de in hoofdstuk 2 verzamelde dataset gebruikt voor een Kwalitatieve Vergelijkende Analyse ('qualitative comparative analysis' of QCA). Deze methode wordt gebruikt om casussen structureel te analyseren en combinaties van elementen te vinden die bijna altijd samen worden geobserveerd met een bepaalde uitkomst. In onze studie analyseerden we de ecosystemen voor ondernemerschap van 273 regio's in Europa om te zien voor welke combinatie van ecosysteemelementen, zogenaamde configuraties, een hoge ondernemerschapsoutput werd waargenomen. Hoewel bestaande casestudies suggereerden dat regio's goed kunnen presteren met verschillende configuraties (bijv. Spigel, 2017), is de meeste literatuur over ecosystemen voor ondernemerschap gebaseerd op het idee dat ecosystemen alle elementen op een hoog niveau moeten hebben om goed te functioneren (bijv. Acs et al., 2014). Het doel van deze studie was om deze

aanname empirisch te testen in de Europese Unie. De resultaten toonden aan dat regio's relatief hoge niveaus van ondernemerschapsoutput kunnen bereiken met verschillende configuraties, waarbij een hoog niveau van kennis of talent gecombineerd wordt met sterke formele instituties of leiderschap. Deze resultaten wijzen dus op het belang van een bron van ideeën voor nieuwe ondernemingen, die voort kunnen komen uit innovatie of hoogopgeleid personeel. Daarnaast is er een vorm van bestuur nodig om het ecosysteem te leiden, dit kan worden geleverd door formele instituties (met name de overheid) of op een meer informele manier door leiders zoals succesvolle ondernemers.

In de analyse van de regio's met de hoogste ondernemerschapsoutput toonde de QCA slechts één consistente configuratie waarin alle elementen van het ecosysteem goed ontwikkeld zijn. Dit ondersteunt de veronderstelling dat *alle* elementen van het ecosysteem bijdragen aan ondernemerschap en dat ecosystemen op het hoogste niveau functioneren wanneer het hele ecosysteem goed ontwikkeld is. Maar zelfs op dit niveau zien we enkele uitzonderingen, er zijn regio's die zeer goed presteren terwijl niet alle ecosysteemelementen ontwikkeld zijn. Vergelijkbare uitzonderingen worden geobserveerd wanneer we regio's met ‘unicorns’ analyseren. De resultaten tonen dus aan dat er regionale diversiteit is in ecosystemen voor ondernemerschap en dat regio's redelijk goed kunnen presteren met verschillende configuraties. Tegelijkertijd hebben regio’s met een volledig ontwikkeld ecosysteem de grootste kans om veel ondernemerschap voort te brengen.

In hoofdstuk 4 zijn we ingegaan op het verband tussen de output, het aantal nieuwe ondernemingen, en het uiteindelijke doel van het ecosysteem, het aanjagen van economische groei. Terwijl voorheen het meeste onderzoek gericht was op economische groei, zijn meer wetenschappers en beleidsmakers zich er nu van bewust dat dit niet gelijkgesteld kan worden aan maatschappelijke vooruitgang. Daarom onderzochten we in

dit hoofdstuk hoe ondernemerschap kan bijdragen aan maatschappelijk welzijn oftewel brede welvaart. Het onderzoek was gericht op snelgroeiende bedrijven, omdat deze doorgaans worden beschouwd als de belangrijkste output van het ecosysteem en veel aandacht krijgen van beleidsmakers. Om te begrijpen hoe deze bedrijven bijdragen aan maatschappelijk welzijn, gebruikten we het 'stakeholder capability' raamwerk ontwikkeld door Ali en Cottle (2021), gebaseerd op de 'capabilities approach' van Amartya Sen (1999). Dit raamwerk stelde ons in staat om een compleet beeld te genereren van de potentiële effecten van snelgroeiende bedrijven op brede welvaart, omdat het alle partijen waarmee het bedrijf interacteert (stakeholders) en verschillende dimensies van welvaart omvat. Ons doel in dit hoofdstuk was om te begrijpen hoe snelgroeiende ondernemingen waarde kunnen creëren of vernietigen voor hun stakeholders. Alhoewel economische waarde hier een belangrijk deel van is, keken we nadrukkelijk breder naar aspecten zoals waarde op het gebied van persoonlijke ontwikkeling of sociale cohesie. Het onderzoek was verkennend van aard en ontworpen om een overzicht te creëren van de potentiële mechanismen van waardecreatie en -vernietiging. Het unieke kenmerk van snelgroeiende ondernemingen is de zeer snelle groei die ze doormaken en daarom besteedden we speciale aandacht aan de rol van bedrijfsgroei.

De 23 interviews met oprichters en CEOs van snelgroeiende bedrijven in Nederland illustreerden vele mogelijke mechanismen voor waardecreatie. De waarde die snelgroeiende bedrijven creëren voor hun stakeholders is divers en omvat verschillende aspecten. Er zijn ook meerdere voorbeelden van mechanismen die waarde vernietigen voor stakeholders en deze lijken vaak gerelateerd te zijn aan de druk die snelle groei met zich meebrengt. De gecreëerde waarde verschilde substantieel tussen bedrijven en we konden verschillende bedrijfstypes onderscheiden op basis van de waarde die zij creëren voor hun stakeholders.

Deze omvatten bedrijven die bijna uitsluitend gericht zijn op winst, zogenaamde winstgedreven snelgroeiende bedrijven, bedrijven met een duidelijke maatschappelijke missie, zogenaamde missiegedreven snelgroeiende bedrijven, en bedrijven die een combinatie zijn van deze twee met aandacht voor een breed scala aan stakeholders, zogenaamde bewuste snelgroeiende bedrijven. Snelgroeiende bedrijven vormen dus een heterogene groep en al deze bedrijfstypen hebben te maken met verschillende afwegingen tussen stakeholders. Wanneer deze afwegingen echter zorgvuldig worden gemaakt, hebben deze bedrijven het potentieel om aanzienlijke waarde te creëren voor de maatschappij.

Het onderzoek in dit proefschrift laat zien dat ecosystemen voor ondernemerschap van groot belang zijn voor ondernemers. Regio's die een goed ontwikkeld ecosysteem hebben, hebben ook meer innovatieve en succesvolle jonge ondernemingen. Regio's zijn echter heel divers en dit wordt gereflecteerd in hun ecosysteem. We zien veel verschillende variaties en het is belangrijk dat regio's zich vooral op hun eigen kracht richten. Om een succesvol ecosysteem te ontwikkelen is het daarom belangrijk om veel kennis te hebben over de regio in kwestie. Op deze manier kan er aan bepaalde elementen prioriteit worden gegeven, bijvoorbeeld op basis van hoe vergelijkbare regio's hun ecosysteem ontwikkelen. Uiteindelijk is elk onderdeel van het ecosysteem echter belangrijk om ondernemerschap te bevorderen en zijn de verschillende elementen sterk met elkaar verbonden. Het ecosysteem raamwerk is daarom nuttig om alle aspecten die van belang zijn voor ondernemerschap in de regio in kaart te brengen.

Ondernemers kunnen een belangrijke positieve invloed uitoefenen op brede welvaart en bijdragen aan maatschappelijke transities. Elke onderneming is echter uniek en heeft ook een uniek effect op de maatschappij. Alhoewel snelgroeiende bedrijven vaak als één groep worden gezien is er veel diversiteit. Het is belangrijk om hier oog voor te hebben, met name

als het doel van ondernemerschapsbeleid niet enkel het creëren van meer economische groei is. Sommige bedrijven hebben een expliciete maatschappelijke missie, terwijl andere vooral gericht zijn op het creëren van winst voor de ondernemer. Deze diversiteit binnen ondernemingen verdient meer aandacht. Als we ons beter bewust zijn van de verschillen tussen bedrijven kan er meer gerichte ondersteuning komen voor de ondernemers die echt iets bijdragen aan de maatschappij.

Curriculum vitae

Mirella Schrijvers was born in Gouda, the Netherlands, in 1995. She completed a BSc in International Development Studies with a specialization in development economics at Wageningen University in 2015. After this she continued her studies in Oxford with a MSc in Economics for Development. She then worked for one year as a research and teaching assistant at the Development Economics group in Wageningen. Following this, Mirella acquired a stronger background in economic theory and methods during a Master in Analysis and Policy in Economics at the Paris School of Economics.

She followed several courses of the PhD program in Applied Economics at Cornell University and started her PhD research in 2019 at the Utrecht University School of Economics. Her PhD was part of a large EU Horizon 2020 project on the effects of digitalization on the welfare of European citizens. Her research on entrepreneurial ecosystems was used as input for several of the project meetings and reports. During her PhD she spent one semester at MIT as a visiting researcher at Sloan School of Management. The results of her PhD research were published in several academic journals (such as Research Policy) and presented at various international conferences. In addition, Mirella contributed to a policy evaluation of a large entrepreneurship program for the Ministry of Economic Affairs and Climate Policy in the Netherlands. Currently, Mirella is working as a postdoctoral researcher at the Technical University of Munich on topics related to entrepreneurial ecosystems.

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