ENTREPRENEURIAL ECOSYSTEMS
A LITERATURE REVIEW

Word count: 30561

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Master's Dissertation submitted to obtain the degree of:

Master of Science in Business Engineering

Academic year: 2016 - 2017
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name student: Zeger Van de Wiele

signature
Dear reader,

Writing this script was a very educational experience to me. Reading through more than 100 papers, all having their own angle of incidence, was, to put it mildly, an intense activity. I could even call it the most intense period of my student career. But it was worth it.

At first sight, writing a literature review seemed to me of a less direct importance than to investigate a concrete subject. After all, assembling thoughts and findings of other people lacked a certain necessity of originality. I thought… Looking back, I realize in itself it can be very rewarding to make transparent and coherent, what before was rather inaccessible as a whole. It took a lot of assimilating, inventorying, focusing and prioritizing to come to the result you are about to read. Of course designing a new car must be a rewarding accomplishment, but to concretely assemble a car and seeing it role of the assembly line, finally turned out to be also really satisfying.

However, it should be emphasized that writing this thesis would not nearly have been possible without the support of multiple people. Therefore, I would like to commence these pages with some well-meant words of thanks.

A first expression of gratitude goes out to prof. dr. Bart Clarysse, without whom I would not have got the possibility to tackle this really interesting subject. Secondly I would like to acknowledge my promotor Sarah Boone, for always immediately answering my questions. In particular, I would like to thank both for giving me the freedom to explore autonomously. It encouraged me to write with an open mind and give it my own touch.

Furthermore, I would like to mention the support I had from people close to me. To my family and friends for all the patience and, in particular, to let me be during this thesis. Last, but certainly not least, to my girlfriend, Isolde, who was very understanding and supportive during the months I was living like a hermit.

Zeger Van de Wiele,
June 2017
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<th>Description</th>
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<tr>
<td>BEEP</td>
<td>Babson Entrepreneurship Ecosystem Project</td>
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<td>confer</td>
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<td>EE</td>
<td>Entrepreneurial Ecosystem</td>
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<td>e.g.</td>
<td>exempli gratia</td>
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<td>et al</td>
<td>and others</td>
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<td>etc.</td>
<td>etcetera</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>IDE</td>
<td>Innovation Driven Enterprise</td>
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<td>i.e.</td>
<td>id est</td>
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<td>IFF</td>
<td>Innovation Investment Fund</td>
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<td>IPO</td>
<td>Initial Public Offering</td>
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<td>GEDI</td>
<td>Global Entrepreneurship and Development Institute</td>
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<td>GEM</td>
<td>Global Entrepreneurship Monitor</td>
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<td>GII</td>
<td>Global Innovation Index</td>
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<td>KPF</td>
<td>Knowledge Production Function</td>
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<td>KSTE</td>
<td>Knowledge Spillover Theory of Entrepreneurship</td>
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<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
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<tr>
<td>OECD</td>
<td>Economic Co-operation and Development</td>
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<tr>
<td>PRO</td>
<td>Public Research Organization</td>
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<td>R&amp;D</td>
<td>Research and Development</td>
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<td>REAP</td>
<td>Regional Entrepreneurship Accelerate Program</td>
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<td>RIS</td>
<td>Regional innovation systems</td>
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<tr>
<td>SME</td>
<td>Small and Medium-sized Enterprise</td>
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<tr>
<td>TTO</td>
<td>Technology Transfer Office</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>U.S.</td>
<td>United States</td>
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<tr>
<td>vs.</td>
<td>versus</td>
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<td>WEF</td>
<td>World Economic Forum</td>
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1. Introduction

Robert Solow was awarded the Nobel Memorial Prize in Economic Sciences for his growth model, in which he identifies labor and capital as the two main sources of economic growth (Solow, 1956). During that era, large-scale production was the cornerstone of the economy, reflecting the predominance of the Solow’s variables as source of competitive advantage. Subsequently large firms were ruling due to the importance of economies of scope and scale in production, distribution and research and development (Chandler, 1990).

These findings are in accordance with Schumpeter’s (1942) Mark II regime, in which he argues that large firms outperform the SME’s, resulting in a diminishing importance of small businesses over time. This regime is utilized by Audretsch and Thurik (2000, 2001, 2004) to introduce the concept of the ‘managed economy’, which flourished during the first three-quarters of the last century. It is characterized by stability, continuity, specialization and homogeneity and is defined as an economy where routinized output and innovation, enterprise size and economies of scale are positively related to economic performance (Audretsch & Thurik, 2001).

However, the information-technology revolution, the hereby following process of globalization and the myriad of factors that emerged from these factors have led to a shift from the so-called managed economy towards an ‘entrepreneurial economy’ (Thurik, Stam, & Audretsch, 2013) where economic growth occurs through flexibility, novelty, innovation, turbulence, diversity, linking and clustering (Audretsch & Thurik, 2004). Or as Feld describes: “today, we are in the midst of a massive shift from the hierarchical society that has dominated the industrial era to a networked society that has been emergent throughout the information era” (Feld, 2012, p. 1).

ICT made entrepreneurs competitive again, since new technologies create new markets (for example a myriad of software applications), remove incumbent market positions and eliminates barriers to enter older technology markets (Schumpeter, 1942; Spencer, Kirchhoff, & White, 2008).

Furthermore price elasticity is low during the birth phase of these new markets (P. M. Parker, 1992). Next to increasing their competitiveness, it has lowered the competitive advantage of large firms by dropping the costs of communication (Shapiro & Varian, 1999). Moreover ICT is one of the main drivers of globalization, another important factor that spurs the shift towards an entrepreneurial economy (Thurik et al., 2013).
Both globalization and the technological change, induced corporate reorganization such as the corporate downsizing (for example outsourcing and offshoring) and the substitution of labor by technology and knowledge. It is this shift towards a knowledge based economy that drives the change into an entrepreneurial economy, since knowledge and ideas replace physical capital as source of competitive advantage (Thurik et al., 2013). The above listed mix of circumstances explains how entrepreneurship has emerged as the engine of economic growth and social development during the last two decades.

This impact of entrepreneurial activity on economic growth and development was first noticed by Schumpeter (1934). He argues that innovation is the driver of economic change and underlines the role entrepreneurs play in the development and distribution of this innovation, hereby challenging incumbent firms and destroying current technologies and products. This process of ‘creative destruction’ is the main component of his Mark I theory. Complementary, Zoltan J Acs, Audretsch, Braunerhjelm, and Carlsson (2004) state that entrepreneurship contributes to economic prosperity by serving as conduit for knowledge spillovers or as they state it by permeating the ‘knowledge filter’, hereby making inventions marketable that would otherwise not be commercialized.

More recent empirical studies have shown that startups and young firms, i.e. firms aged 1 to 5 years, have caused almost all the net job creation in the United States between 1980-2005 (Haltiwanger, Jarmin, & Miranda, 2009). Most entrepreneurial studies in the 20th century focused on entrepreneurs themselves, trying to find out what kind of characteristics led them to entrepreneurial success (Van de Ven, 1993). Contrarily, Van den Ven was the first one who did not exclusively focus on the individual traits of an entrepreneur. In his ‘Social system framework’ he underscores the importance of a university, financing mechanisms, human competence pool and an institutional arrangement to foster entrepreneurial activity.

Along similar lines, Moore (1993) argues that entrepreneurship does not exist in a vacuum. Even more, entrepreneurs are highly dependent on their environment. Moreover, several authors noted that entrepreneurship is a local phenomenon (M. P. Feldman, 2003; Malecki, 1993; Motoyama, Konczal, Bell-Masterson, & Morelix, 2014). Silicon Valley, Boston’s route 128 and Boulder are just a few examples of entrepreneurial hotbeds nowadays. This is further evidenced by empirical analysis in the United States, which have shown that there is significant variation of entrepreneurship rates by regions (Zoltan J Acs & Armington, 2006).

These findings have led to the emergence of the entrepreneurial ecosystem approach, a popular concept in the academic literature to explain high concentrations of high-growth entrepreneurship within regions. Since the entrepreneurial ecosystem approach has only gained popularity in recent years, literature on
this subject lacks coherence and structure. Most authors have been talking at cross purposes, sometimes leading towards seemingly ambiguous statements, making it difficult to understand their structure. This paper tries to give a coherent and holistic view on the existing literature on entrepreneurial ecosystems.

The first chapter explains the concept of entrepreneurial ecosystems in detail and a comparison is given between entrepreneurial ecosystems and related concepts as clusters, regional innovation systems and other types of ecosystems. The next section explores the components of the ecosystem. Several core elements are identified and their contribution to venture creation is investigated more thoroughly. What follows is an examination of the interdependencies between those elements. Two theoretic frameworks are based on these relationships and are therefore also discussed in this chapter. Furthermore, the evolutionary dynamics of the EE are reviewed, as entrepreneurship is a dynamic rather than a static phenomenon. Section 2.5. examines the ecosystem metrics. Lastly, this paper concludes with suggesting directions for future research.
2. Literature review

2.1. Deconstructing an entrepreneurial ecosystem

The term entrepreneurial ecosystem refers to two concepts: entrepreneurship and ecosystem. This first chapter examines each component individually in order to define the concept of an entrepreneurial ecosystem. Finally, a comparison is made with several related concepts.

2.1.1. Entrepreneurship

This section starts with the ‘what’ and ‘why’ of entrepreneurship before getting to the ‘how’ question, since one cannot solve the how question if there is uncertainty and ambiguity on what entrepreneurship exactly is and why it is such an important topic.

2.1.1.1. What

This is partly a semantic issue. Nonetheless, several authors have tried to demarcate the entrepreneurial concept. According to Isenberg (2011a), the term entrepreneurship runs the risk of being broadened out of meaning due to its myriad of derivatives. Therefore, one should differentiate among small and medium-sized enterprises, self-employment and entrepreneurship. He defines an entrepreneur as a person who is continuously trying to create economic value through growth. This definition implies that an entrepreneur is always unsatisfied with status quo. Or as Isenberg states: entrepreneurship is aspirational, risk-taking and has an intrinsically contrarian nature as exploiting an opportunity is based on the perception that you know, see or have something others do not know, see or have; or that others perceive differently. Hence, one can state that self-employment alone is not entrepreneurial. Contrary, self-employment plus aspiration is. In summary, aspiration, not venture ownership by itself, is what distinguishes a non-entrepreneur and an entrepreneur.

Similarly, Motoyama (2014) declares that there is a need to have a more streamlined comprehension of entrepreneurship since firm formation, high-growth, self-employment and innovations in high-tech sectors differ substantially. Along complementary lines, Aulet and Murray (2013) identify two distinct types of entrepreneurship: ‘innovation-driven-enterprises’ (IDEs) and small and medium-sized enterprises (SMEs). These fulfill different economic roles and need separate policies to support them. IDEs are businesses that try to exploit global opportunities by identifying and commercializing high-growth potential innovations which create a competitive advantage.
This is in line with Schumpeter’s (1934) definition of an entrepreneur, in which all the entrepreneurial activities are related to innovation. Aulet and Murray (2013) do not use the term ‘technology-driven’, since innovation is not confined to technology. Innovation implies a new-to-the-world idea and can take many different forms, including technology, process and business model. This is an important distinction, considering that some of the most groundbreaking innovations of our time, e.g. google, iTunes, Netflix, eBay, and Zipcar, are in essence business model innovations. These are enabled by technology, but the owners do not have to fully comprehend the complexities of these technologies to be successful. SMEs, on the other hand, serve local markets, with conventional business ideas often lacking a huge competitive advantage. Figure I summarizes both types.

<table>
<thead>
<tr>
<th>SME Entrepreneurship</th>
<th>IDE Entrepreneurship</th>
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<tr>
<td>Focus on addressing local and regional markets only.</td>
<td>Focus on global markets.</td>
</tr>
<tr>
<td>Innovation is not necessary to SME establishment and growth, nor is competitive advantage.</td>
<td>The company is based on some sort of innovation (tech, process, business model) and potential competitive advantage.</td>
</tr>
<tr>
<td>“Non-tradable jobs”—jobs generally performed locally, e.g. restaurants, dry cleaners, service industry.</td>
<td>“ Tradable jobs”—jobs that do not have to be performed locally.</td>
</tr>
<tr>
<td>Most often family businesses or businesses with very little external capital.</td>
<td>More diverse ownership base including wide array of external capital providers.</td>
</tr>
<tr>
<td>The company typically grows at a linear rate. When you put money into the company, the system (revenue, cash flow, jobs, etc.) will respond quickly in a positive manner.</td>
<td>The company starts by losing money, but if successful will have exponential growth. Requires investment. When you put money into the company, the revenue/cash flow/jobs numbers do not respond quickly.</td>
</tr>
</tbody>
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![SME Revenue, Cash Flow, Jobs over Time](image1)

![IDE Revenue, Cash Flow, Jobs over Time](image2)

*Figure I. IDE vs. SME (Aulet & Murray, 2013)*
One can derive that Isenberg’s understanding of entrepreneurship coincides with the above mentioned concept of innovation-driven-entrepreneurship. Both, Aulet and Murray (2013) and Isenberg (2011a) identify innovation and growth-ambition as the two main characteristics of entrepreneurship, which corresponds to ‘Schumpeterian entrepreneurship’ (Schumpeter, 1934). Furthermore they both state that innovation-driven-entrepreneurship requires different policies, support structures and environments than self-employment and SMEs. They also need different metrics and should be evaluated over different time-frames. This separation between traditional criteria of entrepreneurship and more appropriate measures as innovation and growth-orientation, is more and more highlighted in entrepreneurship literature (Henrekson & Sanandaji, 2014; S. Shane, 2009; Stam et al., 2012).

The entrepreneurial ecosystem approach often narrows entrepreneurship down to high-growth firms, arguing that these ventures are the main source of employment, innovation and growth (Foster et al., 2013; C. Mason & Brown, 2014). However, empirical studies have shown that this notion is too restrictive. Baumol (1990), for example, declares that innovative start-ups and/or entrepreneurial employees can also be forms of what he calls ‘productive entrepreneurship’, hereby inducing economic growth. The importance of startups is also mentioned by C. Mason and Brown (2013), as they are the pipeline for companies to become future high-growth firms. This is evidenced by Motoyama’s (2014) empirical study in the United States, which revealed that states with higher startup ratios have a tendency to create more high-growth firms.

Nonetheless, “it is clear that the entrepreneurial ecosystem approach does not by definition include the traditional indicators of entrepreneurship, such as self-employment or small businesses into entrepreneurship”(Stam, 2015, p. 1760). Therefore, startup support should be focused on ventures with the highest potential, i.e. ambitious, growth-oriented enterprises which target large potential markets (Daniel Isenberg, 2010; C. Mason & Brown, 2013). Conclusively, the term ‘entrepreneurial’ in entrepreneurial ecosystems refers to Isenberg’s view on entrepreneurship, which is the same as above mentioned IDEs. That is why this paper refers to Isenberg’s view on entrepreneurship when talking about it, unless otherwise stated.

2.1.1.2. Why

The interest in entrepreneurship can be largely reduced to one word: ‘job-creation’. The disproportionate large share of all net job creation generated by these innovation-based ventures in the Western World is well-documented in literature. Firms less than five years old have been at the source of almost all the net job creation in the United States between 1980-2005 (Haltiwanger et al., 2009). Stangler and Litan (2009)
further examined this net addition of jobs from year to year. Their research reveals that job creation has three main drivers: startups, young firms aged one to five years, and the largest and oldest companies. Subsequently, one can spot somewhat of a barbell-effect, as the net-addition of new jobs occurs at the extremes of the firm’s age spectrum, characterized by a pretty flat curve in between. However, this is not the complete picture, because these youngest firms also experience a high level of job destruction and because there are interactive relations at play between the oldest and youngest firms.

Startups have served as the main driver for immediate job creation over the past thirty years in the economy of the United States (Haltiwanger et al., 2009). Even more, if the jobs created through startups are excluded, the U.S. economy experiences a negative net employment growth on average. This is shown in figure II.

![Figure II](image.png)

*Figure II. The first source of job creation: startups (Stangler & Litan, 2009)*

Yet it is not all roses. Approximately one out of three new ventures closes by their second year of existence while only half of them survives until the age of 5 (Stangler, 2009). Consequently a large part of the jobs

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1 The authors underline that they are discussing net job creation: the in- and outflow of employees in enterprises of every age is not reflected. Hence, the middle-aged enterprises still hire employees in gross. However, every class of enterprises also experiences a constant outflow of employees. Conclusively, the youngest and oldest firms have a higher inflow than outflow, hereby resulting in a positive net figure.
that emerge through startups will disappear in subsequent years, hereby diminishing their contribution to net job creation over a longer period of time. “No economy could long survive if every year’s new jobs were simply eliminated within such a short period” (Stangler & Litan, 2009, p. 6). Hence, the question then arises as to what happened to the other half of the startups, which made it to the age of five. These represent the second driver of net job creation: the young firms. Stangler and Litan (2009) found that young firms have been most active in adding new jobs to the U.S. economy in 2007. They created around two third of all new jobs, if startups jobs are excluded. Moreover, they also accounted for the highest number of average jobs. This is illustrated in figure III and IV.

Along similar lines, Haltiwanger, Jarmin, and Miranda’s (2013) research revealed that 40 percent of the jobs created by new ventures have been eliminated by exit within five years. Nonetheless, they also found that these young firms grow faster than their older counterparts, if they are able to survive. Moreover, it is important to underline that job creation and destruction are part of a healthy economy (Haltiwanger, 2012). In fact, the mechanism of entering, thriving, growing, declining and sometimes exit is inherent to any dynamic capitalist economy; or as Feld (2012) states: “Failing is inevitable for many startups and should be viewed as a lesson on a longer entrepreneurial journey. Furthermore he emphasizes the importance of failing fast to prevent putting energy into initiatives that are not working. This reallocation helps to move away economic resources from ineffective or unproductive firms and reallocates them into more productive enterprises (Haltiwanger, 2012).

![Figure III. Young Firms Account for Largest Share of Job Creation (Stangler & Litan, 2009)](image1)

![Figure IV. Young Firms Account for the Most Jobs and Highest Average Number of Jobs Created (Stangler & Litan, 2009)](image2)
Figure III and IV also show the previously mentioned barbell-effect and the hereby associated positive contribution of the oldest companies (i.e. the k. Left Censored in the figure) to net job creation. These firms account for about 10 percent of net job creation, if new ventures are disregarded. The authors suspect that this is due to symbiotic relationships with the young firms. Older, bigger enterprises can almost only add net jobs by acquiring other firms (mostly young firms). Therefore, these young businesses do not only generate jobs, but also pioneer innovations which these older firm purchase in order to achieve revenue growth.

These results bring up the question whether age is serving as a proxy for size; or differently stated when someone is talking about ‘young’ enterprises, isn’t he really talking about ‘small business’? This view that small businesses create the most jobs, is widely shared among policymakers (Haltiwanger et al., 2013). However, recent studies have illustrated that once they do research on firm age, they do not find a systematic relationship between economic growth and firm size (Haltiwanger, 2012; Haltiwanger et al., 2013; Stangler & Litan, 2009). Conclusively, young companies are the drivers of job creation; not small companies. This is in line with the earlier mentioned view on entrepreneurship in an entrepreneurial ecosystem context, which excludes self-employment and small firms.

The advantages of new venture creation extend beyond job creation. As new enterprises commercialize new innovations, they become probably more productive than incumbent firms, hereby contributing to aggregate wealth creation (Stangler, 2009). Along complementary lines, Haltiwanger (2012) compares the productivity of exiting firms, both young and mature, and young survivors, i.e. firms younger than five years, with the productivity of mature firms for the retail sector. Figure V indicates that, conditional on survival, young enterprises are more productive than mature incumbents. Moreover, these young enterprises stay more productive, even after five years. In line with the above statement about the necessity of failing, this figure also illustrates the inefficiency of exiting firms.

Figure V. Productivity of young businesses relative to mature surviving incumbent, U.S. retail trade (Haltiwanger, 2012)
Lastly, successful entrepreneurship causes important spillover effects (Daniel Isenberg, 2011a). Successful entrepreneurship tends to create more entrepreneurial activity. For instance, it inspires others, hereby igniting an entrepreneurial, risk-taking mindset among the population. Moreover, most successful entrepreneurs stay involved in the entrepreneurial community after they sold their business. Some of them engage in supporting activities which strengthen the entrepreneurial community, such as building entrepreneurial support organizations or acting as lobbyist. Others become serial entrepreneurs, creating multiple new ventures, act as mentors and advisors, or take on positions as board member. Some cashed-out entrepreneurs become business angels or even raise a venture capital fund. Others become ‘pracademics’, teaching entrepreneurship. Moreover, most entrepreneurs combine several of these activities feeding back their experience and reinvesting their wealth. C. M. Mason and Harrison (2006) call this phenomenon ‘entrepreneurial recycling’. This entrepreneurial recycling is one of the key characteristics of a vibrant entrepreneurial ecosystem (C. Mason & Brown, 2014); or as Daniel Isenberg (2011a) states: successful entrepreneurship causes multiple spillover effects, which enhance the entrepreneurial ecosystem in almost all of its domains.

Figure VI. Spillover effects from successful entrepreneurship (Daniel Isenberg, 2011a)

It should be mentioned that successful entrepreneurship also creates spillovers in terms of charity, life quality and social innovativeness (Daniel Isenberg, 2011a). The Bill & Melinda Gates Foundation and the Buffet Foundation are just two examples of this kind of philanthropy. Likewise, the possibility to fly to almost any country in Europe for less than €100 (Ryanair) or to listen to music, search on internet and make phone calls on the same device (smartphones), are examples of improvements of the quality of life. As a conclusion we could say entrepreneurship is omnipresent in our society. As an engine of economic development and as a main driver of innovation, its importance cannot be overlooked. The question that now arises is how it can be developed and more importantly, how it can be supported and sustained.
2.1.1.3. How

Previous sections explained the what and the why question. This section goes on to discuss the how question and is where the entrepreneurial ecosystem approach comes into play. Daniel Isenberg (2011a) states that in order for entrepreneurship to be relatively self-sustaining and self-generating, public leaders need to take into account the interrelated character of an entrepreneurial environment and intervene holistically. By public leaders, Isenberg refers to elected, professional and private sector. In other words, they have to follow an entrepreneurial ecosystem strategy (Feld, 2012; Daniel Isenberg, 2010; Daniel Isenberg, 2011a; C. Mason & Brown, 2014; Motoyama & Knowlton, 2014; Neck, Meyer, Cohen, & Corbett, 2004; Spigel, 2015; Stam, 2015; Suresh & Ramraj, 2012). This implies moving away from company specific interventions towards a more holistic approach, including establishing supporting infrastructure, developing networks and creating synergies among stakeholders (Rodríguez-Pose, 2013; Warwick, 2013). Consequently, the entrepreneurial ecosystem approach argues that there exist elements outside the boundaries of a company, but inside those of a region which enhance the competitiveness of a new enterprise (Spigel, 2015; Stam & Spigel, 2016). Therefore, it focuses on strengthening these external components, hereby creating a conducive external business environment which turbocharges venture creation and growth within the region. This approach embodies a more nuanced perspective on the entrepreneurial activity which views entrepreneurship as part of a broader context, including social, cultural and economic factors, instead of ascribing it to the activities of a Schumpeterian ‘economic superhuman’ (Nijkamp, 2003; Steyaert & Katz, 2004). In fact, the how question is one of the main subjects of this thesis and will be answered throughout this paper.

2.1.2. Ecosystem

The second term is a well-known concept in the field of ecology. More recently it has been introduced in the economic and business literature.

2.1.2.1. Analogy with ecology

The term ecosystem was introduced by Tansley (1935) in a biological context. He describes it as the whole of living and nonliving organisms interacting with one other and with their environment. Of course, this biological interpretation should not be taken too literally. Nonetheless, it has some similarities when comparing it with its economic counterpart. Moore (1993) was the first one to use it in an economic context. He argued that entrepreneurship does not exist in a vacuum, hereby emphasizing the importance of its environment.
Another important aspect of an entrepreneurial ecosystem is the interconnectedness among its actors (Motoyama et al., 2014; Spigel, 2015). This interaction between an enterprise and its environment implies the notion of co-evolution (Moore, 1993), in which co-evolution refers to the “two way interaction where both entities have an effect on each other’s success potential, which may induce changes in some direction” (Peltoniemi, 2006, p. 12). Hence, ecosystems are dynamic. This will be reviewed further in chapter 2.3.

Finally, the ecosystem concept has been used to explore the self-organizing of natural ecosystems (Nachira, Nicolai, Dini, Le Louarn, & Leon, 2007; Peltoniemi, 2006). This self-organization refers to a decentralized decision making process, which is enabled by the current market economy (Peltoniemi, 2006). Governmental interventions – which are inevitably in any real life ecosystem- can be regarded either as developing supportive structures for self-organization or as inhibiting it (Peltoniemi, 2006).

### 2.1.2.2. Critique on the term

Although the term ecosystem has been widely used by scholars, politicians and others in an economic context, Oh, Phillips, Park, and Lee (2016) elaborated a well-argued comment on its use. In a recently published article in Technovation, they critically examine the use of the word ‘ecosystem’ in an innovative context. Relying/drawing on the existing literature, they identify five limitations involving innovation ecosystems and argue it does not add much value to current innovation systems.

First, it is a flawed analogy as the resemblance with natural ecosystems is imperfect. Artificial ecosystems are designed with a purpose, which differentiates them from evolved biological ecosystems (Papaioannou, Wield, & Chataway, 2009). Once designed, they evolve. “In an evolved ecology a leopard that devours a gazelle remains a leopard. In an innovation ecology a company that eats (acquires) another company becomes a new entity, of a different nature” (Oh et al., 2016, p. 4). Furthermore, biological ecosystems do not have government policies (Papaioannou et al., 2009). Oh et al. (2016) also notice that many scholars often mention the postulation of a ‘sustainable ecosystem’. However, these do not exist in the natural world. Climate change and species extinctions are good examples of this. Lastly, they argue that ecological ecosystems are always local, even the biggest ones. Innovation ecosystems, on the contrary, can be global.

As second critique, Oh et al. (2016) state that there is a lack of consistency in the use of the term, hereby making an unambiguous definition impossible. The third critique entails the unavailability of metrics. “A majority of experts volunteered that commonly used research commercialization metrics (number of spin-
offs, licensing revenue etc.) were often not a reliable indicator of a university’s long-term capability to support or develop a vibrant ecosystem” (Graham, 2013, p. 18). Oh et al. (2016) have found three reasons for this lack of measurability:

1. An ecosystem consists of many different components and each of these components attaches different importance on different outcomes (e.g. job creation, quality of life, etc.).
2. The performance is more dependent on the relationships between actors and less on taylorist tactics as employee efficiency.
3. Leadership, innovation allowance/acceptance and education are the main drivers of success.

The Fourth critique is about the contradiction between the notion of a closed system and the tendency of open innovation. Finally, there is no empirical support for the postulations that these ecosystems display particular complex system behavior nor are there strict correspondence rules with natural ecosystems. In other words, the concept still has to be substantiated, which makes it just an extended, though very convincing, metaphor.

Oh et al. (2016) also identify some benefits as the encouragement of systemic thinking, readiness to learn from biological systems and the motivation of future entrepreneurs. “However, the notion does not in itself constitute or provide such truths or methods” (Oh et al., 2016, p. 5).

One should note that this examination is on innovation ecosystems. However, the emphasis lies on the application of the word ecosystem in an economic/innovation/management context, which makes it also applicable to entrepreneurial ecosystems. As shown in one of the following subchapters, innovation ecosystems are closely related to entrepreneurial ecosystems. Moreover, the authors also mention the term entrepreneurial ecosystem once, which further supports the reasoning that this critique also applies to entrepreneurial ecosystems.

### 2.1.2.3. A response to the critique

Although the above noted reflection on the use of ecosystems is very recent, two different authors already refuted the critique.

Smorodinskaya, Russell, Katukov, and Still (2017) state that the term ecosystem highlights the shift in a social, cultural and organizational context towards a knowledge-based economy. Hence, it emphasizes the emergence of an network-based environment – an ecosystem - in which innovation occurs through
collaboration. While ecosystems are derived from collaborative co-creation, systems are clearly not. Like natural ecosystems, they self-organize, self-develop and self-correct through the interrelationships of the components and through the influence of the environment, instead of the top-down and/or external interventions characteristic for traditional systems. In other words, the ‘eco’-suffix refers to the non-linear character of innovation. Nonetheless, they recognize the differences between natural and economic ecosystems. But according to them, the above mentioned reasons justify the use of the term ‘ecosystem’.

Ritala and Almpanopoulou (2017) distinguish between innovation ecosystems and innovation systems as the first one being more market-driven and the last one being more policy driven. However, there are definitely shades of grey among both concepts, which emphasizes the need of careful usage of both terms. Moreover, they reflected on the critique postulated by Oh et al. (2016). By investigating the existing literature, they reply on the false analogy critique, the lack of consistency problem and the measurement issue. Hereby, they provide also some suggestions/solutions on how the critique should be approached. Their arguments are not definitive. On the contrary, the authors try to fuel the debate on the use of the ecosystem concept and stimulate future research to ameliorate theoretical and empirical strictness.

Management literature often applies ecological analogies, hereby improving the comprehension of the underlying concept. An example is the notion of ‘ambidexterity’, which implies the equal usage of the right and left hand (Oxford dictionaries, 2017). In a management and innovation context, it refers to an organization’s capability to both explore and exploit (O’Reilly & Tushman, 2013). Two hands are very similar biologically seen. Exploration and exploitation, on the contrary, are definitely not (Ritala & Almpanopoulou, 2017). By giving this example, the authors demonstrate that borrowing from ecology doesn’t require a perfect replication of the original meaning, to be contributory to academic goals in a different domain.

While similarities between both concepts may be helpful for enhancing the literature, any discrepancies may induce deterioration unless properly acknowledged (Ritala & Almpanopoulou, 2017). They provide a deeper insight in purposeful design and in the differences in scope. Evolution occurs in all organizations (Nelson Richard & Winter Sidney, 1982). Hence, artificial ecosystems have features of both, teleological design and evolutionary nature, which makes them viable for investigating natural phenomena in each of these important aspects (Ritala & Almpanopoulou, 2017). Therefore, they argue that ecosystem academics should gain insight in which parts are designed and which parts originate from self-development and co-evolution.
Oh et al. (2016) state that biological ecosystems are always local, while innovation ecosystems can also be global. However, the ecology does not provide a rigorous definition either on the ecosystem’s scope, since “an ecosystem may range from an anthill to the entire globe” (Willis, 1997, p. 269). In particular, Willis’s literature review shows that the term can accommodate both a holistic and a reductionist approach. Furthermore, its ability to extend across scales, geographically and temporally, proves the terms robustness. These features could also be applied on innovation and management ecosystems (Ritala & Almpanopoulou, 2017). Due to this scalability, application of the concept becomes problematic, since any networked innovation collaboration could be viewed as an ‘ecosystem’. Therefore the authors advocate for critical thinking, incorporating the added value of the term and all of its constituents. In conclusion, “innovation ecosystem theorists may relax some axioms of ecology (and perhaps introduce a small number of additional ones) in order to fit for the needs of artificial ‘ecosystems’” (Oh et al., 2016, p. 5).

By utilizing features of other domains, such as co-evolution (ecology) and complex adaptive systems (system thinking), the innovation literature can be approached more holistically and realistically (Ritala & Almpanopoulou, 2017). However, scholars should take into account dissimilarities in order to prevent dysfunctional contradictions.

The conceptual unclarity was another comment elaborated by Oh et al. (2016). However, Ritala and Almpanopoulou (2017) noted that most approaches, such as firm-led ecosystems, digital platforms, regional and national innovation ecosystems, etc., all share several common characteristics. While actors, contexts and boundaries of ecosystems differ among different research studies, the goal/focus of all these ecosystems remains the same, namely innovation. Moreover, these ecosystems typically encompass one or various focal components, which lie at the heart of the ecosystem and help to demarcate it.

Examples from the literature are: a particular technology (Overholm, 2015), digital platform (Cusumano & Gawer, 2002) or enterprise (Li, 2009). Hence, “ecosystems are deliberately designed around and evolve around a key set of entities, at least in a particular point in time” (Ritala & Almpanopoulou, 2017, p. 2). Nonetheless, they argue that the level of examination must be the system level. Therefore to comprehend ecosystems, the system boundary definition is crucial (Gulati, Puranam, & Tushman, 2012). Ritala and Almpanopoulou (2017) suggest that an innovation ecosystem should be viewed as a system, which aims to innovate (goal) in the context of an interconnected environment (spatial dimension) and addresses the hereby implied co-evolution of its components (temporal dimension).
The current incapability of measuring the co-evolution aspect is the last critique Ritala and Almpanopoulou (2017) reply. They agree on this notion. Even so, they point to the fact that this problem arises for every examination on multi-actor networks.

Therefore, they argue that it is worthwhile to examine real-life phenomena by using several academic research methodologies, even if perfect research design is impossible. For example, the use of simulation modeling (e.g. system dynamics, agent-based modeling), control and system theory, and other related theories can result in more predictive studies on business related ecosystems, in comparison with the current merely descriptive inquiries. Furthermore, simulation modeling can also give a better understanding of the complex and dynamic character of these ecosystems, since it can reveal the complex connections among constructs or the results of interplay among several strategic and organizational processes (Davis, Eisenhardt, & Bingham, 2007). Therefore, simulation theory is helpful for theory development (Davis et al., 2007), especially as the constructs and processes unfold over time (Zott, 2003). Moreover, Ritala and Almpanopoulou (2017) also advocate for qualitative research, since these can provide further insights in the hows and whys of the dynamic processes (Langley, 1999). Measurement could also be external to the ecosystem by comparing the competitiveness of an ecosystem with innovations outside it (Ritala & Almpanopoulou, 2017). In any case, the metrics have to be related to the research question and the level of analysis, like in any research.

In conclusion, the ecosystem term has caused quite a stir in literature. Ritala and Almpanopoulou (2017) therefore advocate for a more careful usage of the ecosystem concept in an innovative context, which will require strict academic studies and a mindful use of the term.

Up until now, this paper reviewed each term of the concept of entrepreneurial ecosystems individually. The following section will combine these insights, providing some definitions on entrepreneurial ecosystems.

2.1.3. Defining an entrepreneurial ecosystem

Nowadays, there is no widely shared definition on entrepreneurial ecosystems. Therefore this paper paraphrases and/or cites some recently used definitions of important authors in the entrepreneurial literature. The first is related to a practitioner-based study. The others are derived from the academic literature.
An entrepreneurial ecosystem contains a set of individual elements within a region —such as human capital, an entrepreneurial culture and supportive organizations that interact in complex ways. In isolation, each is contributive to entrepreneurship but insufficient to preserve it. Together, however, these elements foster the development and growth of innovative enterprises (Daniel Isenberg, 2010).

Vogel (2013, p. 446) defines it as “an interactive community within a geographic region, composed of varied and inter-dependent actors (e.g. entrepreneurs, institutions and organizations) and factors (e.g. markets, regulatory framework, support setting, entrepreneurial culture), which evolves over time and whose actors and factors coexist and interact to promote new venture creation”.

Furthermore, this section provides a definition used by an OECD study, which they base on a combination of definitions they found in the literature. It goes as follows: an entrepreneurial ecosystem is “a set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organizations (e.g. firms, venture capitalists, business angels, banks), institutions (universities, public sector agencies, financial bodies) and entrepreneurial processes (e.g. the business birth rate, numbers of high growth firms, levels of ‘blockbuster entrepreneurship’, number of serial entrepreneurs, degree of sellout mentality within firms and levels of entrepreneurial ambition) which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial environment” (C. Mason & Brown, 2014, p. 5).

Lastly, this paper refers to Spigel’s (2015) ‘Relational Organization of Entrepreneurial Ecosystems’ in which he describes entrepreneurial ecosystems as the union of social, cultural, political and economic attributes within a region which contribute to the development and growth of innovative new ventures, and foster a supportive, risk-taking culture among nascent entrepreneurs and other actors.

One can conclude that an entrepreneurial ecosystem refers to a network of interconnecting and interacting elements within a region of which both the individual contribution as well as the interactions between those elements are essential for turbocharging the development and growth of entrepreneurship in that region. The entrepreneurial ecosystem’s components and their individual contribution are the subject of the next chapter, while chapter 2.3 reviews their interconnection. Section 2.4. describes the dynamic character of entrepreneurial ecosystems, as mentioned by Vogel’s (2013) definition. However, before getting to these topics, a comparison is made between entrepreneurial ecosystem and some related concepts. Also an explanation is given why firms tend to hub together.
2.1.4. Related concepts

In the field of business and innovation research, the notion of an ecosystem is relatively new. The literature provides a variety of ecosystem models, such as knowledge ecosystems (e.g., Clarysse, Wright, Bruneel, & Mahajan, 2014), business ecosystems (e.g., Clarysse et al., 2014; Moore, 1993), innovation ecosystems (e.g., Adner, 2006; Jackson, 2011), startup ecosystems (e.g., Herrmann, Gauthier, Holtschke, Berman, & Marmer, 2015; Motoyama & Knowlton, 2014) and entrepreneurial ecosystems (e.g., Daniel Isenberg, 2011a; Stam & Spigel, 2016). Moreover, the entrepreneurial ecosystem approach is also related to more established concepts as clusters (e.g., Porter, 1998), innovation systems (e.g., Cooke, Uranga, & Etxebarria, 1997) and industrial districts (e.g., Marshall, 1890). This subchapter aims to provide a better understanding in these concepts and how they are related.

2.1.4.1. Comparison with clusters, innovation systems and industrial districts

The entrepreneurial ecosystem concept provides a new and distinctive viewpoint on regional entrepreneurship, although it also coalesces with many postulations of the cluster, innovation system and industrial district theory (C. Mason & Brown, 2014). What all these concepts (including entrepreneurial ecosystems) have in common is the emphasis on the external business environment (Spigel, 2015; Stam & Spigel, 2016). In particular, they argue that there exist certain forces outside the boundaries of an enterprise, but within a region, which enhance the competitiveness of a company. Figure VII provides a complete overview. In industrial districts the focus lies on a strong specialization of workers in an industry, i.e. a local division of labor (Marshall, 1920). More recently it is described as socio-territorial entity in which a community of people and a population of corporations tend to merge (Becattini, 1990). The cluster theory is defined as “geographic concentrations of interconnected companies and institutions in a particular field” (Porter, 1998, p. 78). They include specialized suppliers, industrial companies, (governmental) institutions, e.g. universities and think tanks, that provide special support. The list of elements can be categorized in four factors: 1) firms of a related industry, its strategy and rivalry, 2) demand conditions, 3) factor conditions and 4) related and supporting industries (Porter, 2000). The cooperation and competition among these components, i.e. the cluster’s interconnectedness, can ignite growth, competition and innovation (Porter, 1998). The interrelationships between knowledge creating institutions, such as universities and public research organizations, and innovative enterprises are the subject of Regional innovation ecosystems (RIS). These networks enable knowledge to spill over, hereby fostering the innovativeness of the region (Cooke et al., 1997).
The first difference between the entrepreneurial ecosystem approach and industrial districts, innovation systems and clusters is the fact that entrepreneurs themselves, rather than enterprises, lie at the heart of the concept (Stam & Spigel, 2016). Hence, the entrepreneurial ecosystem approach does not only interpret the entrepreneurship as an outcome of the ecosystem but also as an important input factor, since an entrepreneur performs the role of key player in the ecosystem by creating the system and keeping it healthy (M. P. Feldman, 2014). This privatization results in a diminishing role of the government compared with the other three concepts (Stam & Spigel, 2016). Similarly, Feld (2012) states that it changes the government’s role to that of a feeder. Other examples of feeders are financial and service support organizations. Furthermore, these entrepreneurs can act as mentors (Feld, 2012) or as ‘dealmakers’ - individuals with their own social network, hereby mediating relationships among other actors and fostering new venture creation (M. Feldman & Zoller, 2012).

Clusters and industrial districts are, by definition, made up of enterprises in a particular industry, whereas an entrepreneurial ecosystem is composed of a heterogenous set of companies (Spigel, 2015). Furthermore, the ecosystem literature explicitly focuses on high growth firms and startups, as opposed to innovation systems, clusters and industrial districts literature(C. Mason & Brown, 2014; Stam & Spigel, 2016). The emphasis of these last three concepts lies on the large established firms and/or small and medium-sized enterprises (Stam & Spigel, 2016). Along similar lines, A. Markusen (1996) notes that clusters and industrial districts not always comprise these high-growth startups. Although innovation

<table>
<thead>
<tr>
<th>Key actors</th>
<th>Key concepts</th>
<th>Input into Entrepreneurial Ecosystem approach</th>
<th>Key outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshallian industrial district</td>
<td>SMEs</td>
<td>Labor market pooling; specialized goods and services; knowledge spillovers; market competition</td>
<td>Talent (labor market pooling), intermediate services (specialized goods and services), knowledge (spillovers)</td>
</tr>
<tr>
<td>Italianate Industrial district</td>
<td>SMEs; local government</td>
<td>Flexible specialization, interfirm cooperation, trust (social embeddedness)</td>
<td>Networks between entrepreneurs and enterprises</td>
</tr>
<tr>
<td>Cluster</td>
<td>Innovative firms</td>
<td>Factor conditions; demand conditions; related and supporting industries; firm structure, strategy and rivalry</td>
<td>Talent, finance, knowledge, physical infrastructure (factor conditions); demand (demand); support services / intermediaries (related and supporting industries); …</td>
</tr>
<tr>
<td>Innovation system</td>
<td>Innovative firms; national government</td>
<td>Networks, inter-organizational learning, system</td>
<td>Knowledge, finance, formal institutions, demand</td>
</tr>
</tbody>
</table>

*Figure VII.* Comparison with industrial district, cluster and innovation system literature (Stam & Spigel, 2016)
systems, clusters and industrial district theories do incorporate a role for entrepreneurs (e.g. Cooke, 2001; Ylinenpää, 2009), these studies do not view them as focal points, but rather focus on their role within the larger whole of value creation and innovation (Stam & Spigel, 2016). That is why these frameworks often interpret startups as smaller alternatives for large corporations. Contrarily they should be seen as unique organizations with distinct, more constrained capabilities and resources. Spigel (2015) concludes: “the advantages of an entrepreneurial ecosystem are related to resources specific to the entrepreneurship process such as startup culture and financing rather than other types of industrial benefits found in clusters that accrue to firms of all sizes and ages” (Spigel, 2015, p. 52).

The last difference is related to the role of knowledge spillovers (Stam & Spigel, 2016). The traditional models, as clusters and innovation systems focus on technological knowledge and market knowledge (Cooke, 2001). The first one is important for creating and developing new products and technologies. The second type of knowledge is necessary to find out whether these new products have chances to succeed in the marketplace. Next to these 2 kinds of knowledge, the ecosystem approach incorporates a third type of knowledge: knowledge about the entrepreneurship process itself (Stam & Spigel, 2016). Some examples of this type of knowledge are cognizance on challenges as scaling an enterprise, how to pitch an idea to investors and develop business plans, how to attract new suppliers and potential clients as starting venture, etc. Therefore, entrepreneurs are crucial to the ecosystem since they act as mentors and network with other entrepreneurs, which causes the proliferation of entrepreneurial knowledge (Lafuente, Vaillant, & Rialp, 2007). These distinctive features are summarized in figure VIII.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Industrial District, Cluster, Innovation System</th>
<th>Entrepreneurial Ecosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main focus</td>
<td>Main focus is on economic and social structures of a place that influence overall innovation and firm competitiveness. In many cases, little distinction made between (fast growing) startups and other types of organizations.</td>
<td>Startups explicitly at centre of ecosystem. Seen as distinct from established large firms and (lower-growth) SMEs in terms of conceptual development and policy formation.</td>
</tr>
<tr>
<td>Role of knowledge</td>
<td>Focus on knowledge as source of new technological and market insights. Knowledge from multiple sources is recombined to increase firm competitiveness. Knowledge spillovers from universities and other large research intensive organizations are crucial.</td>
<td>In addition to market and technical knowledge, entrepreneurial knowledge is crucial. Knowledge about the entrepreneurship process is shared between entrepreneurs and mentors through informal social networks, entrepreneurship organizations, and training courses offered.</td>
</tr>
<tr>
<td>Locus of action</td>
<td>Private firms and state is primary focus of action in building and maintaining industrial district/cluster/innovation system. Little room for individual agency in their creation.</td>
<td>Entrepreneur is the core actor in building and sustaining the ecosystem. While state and other sources might support ecosystem through public investment, entrepreneurs retain agency to develop and lead the ecosystem.</td>
</tr>
</tbody>
</table>

*Figure VIII.* Differences and similarities between entrepreneurial ecosystems and related concepts (Stam & Spigel, 2016)
To end, this paper refers to Daniel Isenberg (2011a) as he maintains that the entrepreneurial ecosystem approach constitutes a novel and cost-effective approach for fostering economic prosperity. According to him, an EE “either replaces, or at least is a necessary complement, or even pre-condition to, cluster strategies, innovation systems, knowledge based economies and national competitiveness policies” (Daniel Isenberg, 2011a, p. 1)

2.1.4.2. Link with other types of ecosystems

Smorodinskaya et al. (2017) examined the existing ecosystem literature. Their research confirms that the ecosystem concept is often used without clear definitions (Valkokari, 2015) which results in an increased ambiguity on the different ecosystem approaches (Oh et al., 2016; Suominen, Seppänen, & Dedehayir, 2016). Moreover, these different approaches are often used interchangeably (Aarikka-Stenroos, Peltola, Rikkiev, & Saari, 2016). Drawing on the existing literature, this paper will try to shed a light on these different ecosystem aspects. However, future research on this topic is necessary.

The main focus of previous research lies on one specific type of ecosystem. In practice, however, its inhabitants, i.e. the actors of the ecosystem, have interests in multiple parts (Muegge, 2013). Thus, ecosystems are partially overlapping, (Valkokari, 2015). The system boundary definition is of critical importance to gain a deeper insight in the different ecosystem types (Gulati et al., 2012; Post, Doyle, Sabo, & Finlay, 2007). There exist multiple ways to set ecosystem boundaries: “by geographical scope (local vs. regional or national vs. international), by temporal scale (from history to future or static snapshots vs. dynamic interactions), by permeability (open vs. closed) as well as by types of flows (knowledge, value, material), which must be decided upon” (Valkokari, 2015, p. 18). Valkokari (2015) chose to distinguish based on the type of flow, i.e. the shared intention among the ecosystem’s actors. In other words, her approach aims to differentiate on the outcome of each ecosystem. Hence, by combining artefacts, skills and ideas, i.e. interbreeding, ecosystems are able to produce new outcomes (Corallo & Protopapa, 2007) and it is these different business, knowledge and innovation outcomes that differentiate ecosystems from each other (Valkokari, 2015). She also discusses temporal and geographical scales as space and time are intimately related to any consideration of ecosystem boundaries (Post et al., 2007). This paper will follow the same reasoning.

Startup, innovation and entrepreneurial ecosystems

This distinguishing between these ecosystems is the most difficult one, as they are often used interchangeably. For example, the title of Feld’s (2012) book is: ‘Startup Communities: Building an
entrepreneurial ecosystem in your city’. Moreover, literature on the conceptual differences is very sparse. The definitions of the outcomes of each of these ecosystems, i.e. startups, entrepreneurship and innovation, further illustrate how complex this issue is.

The concept of entrepreneurship is already elaborated in detail in the subchapter ‘entrepreneurship. As recapitulation: innovation and growth-ambition were identified as the two main characteristics of entrepreneurship (Aulet & Murray, 2013; Daniel Isenberg, 2011a).

According to Forbes (2013): “To be a startup is to claim a freshness that suggests a finger on the pulse of the future”. Forbes identifies the ability to grow as the key attribute of a startup; or as he states it: “It is this focus on growth unconstrained by geography which differentiates startups from small businesses. A restaurant in one town is not a startup, nor is a franchise a startup”. Hence, growth and innovation are also the two main characteristics of a startup. They also emphasize the importance of self-ownership of the company, as an acquired firm becomes part of a bigger company. The Forbes article concludes with some benchmarks to characterize startups. They argue a startup generates less than $20 million revenues and has less than 80 employees.

The literature provides many definitions on innovation. Garud, Tuertscher, and Van de Ven (2013, p. 778) define it as “the invention, development, and implementation of new ideas”. The World Economic Forum (2015, p. 53), on the other hand defines it as “ecosystem conducive to the generation of ideas and the implementation of these ideas in the form of new products, services, and processes in the marketplace”. Similarly, Crossan and Apaydin (2010) describe innovation as the generation of new knowledge and inventions and the successful commercialization of these on the markets. In conclusion, innovation involves both, the creation and commercialization of inventions. Along similar lines, Oh et al. (2016) hypothesize that the tension between the research economy and the commercial economy might be the driver behind the recent rise of the innovation ecosystem terminology.

As demonstrated by these definitions, there is a very thin line between the concepts of startups, entrepreneurship and innovation. Nonetheless, the attentive reader could derive that innovation in fact includes entrepreneurship as it incorporates the implementation, i.e. the commercialization, of these inventions. Additionally entrepreneurship encompasses startups, since they are the pipeline for companies to become future high-growth firms (C. Mason & Brown, 2013). Or as Motoyama and Knowlton (2014) state, startup entrepreneurship is very early-stage entrepreneurship. This reasoning is in line with the sparse literature on the relationships between innovation, entrepreneurial and startup ecosystems
since startup ecosystems are segment of entrepreneurial ecosystems (Motoyama & Knowlton, 2014), and entrepreneurial ecosystems are the entrepreneurial subset of the innovation ecosystems (Oh et al., 2016).

However, many academics also state that the environments in which startups flourish can be contextually different from those of high-growth firms (Zoltan J Acs & Mueller, 2008). Along complementary lines, scholars argue that policy-makers should start focusing on high-growth firms and cease supporting startups (S. Shane, 2009). The question then arises as how they define startups, since they often include self-employment and slow growing SMEs. This statement is further strengthened by C. Mason and Brown (2013) who state that startup support should be focused on ventures with the highest potential, i.e. ambitious, growth-oriented enterprises which target large potential markets.

The geographical scope of startup ecosystems (Motoyama & Knowlton, 2014) and entrepreneurial ecosystems is local/regional (Daniel Isenberg, 2011a; Pilinkienė & Mačiulis, 2014). Innovation ecosystem’s geographical scope, on the contrary, can range from local to global. (Oh et al., 2016; Pilinkienė & Mačiulis, 2014; Ritala & Almanopoulou, 2017).

The following section explains how innovation ecosystems (and thus also its subset of entrepreneurial ecosystems) relate to and differ from business and knowledge ecosystems.

**Business, innovation and knowledge ecosystems**

Valkokari (2015) aims to explain the differences between business, innovation and knowledge ecosystems in terms of their outcomes, logic of action, actor roles and interplay. The results are summarized in figure IX. Moreover, she examines the relationships and interplay between these types of ecosystems.

Valkokari (2015, p. 18) defines a business ecosystem as “an economic community supported by a foundation of interacting organizations and individuals - the organisms of the business world”. Business ecosystems refer to value networks through which mutually complementary firms can realize competitive advantage (Clarysse et al., 2014) which implies that companies can act as both key player and niche player in the ecosystem (Carbone, 2009; D. Smith, 2013). Just as value (Allee, 2002) and business (Halinen & Törnroos, 2005) networks, they can be viewed as a cohort of enterprises and other institutions, working around a keystone company or platform, aiming to create and capture value through collaboration and combining its resources (Milinkovich, 2008). What distinguishes them from business networks is the variety of its actors as business ecosystems typically contain more actors (Heikkilä & Kuivaniemi, 2012). These actors can be categorized into several layers of the ecosystem, associated with the degree of
commitment to the business (Moore, 1993). Suppliers, distributors, customers and the focal firm form the heart of the ecosystem, i.e. the core business layer.

Geographically clustered organizations benefit from their locations to generate knowledge (Almeida & Kogut, 1999; Clarysse et al., 2014), as they experience reduced costs of moving people and ideas, i.e. external economies of scale (Clark, Feldman, & Gertler, 2000), and local spillovers (Agrawal & Cockburn, 2002). These knowledge ecosystems’ main focus lies on generating knowledge (Clarysse et al., 2014). They are centered around knowledge generators as universities, public research organizations (PROs) and large firms with established R&D departments, since these are the cornerstones of a knowledge ecosystem (Clarysse et al., 2014). Hence they focus on exploration rather than exploitation (Valkokari, 2015). Open source communities are a good example of this ecosystem type (Koenig, 2012) and illustrate that virtual proximity, e.g. emotional closeness, can also be interpreted as co-location (Coughlan, 2014).

As already explained above, the innovation ecosystems provide an innovation conducive environment in which innovation and growth are catalyzed (Ritala & Almpanopoulou, 2017; Smorodinskaya et al., 2017). The financial network, e.g. private investors as business angels and venture capital funds, which supports the companies and research organizations, play a prominent role in the development of the ecosystem (Clarysse et al., 2014). Furthermore, innovation ecosystems are highly dependent on intermediators, who assemble the various components of the ecosystem, hereby facilitating interplay and creating dependency among its actors (Valkokari, 2015). Lastly, innovation ecosystems are future-oriented, which stands in contrast to the temporal scale of business and knowledge ecosystems.

<table>
<thead>
<tr>
<th></th>
<th>Business Ecosystems</th>
<th>Innovation Ecosystems</th>
<th>Knowledge Ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline of Ecosystem</strong></td>
<td>Resource exploitation for customer value</td>
<td>Co-creation of innovation</td>
<td>Knowledge exploration</td>
</tr>
<tr>
<td><strong>Relationships and Connectivity</strong></td>
<td>Global business relationships both competitive and co-operative</td>
<td>Geographically clustered actors, different levels of collaboration and openness</td>
<td>Decentralized and disturbed knowledge nodes, synergies through knowledge exchange</td>
</tr>
<tr>
<td><strong>Actors and Roles</strong></td>
<td>Suppliers, customers, and focal companies as a core, other actors more loosely involved</td>
<td>Innovation policymakers, local intermediaries, innovation brokers, and funding organizations</td>
<td>Research institutes, innovators, and technology entrepreneurs serve as knowledge nodes</td>
</tr>
<tr>
<td><strong>Logic of Action</strong></td>
<td>A main actor that operates as a platform sharing resources, assets, and benefits or aggregates other actors together in the networked business operations</td>
<td>Geographically proximate actors interacting around hubs facilitated by intermediating actors</td>
<td>A large number of actors that are grouped around knowledge exchange or a central non-proprietary resource for the benefit of all actors</td>
</tr>
</tbody>
</table>

*Figure IX.* Characteristics of ecosystem types (Valkokari, 2015)
Each ecosystem type has a different logic of action (Clarysse et al., 2014) and the same player can participate in different ecosystems (Valkokari, 2015). This is illustrated in figure X. Moreover, these players perform different roles in each of the ecosystems they take part in (Valkokari, 2015). Therefore they perceive the interplay and relationships between ecosystems types differently. Hence, “highly mobile actors, platform owners or keystone companies are examples of actors boosting the interaction between the ecosystem types” (Valkokari, 2015, p. 18). Conversely, ecosystems are related through these different actors. Due to these interconnecting role of actors, ecosystems do interact with one other and hereby they are developing next to each other. As illustrated in figure X, innovation ecosystems act as integrating instrument between the generation of new knowledge in knowledge ecosystems and the exploitation of it in business ecosystems. This is in line with Oh et al. (2016), who hypothesize that the tension between the research economy and the commercial economy might be the driver behind the recent rise of the innovation ecosystem terminology. Also Clarysse et al. (2014) articulated a similar reasoning, as their research revealed that business ecosystems and knowledge ecosystems are partially distinct but interrelated within the bigger picture of innovation activities. These relationships between overlapping ecosystems are an important theme for future research.

**Figure X.** Relationships between overlapping ecosystems (Valkokari, 2015)

One can now differentiate among these related concepts. Another important question regarding entrepreneurial ecosystems (and related concepts) is why some areas are hotbeds of entrepreneurship and innovation whereas others are clearly not. This question will be answered in the following subchapter.
2.1.5. Scientific explanation of an entrepreneurial ecosystem

Literature provides three frameworks to explain the clustering of enterprises (Feld, 2012). These explanations each come from a different discipline, namely economics, geography and sociology. Feld further states that these explanations are mostly nonexclusive and complementary.

The economic explanation is called agglomeration economies and explores the benefits enterprises obtain by locating in proximity of each other. Discussions of this topic can be traced back as far as Marshall (1890). He applies economic concepts on location. One concept is the idea of external economies of scale, i.e. the lowering of a company’s average costs when industry-wide output increases within that firm’s region. Marshall (1920) identifies three sources for these external economies of scale, namely input sharing, labor market pooling and knowledge spillovers. The more recent literature has found many other causes of firm proximity, such as natural advantage, home market effects, urban consumption opportunities and rent-seeking (Rosenthal & Strange, 2004). A second economic concept related to agglomeration economies, network effects, explains an additional advantage of geographic concentration (Feld, 2012). Network effects are the influences that one user of a good or service has on the value perceived by the others using that service or product (Katz & Shapiro, 1994). The value of that product/service is dependent on the amount of users; more specifically the addition of one member to a network enhances the value for the other users (Katz & Shapiro, 1994). By including this vision, one can state that, due to network effects, a higher concentration of labors with specific knowledge in the same area is more valuable to the ecosystem than a lower concentration. Or as summarized by Feld (2012, p. 23): “external economies of scale lower certain costs; meanwhile, network effects make co-location more valuable”.

The social explanation of entrepreneurial ecosystems is given by Saxenian (1994). She introduced the concept of ‘horizontal networks’ because she noticed that the development of an entrepreneurial ecosystem cannot be fully explained by external economies. By comparing the evolution of two entrepreneurial ecosystems, Silicon Valley and Boston’s route 128, she argued that a culture of openness and information exchange is more beneficial for growth than closed systems. Silicon Valley’s horizontal exchange of information between and across ventures facilitated companies to better leverage innovation and adapt to new conditions; hereby causing massive growth of the area in the 1990’s. Route 128’s vertical integration and closed systems, on the other hand, disadvantaged many companies in the area during the technological revolution in the 1990’s. This argument is in accordance with network effects, which are more leveraged by culture of open information (Feld, 2012).
The last framework, the geographical explanation, is based on the “Creative Class Theory” (Florida, 2002). Florida describes the connection between innovation and the so-called creative class individuals. These include scientists, engineers, entrepreneurs, professors, artists and anyone else whose job is to create new ideas. They are the key driving force for economic development in post-industrial areas. Furthermore he argues that these individuals want to live in places with an open minded culture and a tolerance for weirdness. Even more important, they want to live with fellow creative class individuals. Thus, a location with creative class individuals has a competitive advantage over an area that yet has to attract them. This third explanation is also tied to network effect, since each additional creative individual creates more value to the entire ecosystem (the more creative class individuals in the area, the more other creative class individuals will be attracted to the area, which in turn enhances the value of the area even more). Along similar lines Lee, Florida, and Acs (2004) posit that diversity and creativity of a region can influence the concentration of human capital. They find empirical evidence that new firm formation is related to the creativity (measured by the ‘Bohemian Index’) in a region. The effects of diversity were mixed. Nonetheless this does not necessarily imply that diversity does not have an influence. As immigrants and foreign-born people cause most population increases in US cities, it is possible that the population growth rate, which has a significant impact on the entrepreneurial activity, has taken away the effect of the diversity measure.
2.2. Components of an entrepreneurial ecosystem

As described in the chapter 2.1, an entrepreneurship ecosystem consists of several components. This chapter identifies the most commonly accepted components and examines whether these components are essential or not.

Most past studies on the entrepreneurial ecosystem focused on identifying all its participants (Mack & Mayer, 2016; Motoyama & Knowlton, 2014). Van de Ven (1993) was the first one who did not exclusively focus on the individual characteristics of an entrepreneur. In his ‘Social system framework’ he emphasized the importance of a university, financing mechanisms, human competence pool and an institutional arrangement to legitimize, regulate and standardize activities on entrepreneurship.

Neck and her colleagues adapted this framework, based on a case study in Boulder, Colorado (Neck et al., 2004). Figure XI shows their taxonomy. The percentages written in the corner of the components, reveal the frequency of response during their in-depth interviews. The entrepreneurial ecosystem is composed of incubator organizations and the county. More important however, is how these constructs are subdivided and connect with the entirety. Their research indicates that there are six major components in an entrepreneurial ecosystem: incubators, spin-offs, informal networks, formal networks, infrastructure and culture.

Incubators are defined as the organization in which the entrepreneur worked before beginning his or her own company (Cooper, 1985). The relationship between these incubators and their implicit and/or explicit spin-offs, whereas implicit means that the incubator was not aware of the employee wanting to leave and explicit indicates the incubator knew about the employee’s plans, is of crucial importance in creating and growing an entrepreneurial ecosystem (Neck et al., 2004). Furthermore informal networks, which include friends, families, colleagues and informal relations with comparable companies, and formal networks, representing a diverse group in an economic community (see figure XI), play an important role in fostering venture creation. Finally the physical infrastructure, i.e. the tangible components of the county’s infrastructure such as roads, traffic office space and real estate, and culture, which is everything what makes an organization industry or nation unique, also enhance the development and growth of startups.
Hence, their research provides a key role for entrepreneurs (i.e. incubator organizations and their spin-offs). Furthermore, they underline the access to a multitude of resources (financial capital, human capital and support services); the formal (university, government and physical infrastructure) and informal institutions (culture); and lastly the interplay among these actors (formal and informal networks and the relationships between spin-offs and incubators).

![Figure XI. Taxonomy of the Boulder Country Entrepreneurial System](image)

Another, more practitioner-based, Boulder study divides the participants in an entrepreneurial community into leaders and feeders (Feld, 2012). The entrepreneurs should be the leaders of the ecosystem. Everyone else in the startup ecosystems can be seen as feeders. This includes investors, universities, service providers, large companies, government, and mentors. Furthermore, he enhances the importance of accelerators and incubators, which are both support organizations. One can derive that these two studies identify more or less the same core elements. This seems reasonable because both studies apply to the same region.
Even though the above listed elements are derived from only one case study, they largely overlap with the eight pillars identified by a study of the World Economic Forum (WEF), which inquires over 1000 entrepreneurs from around the globe (Foster et al., 2013). Similarly, these pillars also emphasize the importance of local resources (e.g. workforce, funding, and support services) and informal (cultural support) and formal institutions (major universities, regulatory framework and infrastructure) facilitating entrepreneurial activity. Additionally, this study identifies the access to markets (foreign and/or local) as an additional crucial component. Figure XII identifies the individual components underlying these eight pillars. However, their research also indicates that major differences exist in the availability of these ecosystem pillars across regions of the globe.

**Figure XII.** Entrepreneurial ecosystem pillars and their components (Foster et al., 2013)

In his ‘Relational Organization of Entrepreneurial Ecosystems’, Spigel (2015) refers to all these previously cited components. More specifically, he summarizes the most commonly mentioned elements in literature until 2015. He broadly grouped them into three main categories: cultural, social and material
attributes. The cultural attributes represent a region’s underlying beliefs and prospects about entrepreneurship. It includes the cultural attitudes and historical entrepreneurial success stories. The social attributes, on the other hand, represent all the resources composed of or obtained through the social networks. They comprise the network themselves, financial capital, mentors and dealmakers and worker talent. Lastly, there are universities, support services and facilities, policy and government and open markets that constitute the material attributes. These are all components with a tangible presence in the district. This can be either a physical location or the formalized rules that materialize locally.

Daniel Isenberg (2011a) identifies the same elements as Spilling but categorizes them differently. He stated that a region needs leadership, government, funding, cultural norms, success stories, human capital, universities, entrepreneurship organizations, infrastructure, support services, networks, and early customers in order to have self-sustaining entrepreneurship which is, according to him, only possible if there exists an entire entrepreneurial ecosystem. As shown in figure XIII, these participants can be consolidated into six domains: policy, finance, culture, supports, human capital and markets.

![Figure XIII. Relationships Among Ecosystem Attributes (Daniel Isenberg, 2011a)](image-url)
Another case-based conceptual framework, is developed by Suresh and Ramraj (2012). It identifies eight systems of support that influence an individual to become (or not to become) an entrepreneur: moral support (friends, family, and society at large..), financial support, network support, government support, technology support (e.g. from universities, incubators, human capital, etc.), market support (i.e. opportunities in the market), social support (e.g. acceptance of failure, exposure by media, etc., which is the same as the so-called ‘culture’) and environmental support (which are the local conditions: available resources, climatic condition,...). The attentive reader can infer that most of these ‘supports’ are already mentioned in the above literature. Only the notion of moral support is completely new.

The literature above shows that most past studies try to identify all the participants in the ecosystem. This often results summing up all possible elements, if only tangible, without considering the economic relevance of these elements. Motoyama and Knowlton (2014) find examining which attribute could be included in the ecosystem and which not, little effective. Moreover, they see this holistic approach as a limitation, since it implies homogeneity of ecosystems. According to them, most past studies assumed that every entrepreneurship ecosystem should be more or less the same in theory, irrespective of the local conditions. They, on the contrary, start with a postulation of heterogeneity, i.e. different regions can have different ecosystem structures. In accordance with this heterogeneity assumption, they take on a minimalistic approach and argue that the question should be what the most crucial parts in the ecosystem are, how these are related and how they evolve. Other academic studies also recognize the importance of investigating the interdependencies between ecosystem participants and their dynamic character (e.g. Mack & Mayer, 2016; Spigel, 2015).

The study of the WEF identifies market accessibility, human capital and access to funding as most crucial components of the ecosystem. Motoyama and Knowlton (2014) mainly agree with these findings, as they also identify support organizations (which include financial support) and entrepreneurs (human capital) as areas of pivotal importance in the ecosystem. Additionally, their research underlines the importance of entrepreneurial events and universities and reveals that the connections between those four elements play a crucial role in the development of the ecosystem. How these components are interconnected, will be examined in detail in the next chapter.

Spigel (2015) disagrees with Motoyama and Knowlton’s statement about the limitation of a holistic approach. He, on the contrary, argues that there is a huge need for theoretical development as it provides deeper insights in the process through which ecosystems emerge and aids to find out how these ecosystems influence the entrepreneurial activities in a region. Nonetheless, his study is predominantly in line with their findings. Although he advocates for a holistic approach instead of a minimalistic one, he
agrees on the notion that not all elements are equally needful. In his theoretical framework, he identifies ten attributes (confer supra) which comprise an entrepreneurial ecosystem but underscores the fact that not all of these elements are necessary for the development of a flourishing ecosystem. There are plenty examples of successful ecosystems that miss one or more elements. Secondly, he also emphasizes the importance of connections in an entrepreneurial ecosystem. Moreover, he even stated that the relationships between those attributes reproduce the entire ecosystem, not the individual elements themselves. Finally, he argues that an entrepreneurship ecosystem can be configured in multiple ways. In other words, Spigel agrees with the assumption of heterogeneity, which implies one should take into account local specificities when discussing entrepreneurial ecosystems.

Also Daniel Isenberg (2011a) recognizes the notion of heterogeneity. He claims that in order for entrepreneurship to be self-sustaining, his above mentioned elements should always be present, but that the combinations of these elements are always unique in each ecosystem. Along similar lines, Vogel (2013) argues that ecosystem elements are quite different across the world. Therefore it is important to understand a region’s strengths and weaknesses, hereby enabling the development of the ecosystem around its local specificities.

In summary, literature on which components to include in an entrepreneurial ecosystems has some small discrepancies. The question is not only a matter of the statistical significance, but also of economic relevance. Furthermore there is the postulation of heterogeneity, which only complicates the discussion. Therefore, these elements should be interpreted as major components that aid to develop supportive environments for new venture creation and procure external resources that improve the competitiveness of new firms, not as always necessary constituents. It is the relationships between those elements, not the elements themselves that define the ecosystem.

Following paragraphs review the importance of the most commonly cited elements, which are consolidated into following domains: culture, human capital, universities, support organizations (which include financial support), markets, large corporations and policy. These domains are not mutually exclusive nor exhaustive. On the contrary, the categories are overlapping, related and have a huge influence on each other. The relationships between them will be examined in the next chapter. Obviously, a comprehensive review of the existing literature on the influence of each of these components on entrepreneurship is beyond the scope of this thesis. Nonetheless this paper will try to provide a concise synopsis on the role of each of these components in an entrepreneurial ecosystem.
2.2.1. Culture

2.2.1.1. Culture explained
According to Mintzberg, Ahlstrand, and Lampel (1998) culture is all what makes an organization or region unique. Examples for the Boulder county are geography and climate of the region, intellectual capital and high-technology capabilities (Neck et al., 2004). Motoyama and Knowlton (2014) tried to give a deeper understanding of this cultural aspect, as it has little power to deconstruct into meaningful implications in this vague form. They emphasize the importance of a risk-taking culture; however, such a perception does not come out of the blue. It emerges from successful entrepreneurs who act as role models and who develop through processes and networks. Isenberg (2010; 2011a) calls this the ‘law of the small numbers’: even one success can have an enormous impact on entrepreneurship by igniting the imagination of the people and by triggering imitators. Hence, Culture can be divided into cultural outlooks and histories of entrepreneurship (Daniel Isenberg, 2011a; Spigel, 2015). The following paragraph examines the influence of these two cultural aspects on the entrepreneurship phenomenon.

2.2.1.2. Effect on the entrepreneurship process
Some academics have investigated how cultural attitudes influence the regional entrepreneurship process. Aoyama (2009, p. 500), for instance, declares that local cultures affect entrepreneurial activities “by shaping acceptable entrepreneurial practices and norms”. Another study found out that societal norms influence opinions about entrepreneurship - such as making it look like a standard path on someone’s career ladder or just the opposite, by depicting it as something you do when there are no other options available (Kibler, Kautonen, & Fink, 2014). By comparing the evolution of two entrepreneurial ecosystems, Silicon Valley and Boston’s route 128, Saxenian (1994) showed how two different cultures toward running a business led to totally different entrepreneurial environments.

As already mentioned, success stories have a great influence on these cultural attitudes. (M. Feldman, Francis, & Bercovitz, 2005; Daniel Isenberg, 2010; Motoyama & Knowlton, 2014). Not to mention the role local policy makers can play by celebrating these successes and using them to promote entrepreneurship (Daniel Isenberg, 2010; Nelles, Bramwell, & Wolfe, 2005). Furthermore these examples of successful entrepreneurship feed the debate about the benefits of entrepreneurship and show to secondary-educated students that it is a possible career path, which enables a stable supply of new entrepreneurs (Spigel, 2015).
2.2.1.3. Cultural guidelines for fostering entrepreneurship

Saxenian (1994) advocates for a culture of openness and information exchange. Feld (2012) agrees with this notion. In his Boulder Thesis, he emphasizes the impact of embracing porous boundaries, which implies the sharing of strategies, relationships, ideas and resources. In such an environment, it is even acceptable for employees to trade one company for another. In line with these porous boundaries, is his postulation of an inclusive culture: anyone who wants to participate in the ecosystem, should be able to.

He further accentuates the importance of accepting failure. Failing is inevitable for many startups and should be viewed as a lesson on a longer entrepreneurial journey. He gives the example of Boulder, where the local community quickly absorbs these ‘failed’ entrepreneurs. They can act as employees in other companies, mentors in accelerator programs or just start another business within a few months. If failure is not accepted, entrepreneurs will often put way too much energy in ideas that are already destined to fail. Contrarily, one should try to experiment and fail fast. This concept of experiment and fail fast is recently popularized by Eric Ries (2014) in his book The Lean Startup. As Ries’ concept is representative for an individual firm, Feld (2012) advocates to apply it on the entire entrepreneurial ecosystem- one that needs to try new things, measures the outcomes and either modifies, enhances or kills the approach depending on the outcome. Daniel Isenberg (2011a) also emphasizes the importance of entrepreneurial failure as it redeployes money, people and other resources. He advocates for a Darwinistic approach to resource allocation: “a system in which deserving ventures get resources, and, no less important, in which non-deserving ventures are denied them” (Daniel Isenberg, 2011a, p. 3).

Lastly, Feld (2012) strongly believes in the power of mentors to boost an entrepreneurial ecosystem. Related to this mentor driven approach, is the so-called ‘give before you get mentality’, which all mentors and actually all participants in the ecosystem should have. Also Motoyama and Knowlton (2014) underline the importance of this mentor-mentee relationship. According to them, it even exceeds the effect of success stories in a community. These mentors are role models for everyone in the community and their relationships with nascent entrepreneurs form the processes and networks through which the risk-taking culture can expand.

Moreover, they underline the influence of a supportive culture, i.e. the sharing of the by definition risk-taking experiences of entrepreneurs between peers and the giving and/or receiving of feedback, on perpetuating a risk taking culture through the ecosystem.

In summary, one can conclude that an open, inclusive, mentor-driven approach that is supportive and accepts failure, is beneficial for the entrepreneurial process. To end the discussion about culture, this
The general view on culture is that it does not change quickly; however the way through which people interact and create an open, supportive environment to enhance a risk-taking culture, can change in about five years.

2.2.2. Universities

2.2.2.1. The rise of the entrepreneurial university

As the economy evolved from a ‘managed economy’ driven by physical capital, towards an ‘entrepreneurial economy’ fostered through knowledge (Audretsch & Thurik, 2000, 2001, 2004; Thurik et al., 2013), the role of the university has also changed (Audretsch, 2014). The university has evolved from a Humboldtian model in which teaching and research are the cornerstones (Rothblatt & Wittrock, 1993), towards an entrepreneurial university which also has a third mission, i.e. economic and social development, next to the traditional core pillars of research and teaching (Audretsch, 2014; Etzkowitz, 2004).

Research alone is not sufficient to contribute to innovation activity and the hereby induced economic growth, since knowledge not always spills over automatically due to the existence of the so-called ‘knowledge filter’ (Audretsch, 2014). This knowledge filter is defined as the combination of factors that act as barrier between the creation of new knowledge and its commercialization, and must be penetrated to foster economic growth (Zoltan J Acs et al., 2004). Hence, “universities needed to become more entrepreneurial in that they pro-actively engaged in entrepreneurial activity to facilitate knowledge spillovers for commercialization out of universities” (Audretsch, 2014, p. 317). This implied more applied research oriented towards relevant society challenges, next to the traditional academic subjects and education, characterizing the Humboldt university (Audretsch, 2014). Moreover, it should provide mechanisms to enable the spillover of the core and applied research from the public to the private sector (Lockett, Siegel, Wright, & Ensley, 2005; Lockett, Wright, & Franklin, 2003). Technology Transfer Offices (TTOs) arose as one of the core instruments facilitating these knowledge spillovers, by enabling patenting activity and licensing intellectual property (Siegel, Veugelers, & Wright, 2007). Science parks and incubators are other examples of mechanisms created at universities to enable these spillovers (Phan, Siegel, & Wright, 2005). Figure XIV summarizes these characteristics of an entrepreneurial university.
2.2.2.2. A framework for university entrepreneurship

The leading role of universities (and other research organizations) in creating new knowledge and especially the importance of its research in fostering entrepreneurial activity and economic growth is central to many theories on innovation/entrepreneurship, e.g. the ‘Triple Helix Model’ (e.g. Etzkowitz & Dzisah, 2008; Etzkowitz & Leydesdorff, 2000) and the ‘Knowledge Spillover Theory of Entrepreneurship’ (Zoltan J Acs, Audretsch, & Lehmann, 2013; Zoltan J Acs, Braunerhjelm, Audretsch, & Carlsson, 2009).

However, many startups draw upon knowledge gained within educational environments, but are not related to technologies created within university laboratories (Shah & Pahnke, 2014). Therefore Shah and Pahnke (2014) provide a framework for categorizing new ventures that emerge from universities (see figure XV). In line with Qian and Acs (2013), they differentiate two important dimensions of knowledge, innovative knowledge and entrepreneurial knowledge, that are crucial for entrepreneurship.

Literature mainly focuses on ventures established by faculty and students around innovative knowledge, which is developed as part of academic research programs (Dechenaux, Goldfarb, Shane, & Thursby, 2008; Thursby, Jensen, & Thursby, 2001). By providing the substantial tacit knowledge required for the development and use of new technologies, the university acts as important resource for entrepreneurial activity (Zucker, Darby, & Brewer, 1998). Furthermore, most of this innovative knowledge falls under university ownership, such that universities must provide licenses and patents before commercialization can begin (Shah & Pahnke, 2014; Siegel et al., 2007).

Nonetheless, entrepreneurship education also has a great impact on venture creation as it provides students with insights in the entrepreneurial process, aids them with developing entrepreneurial skills and offers networks from which they can draw resources and expertise (Shah & Pahnke, 2014). This
entrepreneurial education may include coursework, speaker series, internships and business plan competitions. Next to exposing students to both tacit and explicit knowledge, this entrepreneurial education also legitimizes entrepreneurship among students by proposing/suggesting it as possible career path. A last benefit is that it may prevent bad ideas from being commercialized (Shah & Pahnke, 2014). Similarly, Feld (2012) argues that there are two powerful ways to engage students with an entrepreneurial ecosystem. The first one is by internships and recruiting events. The second one is by creating a mentor relationship between the entrepreneurial alumni and the students. The importance of this entrepreneurial education is further emphasized by Stam and Spigel (2016) as they argue that the entrepreneurial ecosystem approach incorporates a third type of knowledge, entrepreneurial knowledge, next to the commonly accepted technical and market knowledge. Daniel Isenberg (2014), on the contrary contests this postulation. According to him, entrepreneurial knowledge provided by a university is not crucial for creating a regional entrepreneurial ecosystem. However, this does not imply it cannot be helpful, it is just not viewed as highly necessary.

<table>
<thead>
<tr>
<th>Source of entrepreneurial knowledge</th>
<th>University provided entrepreneurial education</th>
<th>Other</th>
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<tbody>
<tr>
<td>Academic research</td>
<td>Spinouts-Type 1 (e.g., Google)</td>
<td>Spinouts-Type 2 (e.g., VMware)</td>
</tr>
<tr>
<td>Other</td>
<td>Offshoots (e.g., Instagram)</td>
<td>Seeds (e.g., Netflix)</td>
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*Figure XV.* Framework for university entrepreneurship (Shah & Pahnke, 2014)

Dependent on the knowledge one draws from a university, four types of startups are distinguished: Type 1 spinouts, Type 2 spinouts, Offshoots and Seeds (Shah & Pahnke, 2014). This is illustrated in figure XV.

Startups that commercialize innovations developed by a university (the two top quadrants in the framework), are referred to as ‘spinouts’ or ‘academic spinoffs’ in literature (Shah & Pahnke, 2014). In contrast to prevalent research on spinouts, Shah and Pahnke (2014) differentiate two types of academic spinoffs, dependent on whether or not the founders draw on entrepreneurial knowledge provided by the university. Literature defines ‘academic entrepreneurship’ as the creation of new firms by students, scholars or faculty who innovate in an academic context (M. Feldman et al., 2005; Lockett et al., 2005; Zucker et al., 1998). Therefore, their framework includes, but is not limited to, academic entrepreneurship, as these startups may or may not be founded by employees of the university (Shah & Pahnke, 2014).
The ‘Offshoots’ represent entrepreneurship that is not derived from academic research, but where the founder draws on the resources and connections, i.e. the entrepreneurial knowledge, obtained through the university (Shah & Pahnke, 2014). The bottom right quadrant, represent the ‘Seeds’. Their innovation was not derived from academic research, nor did the founders benefit from entrepreneurial expertise and networks provided by the university. According to Shah and Pahnke (2014) these are the most inclusive among university-based startups, since they consist of firms that do not directly benefit from educational knowledge (innovative or entrepreneurial). Nonetheless, these ventures are still related with the university as their founders probably have profited indirectly from the networks (friends, contacts, etc.) and knowledge (e.g. domain-specific knowledge, analytical and problem-solving skills, etc.) , they were exposed to during their education. Moreover the university culture can legitimize the idea of entrepreneurship as viable career options (Shah & Pahnke, 2014).

Along similar lines, Audretsch (2014) argues that university even further evolved in the entrepreneurial society. According to him, the role of the university extends technology transfer and the generation of startups, as it should be seen in a broader context, in which it provides leadership, entrepreneurial thinking and activity. Audretsch, Keilbach, and Lehmann (2006) refer to this as ‘entrepreneurial capital’. Similarly, Feld (2012) emphasizes the critical role of the university as convener of entrepreneurial activity, as it has great work spaces, e.g. large auditorium facilities, and lots of students excited about entrepreneurship. Therefore the entrepreneurial culture of the university has a great influence on the entrepreneurial ecosystem.

2.2.2.3. Questioning the importance of a university’s research function

However, the re-eminent role of universities in entrepreneurial ecosystems is not shared among all scholars (Feld, 2012; Harrison & Leitch, 2010; C. Mason & Brown, 2014; Motoyama & Knowlton, 2014). In particular, the effectivity of its research function has been widely debated (Motoyama & Mayer, 2016).

First, the theory of universities acting as engines of economic development is based on limited case studies (Lester, 2008; Mayer, 2007), as Cambridgeshire and Oxfordshire in the United Kingdom (Breznitz, 2011; H Lawton Smith & Ho, 2006) or Silicon Valley or Boston in the United States (Etzkowitz & Dzisah, 2008; Saxenian, 1994). As these cases are outliers in entrepreneurship, in both the U.K. and U.S. respectively, they may not reflect the reality for other regions in these countries (Motoyama & Mayer, 2016).

Second, the re-eminent role of universities is further being challenged by regions that failed to foster regional economic development and knowledge to spill over, despite the presence of leading research
universities or other research institutions (Mayer, 2007), such as Cleveland (Fogarty & Sinha, 1999) and Baltimore (M. Feldman & Desrochers, 2003; M. P. Feldman, 1994). These failures emphasize the importance of a so-called ‘innovation milieu’, an economic environment in which the spillover effects can be leveraged (Camagni, 1991). “In the case of Silicon Valley and Route 128, this environment emerged in parallel with the research university” (Mayer, 2007, p. 42). Along complementary lines, Feld (2012) argues that TTOs can sometimes act as barriers for the commercialization of innovative knowledge as result of their restrictive IP protection and severe licensing terms. He therefore recommends all universities to take Stanford and their impact on the Silicon Valley entrepreneurial ecosystem as an example.

Third, world-class research universities are not found in every entrepreneurial ecosystem (C. Mason & Brown, 2014; Motoyama & Mayer, 2016), which for example is illustrated by studies examining the upcoming of the so-called ‘second tier cites’, such as Portland, Idaho, and Oregon(A. R. Markusen, Lee, & DiGiovanna, 1999; Mayer, 2005, 2011). This challenges the postulation of universities as necessary factor for entrepreneurial ecosystems (Feld, 2012; Mayer, 2007).

Fourth, several studies (e.g. Astebro & Bazzazian, 2009; Harrison & Leitch, 2010; Lester, 2008) have shown that the number of spinoffs is disproportionately small in comparison with their impact on the overall economy. For example, Harrison and Leitch (2010) estimated that about 462 spinoffs emerged from research universities in the United states. Similarly Lester (2008) showed that 600 startups directly licensed intellectual property from American Universities. Moreover, these numbers hide the highly skewed patterns of academic research commercialization, as five universities account for more than a quarter of all university patents in the Unites States between 1998 and 2010, and 19 universities for more than half (National Science Foundation, 2012). One should be careful when comparing these numbers with the total number of startups in the whole US economy - around 500000 (Harrison & Leitch, 2010) - since these include mom-and pop shops, SMEs, independent consultants etc. (Motoyama & Mayer, 2016). Therefore it becomes extremely difficult to gauge the impact of university based startups. Nonetheless, there is limited research regarding this aspect: Harrison and Leitch (2010) revealed that spin-offs are mainly technology firms which begin small and achieve limited growth, implying that their impact on economic development is marginal.

A generalized conclusion cannot be drawn, since argument 1-3 are based on case studies. Nonetheless, these case studies were useful to provide counterevidence to the postulation that research based universities necessarily translate into venture creation or economic growth.
Moreover, argument 4 does not capture the potentially larger roles of universities (e.g. indirect consultation and advisory boards) since the scope of these examinations is limited to spin-offs, patents and licenses (Motoyama & Mayer, 2016). Furthermore these surveys were often conducted by inefficiently reported TTOs which often have different goals and may not have all the needful data from faculty members (Kenney & Patton, 2009).

2.2.2.4. Revisiting the role of universities

Because of the above mentioned limitations, Motoyama and Mayer (2016) conducted a different approach, using three sets of methods, hereby investigating the university’s role from a wider scope (i.e. a national macroeconomic scope) to a narrower scope (regional firm analysis and micro to firm-level analysis). Furthermore, they also examined the indirect roles of universities.

All three measurements led to results in the same direction: “the research and scientific output of universities has been overstated, yet the university’s role of producing high-quality labor has been underappreciated”(Motoyama & Mayer, 2016, p. 2). Hence, the role spin-offs and research institutions play in creating high growth firms is substantially smaller than most literature suggests. Entrepreneurial ecosystems mainly benefit from a university’s proximity through their contribution of human capital (Motoyama, 2014; Motoyama & Mayer, 2016).

Feld (2012) argues that universities provide 5 different resources for entrepreneurship: students, professors, entrepreneurship programs, research labs and technology transfer offices. In line with Motoyama and Mayer (2016), he argues that professors and especially students have a greater impact on entrepreneurship than the other three resources, as people are always more important than institutions for creating a vibrant ecosystem.

However, this does not imply that academic research is not important, as the teaching function is often related to academic research of the university (Motoyama & Mayer, 2016). Ideally, these two activities are intertwined: students contribute to academic research via their theses, while research findings are conveyed to students through the university’s teaching activity.

2.2.2.5. The role of universities in a nutshell

Universities play a dual role in fostering entrepreneurial ecosystems (Spigel, 2015). First, they provide human capital (Motoyama, 2014) and disseminate an entrepreneurial mindset among students, encouraging them to found a startup or work within them (Shah & Pahnke, 2014). Second, through
academic research, they develop new technologies, hereby creating entrepreneurial opportunities (Helen Lawton Smith, Chapman, Wood, Barnes, & Romeo, 2014). These innovations can be commercialized by academic entrepreneurs (S. A. Shane, 2004), or they can spill over to existing ventures (Kirchhoff, Newbert, Hasan, & Armington, 2007). This importance of this second role is widely discussed in literature (confer supra). One can conclude that rather than being the engine for entrepreneurial activity, universities act as feeders into the entrepreneurial ecosystem (Feld, 2012).

2.2.3. Human capital

As already stated above, none of these components are mutually exclusive. Conversely, they are overlapping, interconnected and have a huge influence on each other. Human capital, for example, is closely related to universities, as they provide educated students.

Many scholars perceive the presence of a diverse and skilled group of workers (human capital) as one of the most important elements in creating a thriving entrepreneurial ecosystem (Zoltan J Acs et al., 2013; Feld, 2012; M. Feldman et al., 2005; Foster et al., 2013; Motoyama, 2014; Motoyama & Knowlton, 2014; Stam, 2015). Motoyama (2014), for example, investigated the geographical factors related to high-growth firms, based on the framework of the knowledge spillover theory. Their regression analysis revealed that most factors fostering high growth-firms are substantially different from the knowledge spillover theory, since both research activities and venture capital are insignificant. Human capital factors are, on the contrary, highly related to the concentration of high-growth firms. This last observation coincides with the knowledge spillover theory. Stam and Spigel (2016) state than entrepreneurs themselves, rather than enterprises, lie at the heart of the ecosystem. All the other components should be viewed as feeders(Feld, 2012). As illustrated in this paragraph, human capital includes both entrepreneurs and worker talent. One should note that these are two overlapping concepts, as talented workers can start their own business and entrepreneurs can become managers/employees (e.g. if their firm is acquired).

2.2.3.1. Worker talent

An educated population, i.e. worker talent, has been associated with entrepreneurship by many scholars (e.g. Armington & Acs, 2002; Lee et al., 2004; Motoyama, 2014). Worker talent is a necessary precondition for growth in a knowledge economy, and skilled workers are a key resource in improving the competitiveness of new firms (Audretsch, Falck, Feldman, & Heblich, 2012; Qian, Acs, & Stough, 2013). Particularly science and engineering graduates are of crucial importance (Motoyama, 2014). This high level of human capital also include experienced employees and managers (Motoyama & Knowlton, 2014;
Lee et al. (2004) further argue that entrepreneurial activity requires more than workers with technical skills; social diversity, creativity and innovation encouragement are also necessary. Hence, these employees must also have a similar tolerance for risk as entrepreneurs themselves to operate in the chaotic environment characterizing these new ventures (Spigel, 2015). Social networks of both entrepreneurs and workers are used to find good matches between firms and their (future) employees (Van Hoye, Hooft, & Lievens, 2009).

2.2.3.2. The knowledge spillover theory of entrepreneurship & the role of human capital

Entrepreneurial academics have developed a new theoretical framework on entrepreneurship, ‘the knowledge spillover theory of entrepreneurship’ (KSTE), in which entrepreneurial opportunities are treated as exogenous (Zoltan J Acs et al., 2013; Zoltan J Acs et al., 2009). The theory “identifies new knowledge as source of entrepreneurial opportunities, and suggests that entrepreneurs play an important role in commercializing new knowledge developed in large incumbent firms or research institutions” (Qian & Acs, 2013, p. 185). These entrepreneurs act as conduits for knowledge spillovers, by bringing knowledge to the market that would otherwise remain uncommercialized (Audretsch & Keilbach, 2007). According to the theory, more opportunities arise in knowledge-rich contexts (Zoltan J Acs et al., 2009). Elaborating the whole theory is beyond the scope of this thesis. Conversely, this paper will focus on the research of Qian and Acs (2013) as they examine the role of human capital in this theoretic framework and its importance in fostering entrepreneurial activity. In line with Schultz (1961), they define human capital as “the knowledge and skills embodied within people” (Qian & Acs, 2013, p. 190).

Qian and Acs (2013) extend the KSTE by introducing the concept of ‘entrepreneurial absorptive capacity’ and by endogenizing the knowledge production process. This last extension implies the integration of the ‘knowledge production function’ (KPF) into to KSTE, hereby providing a better understanding of the association between knowledge, new knowledge and entrepreneurship.

According to their framework, the level of knowledge spillover entrepreneurship does not only depend on the speed or level of knowledge creation, but also on the entrepreneurial absorptive capacity of individual actors. “Entrepreneurial absorptive capacity is defined as the ability of an entrepreneur to understand new knowledge, recognize its value, and subsequently commercialize it by creating a firm” (Qian & Acs, 2013, p. 191). It is important to elucidate that this entrepreneurial absorptive capacity refers to the individual’s ability to create a new venture; it does not involve the creation itself. Hence, in accordance with Michelacci (2003), the theory argues that knowledge creation does not always induces
entrepreneurship, as it depends on the capability of human individuals to recognize these opportunities, reckon its value and mobilize resources to commercialize these inventions. This is consistent with the previous findings of this paper and the relatively small importance of a university’s research function on entrepreneurial activity.

In line with the above elaborated framework of Shah and Pahnke (2014), Qian and Acs (2013) distinguish two important dimensions of entrepreneurial absorptive capacity: scientific and business/market knowledge. Both types are essential for knowledge spillover entrepreneurship. The former is important to understand the working of the new invention and to recognize its value. The latter is indispensable for commercializing it.

This entrepreneurial absorptive capacity is crucial for both non-inventor and inventor entrepreneurs. Non-inventor entrepreneurs, who are established businessmen with significant entrepreneurial knowledge in most cases, have a greater need to identify and understand inventions developed by others (i.e. innovative knowledge). The exploitation of the new technology by its inventor, depends largely on his market knowledge, as he already has the scientific knowledge.

Figure XVI gives a schematic description of the above elaborated process. The dashed double arrow indicates that both new knowledge and entrepreneurial absorptive capacity are necessary for successful knowledge spillover entrepreneurship.

![Figure XVI](image)

**Figure XVI.** The absorptive capacity theory of knowledge spillover entrepreneurship with exogenously created knowledge (Qian & Acs, 2013)

Cohen and Levinthal (1990) state that prior related knowledge is critical for an individual’s absorptive capacity. Applying this logic on the entrepreneurial absorptive capacity, one can state that both prior
knowledge in technology and in entrepreneurial activities determines an individual’s entrepreneurial absorptive capacity. Qian and Acs (2013) argue that human capital can represent this prior knowledge embodied in individuals. The importance of human capital in ameliorating absorptive capacity is also emphasized by Mowery and Oxley (1995) and can be traced back to Mokyr’s (1990) declaration of industrial revolution. Hence, it can be concluded that human capital is the key determinant of the entrepreneurial absorptive capacity (Qian & Acs, 2013).

The second extension of endogenizing the knowledge production function is in line with Agarwal, Audretsch, and Sarkar (2007). Moreover, this endogenization is closely related with the above introduced absorptive capacity. Qian and Acs (2013) simplify the knowledge production function developed by Romer (1990) as human capital model:

$$d(A) = f(H)$$

where A is the new knowledge output and H is human capital. Hence, “new knowledge is simply a function of human capital” (Qian & Acs, 2013, p. 192).

Due to the inclusion of endogenously created knowledge, the absorptive capacity theory of knowledge spillover entrepreneurship becomes a two-phase process (Qian & Acs, 2013). This is illustrated in figure XVII. The first phase illustrates the dual role human capital plays in fostering entrepreneurship. On the one hand by driving new knowledge production, hereby creating entrepreneurial opportunities. On the other hand by building entrepreneurial absorptive capacity, which enables entrepreneurs to exploit new knowledge. The second phase highlights the mechanism through which possible entrepreneurs, with substantial entrepreneurial absorptive capacity, exploit innovative knowledge due to the creation of a new firm.

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2 Romer (1990) develops the KPF as follows: \(d(A) = f(H,A)\), where H is human capital for research and development and A is the total stock of technological knowledge. This implies that new knowledge creation is a function of the already existing knowledge stock and knowledge workers.

3 The authors provide two reasons to justify this simplification. First, their definition of human capital incorporates both input factors of Romer’s KPF, i.e. knowledge stock and R&D workers. Second, as knowledge stock (A) is the inter-temporal aggregation of new knowledge, the authors argue that it ultimately also depends on human capital.
In conclusion, this two phase model has connected human capital and entrepreneurial activity. Furthermore it provides a deeper insight on how innovative knowledge enables new venture creation (Qian & Acs, 2013).

2.2.3.3. The entrepreneur: the heart of the entrepreneurial ecosystem

Entrepreneurship is not only an outcome of the ecosystem, but also an important input factor, since entrepreneurs drive the ecosystem by creating it and keeping it healthy (M. P. Feldman, 2014). In his ‘Boulder thesis’, Feld (2012) argues that entrepreneurs must lead the ecosystem, as other components may run on different time cycles or have counterproductive objectives. These entrepreneurs must make a long-term commitment to their ecosystem, ideally a forward-looking 20-year perspective in order to develop the ecosystem throughout both economic recessions and peaks. Furthermore, they must be inclusive and take part in catalytic entrepreneurial events, hereby engaging the entire entrepreneurial stack, which includes nascent and experienced entrepreneurs, students, investors, employees and anyone else who wants to be involved. Lastly, they have to place the long-term health of the ecosystem above their own short-term self-interests. He further notes that it is not necessary that all entrepreneurs provide leadership as long as there are a few taking up this role. Feld (2012) ends his argument by stating that an ecosystem can appear anywhere, as long as these conditions are met.

Entrepreneurs can play multiple roles in an entrepreneurial ecosystem (Foster et al., 2013). For example, successful entrepreneurs can act as role models, hereby encouraging other individuals to start their own business (Daniel Isenberg, 2010; Daniel Isenberg, 2011a). Hence, success stories ignite the dispersion of a risk-taking mindset across the region, which finally results in the creation of an entrepreneurial culture.
Isenberg (2010; 2011a) refers to this as the ‘law of the small numbers’. Furthermore, C. M. Mason and Harrison (2006) argue that these ‘blockbuster entrepreneurs’ are the key drivers for the entrepreneurial recycling process (confer supra). In this entrepreneurial recycling process, they can act as investors, mentors, advisors, serial entrepreneurs, teachers of entrepreneurial courses, etc. The mentor role will be further examined in the subchapter support organizations.

Another role worth mentioning is its role as ‘dealmaker’. Dealmakers are defined as exceptional investors, entrepreneurs or service providers who “play a central role mediating, shaping and configuring regional entrepreneurial networks by sharing expertise, information and resources among entrepreneurs and investors thereby facilitating new firm creation and supporting entrepreneurship” (M. Feldman & Zoller, 2012, p. 26).

In conclusion, human capital plays a pivotal role in the development of entrepreneurial ecosystems. Talented graduates, especially in science and engineering, and experiences managers are important sources for a firm’s competitiveness. However, the most important actor in the entrepreneurial ecosystem is the entrepreneur.

2.2.4. Support organizations

Support organizations enable venture creation and growth by connecting the ecosystem actors and by facilitating resources to the entrepreneurs (Napier & Hansen, 2011).

According Motoyama and Knowlton (2014), these organizations provide two types of support: broad types and financial and functional types. Broad supports include mentoring, finding people and connecting. Functional support is more specific and consist of due diligence, space provision, refinement of business models and practice pitching.

One should note that these supports extend beyond the typical services of incubation space and finance (Motoyama & Knowlton, 2014). Mentoring is the most heterogeneous among all these provided supports and is by many support organizations seen as their primary service. However, current knowledge on the exact content of it is rather limited. It could encompass other supports, such as practice pitching, connecting ecosystem actors, and refining the business model. In accordance with Feld’s give before you get mentality (Feld, 2012), Motoyama and Knowlton (2014) found that mentors work on a voluntary basis because they want to give back to the community. Hence, they do not fees for consultation. Feld (2012) argues that not having this economic relation differentiates mentors from advisors.
Along complementary lines, C. Mason and Brown (2014) identify three types of service: technical services, specialist business services and finance providers. These support services are contextually different from above mentioned mentor-based support, as this last one is noncommercially oriented and often associated with a certain region (Motoyama, 2014).

This paper distinguishes four types of support organizations: funding organizations, incubators, accelerators and service providers. It should be emphasized that these organizations often provide overlapping services.

2.2.4.1. Funding organizations

The availability of financial capital is identified as critical source in fostering an entrepreneurial ecosystem (e.g. Foster et al., 2013). Along similar lines, Vanacker and Manigart (2010) state enterprises need investment capital to support their growth. Especially for high-growth firms, external equity is of crucial importance as it enables these firms to grow beyond their debt capacity (Vanacker & Manigart, 2010).

Traditional finance mechanisms as bank loans are mostly unavailable for innovative growth-oriented firms (Carpenter & Petersen, 2002) since these often are characterized by investments in intangible assets (e.g. R&D), high rates of volatility and information asymmetry between finance providers and entrepreneurs (Amit, Brander, & Zott, 1998). “Seed⁴ and venture capital investors are professional financial intermediaries that specialize in investing in young and innovative ventures providing them with the necessary financial resources to develop and grow” (Manigart, Standaert, & Vanacker, 2015, p. 175). Recently, funding mechanisms, such as angel⁵ investment and crowdfunding, have emerged (Manigart et al., 2015). Moreover, empirical research has shown that in addition to the provision of funding, venture capital investors also add value to firms in which they invest, for example by mobilizing resources (Politis, 2008).

There is a positive relationship between venture capital funding and portfolio company performance, disregarding some exceptions (Manigart & Wright, 2013). In comparison with non-venture capital backed companies, they commercialize, on average, products faster (Hellmann & Puri, 2000), create more jobs (Davila, Foster, & Gupta, 2003), invest at higher rates (Bertoni, Colombo, & Grilli, 2011) and fail less during the beginning years (Puri & Zarutskie, 2012).

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⁴ Seed capital can be viewed as a subset of venture capital, which primarily focuses on an firm’s (pre-)startup phase.
⁵ Angel capital is also a kind of venture capital.
Nonetheless, literature on the importance of venture capital in entrepreneurial ecosystems is mixed. Motoyama (2014) did not find a relationship between the concentration of high-growth firms and venture capital investment. Kreft and Sobel (2005) argue that the relationship between venture capital and entrepreneurial activity is reversed, i.e. entrepreneurship causes an inflow of venture capital and not the other way around. Hence, “venture capital lags rather than leads the emergence of entrepreneurial activity” (C. Mason & Brown, 2014, p. 16). This is further emphasized by the observation that venture capital was not part of the initial environmental conditions (M. P. Feldman, 2001; C. Mason, Cooper, & Harrison, 2002; Saxenian, 1994).

Academics tend to overemphasize the influence of venture capital in cultivating entrepreneurial ecosystems (C. Mason & Brown, 2014). Two case studies further illustrate this statement. An inquiry in the United Kingdom revealed that less than five percent of the growth-oriented enterprises used venture capital (Brown & Lee, 2014). Along similar lines, Motoyama, Danley, Bell-Masterson, Maxwell, and Morelix (2013) found that only a small fraction of the high-growth companies in Kansas City raised Venture Capital. Conversely, a combination of self-financing, bootstrapping and loans from family and friends were the most common funding types across these high-growth firms. However

Along complementary lines, Vanacker and Manigart (2010) argue that more profitably firms prefer to use fund investments internally. Another study in the United Kingdom, underscores the emergence of alternative funding mechanisms as source of capital for growth-oriented SMEs, such as crowdfunding, peer-to-peer lending and invoice trading (Collins, Swart, & Zhang, 2013). In conclusion, research suggests that venture capital ignites growth acceleration, not firm creation (Motoyama et al., 2013).

However, it should be emphasized that angel investors play a dual role in the development and growth of new firms, as they provide financial capital and offer their entrepreneurial experience and business networks they acquired throughout their career (Kelly, 2007; C. M. Mason, 2006).

Drawing from the existing literature, Politis (2008) has aggregated the range of these supportive activities in four distinct but complementary value adding roles: sounding board/strategic role, supervision and monitoring, resource acquisition and mentoring. Furthermore, he has linked each of these value adding roles to existing theories to illustrate their potential. His findings are summarized in figure XVIII. 

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6 For a more detailed overview on the supportive function of angel investors, this dissertation refers to Politis (2008)
2.2.4.2. Incubators

Literature on incubators is very extensive. There exist many different incubator models, such as business innovation centers, university incubators, research incubators and stand-alone incubators (Barbero, Casillas, Wright, & Garcia, 2014). Another typical distinction is made between profit and non-profit incubators (e.g. Aernoudt, 2004; Grimaldi & Grandi, 2005). However, examining all these different types is out of scope.

Other studies identify several basic features characterizing incubator models. According to Carayannis and Von Zedtwitz (2005) business incubators should at least provide four of the following supports: access to financial resources, strategic support, physical resources, e.g. office space, access to social capital, i.e. networks, and office support services. An incubators primary focus is the protection of new ventures from typical liabilities of newness, hereby increasing its survival rate (Schwartz, 2013).

2.2.4.3. Distinguishing accelerators from incubators and angels.

A new type of support organization, the accelerator, has emerged in the last decade. This section will differentiate this new relatively new phenomenon from more established concepts as business angels and incubators (see figure XIX).

An accelerator is defined as “a fixed- term, cohort based program, including mentorship and educations components, that culminates in a public pitch event or demo-day” (S. Cohen & Hochberg, 2014, p. 4). Hence, accelerators are limited-duration programs which intend to accelerate new firm creation through
a provision of services, with a particular focus on mentoring and education, to a cohort of startups (S. Cohen & Hochberg, 2014; Miller & Bound, 2011).

<table>
<thead>
<tr>
<th>Duration</th>
<th>Accelerators</th>
<th>Incubators</th>
<th>Angel Investors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohorts</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Business model</td>
<td>Investment, non-profit</td>
<td>Rent; non-profit</td>
<td>Investment</td>
</tr>
<tr>
<td>Selection frequency</td>
<td>Competitive, cyclical</td>
<td>Non competitive</td>
<td>Competitive, ongoing</td>
</tr>
<tr>
<td>Venture stage</td>
<td>Early</td>
<td>Early, or late</td>
<td>Early</td>
</tr>
<tr>
<td>Education offered</td>
<td>Seminars</td>
<td>Ad hoc, hr/legal</td>
<td>None</td>
</tr>
<tr>
<td>Venture location</td>
<td>Usually on-site</td>
<td>On-site</td>
<td>Off-site</td>
</tr>
<tr>
<td>Mentorship</td>
<td>Intense, by self and others</td>
<td>Minimal, tactical</td>
<td>As needed, by investor</td>
</tr>
</tbody>
</table>

**Figure XIX.** Summary of the Differences between Incubators, Investors, and Accelerators (S. Cohen & Hochberg, 2014)

One can derive that a myriad of supportive activities, enhancing the performance of an entrepreneurial ecosystem, are included in accelerators, incubators or angel investors. The fixed length of the accelerator program is main characteristic which distinguishes accelerators from the other concepts. This one difference leads to many other differences such as the forming of cohorts and the cyclical selection character. Other differences can be derived from figure XIX.

It should be noted that although accelerators are often related to incubators, they have more similarities with business angels. Lastly, this paper wants to emphasize one more difference between incubators and accelerators. Whereas incubators aim to nourish new ventures by protecting then from the environment, accelerators have the intention to accelerate market interactions, hereby enabling these new ventures to learn and adapt quickly. This last process results in both, quicker growth and failure (S. Cohen & Hochberg, 2014).

### 2.2.4.4. Service providers

Service providers include accountants, lawyers, recruitment agencies, marketing consultants, etc. (Feld, 2012; Napier & Hansen, 2011), who are accustomed to the challenges early-stage ventures face (Kenney & Patton, 2005; Patton & Kenney, 2005). They assist new ventures to overcome stumbling blocks, by offering them access to capabilities they do not possess themselves (C. Mason & Brown, 2014). In this way, entrepreneurs are able to focus on their core strengths, raising their chances of success (Napier & Hansen, 2011). These support providers have multiple business models. Some establish a very large
customer base and ask low fees (Spigel, 2015). However, most take a long-term view (Feld, 2012). They invest a lot of time and energy in the beginning without charging fees. As these young ventures start growing, the service providers are recompensated with long-term business connections with potential high-growth firms (Feld, 2012; Napier & Hansen, 2011). However, one important comment should be noted. Some scholars found evidence that the relationship is reversed (M. P. Feldman, 2001; Kenney & Patton, 2005). They argue that the presence of service providers may be due to the entrepreneurial success of the region rather than it is an underlying condition for developing an entrepreneurial ecosystem.

2.2.5. Policy

Literature on policy and entrepreneurship is very extensive which makes a comprehensive review on this topic out of scope. Moreover, many authors have been talking at cross purposes. Hence, it is very difficult to paraphrase their findings. Nonetheless, this paper will try to structure some of these policy recommendations.

As already explained in chapter 2.1, one should differentiate among small and medium-sized enterprises, self-employment and (innovative-driven) entrepreneurship (Daniel Isenberg, 2011a). Many policy initiatives fail to achieve entrepreneurial growth because they lump these sorts of ‘entrepreneurship’ together (Aulet & Murray, 2013). IDE has substantially different needs than SMEs or self-employment. Moreover, IDE policy requires different metrics and should be evaluated over different timeframes (Aulet & Murray, 2013). Hence, there may rise trade-offs and even conflicts between SME policies and IDE policies (Autio, Kronlund, & Kovalainen, 2007). S. Shane (2009) even states that supporting these small business is ‘bad public policy’ due to their limited growth, non-innovative character and high failure rates. In line with the definition on entrepreneurship in the first chapter, this section will focus on IDE policy.

2.2.5.1. Focus on ambitious entrepreneurship

Encouraging more individuals to become entrepreneurs is only half of the job. The goal should be to get the right people to found new firms (Autio et al., 2007). A study of the GEM has shown that most high-growth entrepreneurs already have a job (Autio, 2005), which is in line with the general trend that individuals are often middle-aged when founding their first startup7 (Wadhwa, Phelps, & Kotra, 2009). This implies that job experience and social networks are crucial in the exploration and exploitation of

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7 This corresponds to the ‘seed’ type of startup, referred to in the subchapter ‘Universities’.
entrepreneurial opportunities (Autio et al., 2007). Hence, high-potential entrepreneurship can be viewed as a career choice made by actors with high human and social capital (Davidsson & Henrekson, 2002). This emphasizes the importance of spin-offs from incubator organizations as catalyst for high-expectation entrepreneurial activity (Cooper, 1985; Neck et al., 2004). Therefore, policy initiatives should target spin-off formation, especially from knowledge-intensive enterprises and research institutions (Autio et al., 2007).

Furthermore, as these founders of high potential firms are mostly well educated and since universities often participate actively in innovation policy initiatives (e.g. targeted R&D programs aiming to found startups), universities and other educational institutions have become one of the focal points of high-growth entrepreneurship policy (Autio et al., 2007; Lerner, 2013).

Autio et al. (2007) further argue that support initiatives promoting high-potential entrepreneurship must be very selective when choosing participants. The degree of this selectiveness, or even exclusiveness in some cases, depends on the focus of the support. Especially when addressing more developed ventures, rigorous criteria are applied. Innovation and R&D initiatives, on the other hand, encounter less severe selection procedures. A key selective criterion for new ventures is growth orientation, as growth rarely occurs in absence of aspiration. Flexibility is a second selective criterion. For more advanced firms, tangible proof of market acceptance may be an option.

Along complementary lines, Daniel Isenberg (2010) states that government leaders should ‘favor the high potentials’. He argues that social benefits, such as wealth creation, labor force enrichment and reputational value, are much higher when a certain amount of resources is allocated to one ambitious, growth-oriented enterprise addressing a large market than when it is used to support a myriad of small-scale employment alternatives. Or as Autio et al. (2007, p. 80) state: “resource focus is more important for high-growth entrepreneurship policy than resource spread”. Furthermore, one should (over)celebrate the successful entrepreneurial ventures via media events, publicized awards, interviews, etc., since one success can have an instigating effect on the ecosystem. Literature refers to this phenomenon as the ‘law of the small numbers’ (Daniel Isenberg, 2010).

In some countries, e.g. Finland, support initiatives have been proactively approaching high-potential firms (Autio et al., 2007). Such a strategy is consistent with exclusive support philosophy noted above. Furthermore it enables agencies to address emerging needs before these are even recognized by the firms themselves. However, it is not completely riskless. Policy makers can make mistakes and wrongly identify
promising firms. Moreover, it gives a lot of responsibility to support organizations, which may lead to abuse. Lastly, there may be complaints about discrimination.

Most policy-makers tend to focus on technology-based firms, including university spin-offs, as a substitute for high-growth firms (C. Mason & Brown, 2013). However, various scholars have shown that this assumption is not valid, as their research reveals that high-growth firms exist in all sectors (Zoltan J Acs, Parsons, & Tracy, 2008; Anyadike-Danes, Bonner, Hart, & Mason, 2009; Motoyama, 2014). Consequently, a single-minded focus on high-tech sectors may cause sub-optimal results (Autio et al., 2007). Policymakers should take into account this diverse nature of high-potential firms (C. Mason & Brown, 2013).

Lastly, IDEs do not exhibit linear growth (Aulet & Murray, 2013). Policy-makers should thus not focus on short-term returns, but conversely, they should recognize the long-lead times associated with these firms (Lerner, 2013). Moreover, greater growth also implies greater volatility (Aulet & Murray, 2013; Autio et al., 2007). Therefore, these initiatives should be prepared to accept casualties (Autio et al., 2007). This volatility in combination with the long-term perspective requires sustained and focused efforts (Autio et al., 2007).

In conclusion, IDEs policies should focus on quality and dynamism, rather than on quantity and stability (which is typical for SME policies) (Autio et al., 2007).

2.2.5.2. One size does not fit all

There is no ‘one size fits all’ approach (C. Mason & Brown, 2014; Minniti, 2008). Every ecosystem is configured in a unique way (Daniel Isenberg, 2011a; C. Mason & Brown, 2014; Spigel, 2015; Vogel, 2013). Consequently, governments should stop replicating Silicon Valley (Daniel Isenberg, 2010), as an approach duplicating other ecosystems is likely to fail (Lerner, 2013; C. Mason & Brown, 2014). Entrepreneurial ecosystems should be built around local specificities, such as human capital, natural resources and geographical location (Daniel Isenberg, 2010) and policy strategies should take into account the institutional contexts characterizing each economic region (Wagner & Sternberg, 2004).

For example, Zoltan J Acs and Szerb (2007) made a distinction between middle-income countries and developed economies. The first type should focus on increasing human capital (e.g. through education), upgrading technology availability (e.g. via R&D institutions) and promoting enterprise development (i.e. legitimizing entrepreneurial activity). For developed economies a mere reduction of entry regulations will not be sufficient to create high-potential ventures. Conversely, policy should focus on reforming labor markets and deregulating financial markets.
Furthermore, policy strategies need to evolve over time (C. Mason & Brown, 2014), as ecosystems are dynamic rather than static organisms (Mack & Mayer, 2016). Hence, the appropriateness of a policy intervention depends on the maturity phase of the ecosystem. For example, during the ecosystem’s birth phase, the emphasis lies on creating an entrepreneurship-friendly environment and infrastructure and connecting nascent entrepreneurs with more experienced ones (Mack & Mayer, 2016). Growth capital, human capital development and international network support becomes more important when the ecosystems matures (Mack & Mayer, 2016; C. Mason & Brown, 2014).

**2.2.5.3. A mix of bottom up and top down approaches**

Framework conditions (e.g. legal and regulatory frameworks), are often the exclusive focus of governments (Daniel Isenberg, 2010). Taxation, regulations on trade, financing and the encouragement of innovation activities are some of the basic tools, governments use to affect entrepreneurial activity. (Minniti, 2008).

Manipulation of taxes is one of the most commonly used policy measures related to entrepreneurship. The basic idea is that a progressive tax rate, i.e. a taxation mechanism that is favorable for smaller firms, may encourage individuals to start a business (Minniti, 2008). Conversely, Gentry and Hubbard (2000) found that entrepreneurial entry augments when taxes are less progressive. However, they did not investigate whether this taxation system is also encouraging the most-talented entrepreneurs. Another commonly accepted idea is that high marginal (corporate) tax rates inhibit new venture creation (Gentry & Hubbard, 2000; Henrekson, 2005). Bruce and Mohsin (2006) do not contradict this. However, their study has revealed that most of the various tax types, e.g. income, payroll, capital gains, corporate and estate taxes, have significant but negligible effects on self-employment. The payroll and corporate taxes exert the largest effects on self-employment. Their research concludes that although taxes can have significant influences, they are not effective tools in fostering entrepreneurship. It should be noted that their findings were mainly based on self-employment rates. Hence, it is questionable if this is also applicable for high-potential entrepreneurship. Lerner (2013) argues that tax deductions for venture capital investments should be avoided, as tax policy encourages venture capital through the demand side, not the supply side.

Regions with low regulations are conducive for entrepreneurial activity (Feld, 2012; Kreft & Sobel, 2005). Governments should ease business formation (Zoltan J Acs & Szerb, 2007). Furthermore, barriers to trade

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8 This is not consistent with this paper’s definition on entrepreneurship.
impede entrepreneurial activity (Jones, 2007). Similarly, Puia and Minnis (2007) found regions with lower levels of entry regulation tended to have more entrepreneurship. Hence, policy should support internationalization (Autio et al., 2007).

Along complementary lines, Autio et al. (2007) state that entrepreneurial policy should remove disincentives for entrepreneurial growth. They give the example of progressive compliance requirements. These may inhibit growth, if they are not smoothened for enterprises which intend to expand rapidly. Therefore they advocate for a phased introduction of compliance requirements. Honeymoon periods are one example that could enable growing enterprises to solidify/stabilize before tackling compliance, hereby paving the way to more growth.

Financial support, such as grants, subsidies and credit assistance programs is another typical government support. However, literature on the effectiveness of funding is mixed (Minniti, 2008). Cumming’s (2007) analysis on the Australian Innovation Investment Fund (IFF) governmental program revealed that the IFF program has enabled investment in new ventures, early-stage ventures and high-tech firms as well as cost-effective monitoring, hereby advancing the development of the Australian venture capital industry. Along complementary lines, Daniel Isenberg (2010) also found that government can play a significant role in fostering the development of the venture capital industry. However, he stated that the government should ‘design in self-liquidation’, by giving the private sector the option to buy out its interests. Some authors argue that governments should avoid grants and subsidies or at least meet out money very carefully to develop toughness and resourcefulness among entrepreneurs (Daniel Isenberg, 2010; C. Mason, 2008). Too much financial help may distort entrepreneurial behavior (C. Mason & Brown, 2014). Others question the importance of venture capital in fostering entrepreneurship (confer supra).

Other important top-down approaches include immigration and the protection of intellectual property (Zoltan J Acs & Szerb, 2007). Immigration laws should enhance the attraction of talented individuals. Intellectual property protection, such as patents, copyrights and trademarks, could provide incentives for inventors to commercialize their ideas. However, there exists a complicated tradeoff when providing these rights (Merrill, Levin, & Myers, 2004). Governments may grant monopolies, if it provides protection for too long or if it is easily acquired. Contrary, incentives may be deficient if protection laws are too weak or evaded facilely. Complementary, policy should leverage academic research more effectively, since there exists a mismatch between the low level of entrepreneurship and the high level of scientific research (Lerner, 2013). TTOs can play a significant role in this (confer supra).
These top-down approaches are essential, but not sufficient (Daniel Isenberg, 2010; C. Mason & Brown, 2014; Vogel, 2013). Governments have a more holistic role to play. Moreover, most of these reforms take many years to push through (Daniel Isenberg, 2010). Developing entrepreneurial ecosystems requires a mix of ‘bottom up’ and ‘top down’ approaches (C. Mason & Brown, 2014; Vogel, 2013).

One of the most important policy recommendations is to engage the private sector (Autio et al., 2007; Feld, 2012; Daniel Isenberg, 2010; Napier & Hansen, 2011; Vogel, 2013). Private sector participation adds expertise and tacit skills to the initiative (Autio et al., 2007). Moreover, it enhances the credibility and reputation of the programs. This last attribute is important to establish an image of professionalism and competence, which is necessary to create a certain degree of exclusivity (Autio et al., 2007).

Policymakers should also resist to ‘overengineer’ clusters (Daniel Isenberg, 2010) and/or entrepreneurship (Lerner, 2013). Instead they should let the market provide direction and increase an entrepreneur’s flexibility (Lerner, 2013). “Government exist to support” (Feld, 2012, p. 36). Hence, it should reinforce existing clusters, rather than trying to create new ones. (Daniel Isenberg, 2010). Along complementary lines, Desrochers and Sautet (2008, p. 813) state that “policies enabling entrepreneurs to exploit opportunities in a context of spontaneously evolved industrial diversity are better facilitators of regional development”.

Similarly, C. Mason and Brown (2014) argue that government cannot ‘create’ entrepreneurial ecosystems. At best, policy may aid to the development of the pre-conditions of an entrepreneurial ecosystem. Once emerged, they can support the ecosystem by improving the entrepreneurial environment. For example, by assisting pre-startups, startups and early-stage ventures through the provision of formal and informal support services (legal, accounting, etc.) and mentorship (Roper & Hart, 2013). Another possibility for support is through incubation, which incorporates business premises, advice, space provision, networking opportunities and funding (Miller & Bound, 2011).

2.2.5.4. Intervene holistically

“The multi-faced nature of the entrepreneurial process, means that a single policy department, or a single policy initiative, is unlikely to produce lasting results” (Autio et al., 2007, p. 81). In fact piecemeal policy interventions may lead to reversed consequences (Daniel Isenberg, 2011a). Therefore policy makers should take into account the interconnected nature of ecosystem components and intervene holistically (Daniel Isenberg, 2010; Lerner, 2013; Napier & Hansen, 2011; Vogel, 2013). This implies that ecosystem policy requires broad-based collaboration across multiple policy departments, such as education,
innovation, SME, labor and taxation (Autio et al., 2007). Consequently, entrepreneurial policy should be targeted horizontally, rather than vertically. Such a horizontal program requires supervision and monitoring at the highest level.

### 2.2.5.5. Entrepreneurial policy: productive or unproductive

However, the effectiveness of policy measures promoting entrepreneurial activity is also questioned in literature (e.g. Lerner, 2013). Lerner (2013) identifies two types of pitfalls for government initiatives: conceptual issues and implementation issues.

Conceptual issues “doom a program from its very start” (Lerner, 2013, p. 68). An example of such a conceptual problem is that policy makers often do not take into account to realities related to the entrepreneurial process, such as the necessity of a long-term view. Another conceptual problem is the development of programs that ignore market’s dictates.

Implementation issues are related to the execution of the programs. One frequently encountered pitfall is the absence of appropriate evaluation mechanisms. Another implementation problem is the omission of incentives. Lastly, policy makers frequently ignore the international nature of entrepreneurship.

Next to these implantation and conceptual problems, government often impedes business formation by using overwhelming regulatory activities and misguided tax regimes (Feld, 2012).

Accordingly, Daniel Isenberg (2011a, p. 11) states that “government has the mandate to intervene holistically, but not the competence”. The private sector on the other hand, may have the competence to intervene but not the mandate, mindset or it may lack a holistic viewpoint. He therefore advocates that a new organization, which has the competence, mandate and motivation to strengthen the ecosystem, should lead/execute the intervention. He specifies this ‘entrepreneurial enabler’ as follows: it would have a public mandate and the perspective, resources and training necessary to influence all components of the entrepreneurial ecosystem. Furthermore, it would be able to experiment, learn, re-orient, scale and spinoff activities. It would be independent, i.e. not owned by any organization such as a university or ministry, and would be accountable for reaching the turning point where intervention is no longer necessary. Lastly, it would be temporary, i.e. it would design in self-liquidation.

In conclusion, government can enhance an entrepreneurial ecosystem but rather from a supportive role (Feld, 2012). In order to do so, they should intervene holistically, with a blend of top down and bottom up
approaches tailored to specific local conditions and with a specific focus on high-potential entrepreneurship. However, it is also clear that government can impede rather than foster entrepreneurial activity if there is too much public involvement without co-interest from the private sector.

2.2.6. Large corporations

According to a study of the OECD, at least one, and mostly several large companies lie at the heart of an entrepreneurial ecosystem. (C. Mason & Brown, 2014). These established firms help developing the ecosystem in several ways⁹.

1. They often act as ‘talent magnets’ since large firms need to attract large numbers of new employees every year (M. Feldman et al., 2005). Many of them are talented graduates, from outside the region.

2. They are regarded as role models, hereby disseminating a risk-taking culture across the area (Napier & Hansen, 2011).

3. They contribute to the development of talent in the region as they offer business training for their personnel (C. Mason & Brown, 2014). Employees’ technical know-how also improves as they gain more and more experience (Neck et al., 2004). Moreover these firms often have multiple management functions, enabling staff to climb the hierarchy ladder. In this way, employees can acquire management skills next to their technical knowledge for which they were initially hired (Napier & Hansen, 2011). This managerial experience is very valuable for startups (C. Mason & Brown, 2014; Neck et al., 2004).

4. Established firms can act as customers of early-stage ventures, hereby enhancing their credibility (Foster et al., 2013).

5. They often perform the role of incubator organization, as some employees will leave to found their own firms (Cooper, 1985; Foster et al., 2013; Neck et al., 2004).

6. They can provide exit opportunities for potential companies, by acquiring them (Napier & Hansen, 2011). Large corporations can also contribute in a variety of other ways. For example by offering meeting space and supplying resources (Feld, 2012).

7. They can put the entrepreneurial ecosystem on the map, as their mere presence shows to others that one can grow a successful enterprise in the region (Napier & Hansen, 2011).

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⁹ One should note that this section is closely related with the section of entrepreneurs, as entrepreneurs are the founders of these large companies.
8. Some established firms (e.g. Microsoft) have created programs to encourage entrepreneurs to build technologies that strengthen the larger company’s ecosystem (Feld, 2012). Hence, they create market opportunities since startups can commercialize complementary products.

C. Mason and Brown (2014) argue that locally headquartered enterprises, rather than multinationals are crucial for cultivating an ecosystem as these businesses are strongly committed to the local area. This is further implicitly assumed in the FORA model, in which they argue that the difference between developed and less developed ecosystems is presence of the so-called ‘blockbuster entrepreneurs’ and whether they stay and re-invest in the region or not (Napier & Hansen, 2011).

These established firms can also have a positive influence on their environment when they encounter difficulties (Daniel Isenberg, 2011b). Failures can be beneficial by redeploying money, people and other resources (Daniel Isenberg, 2011a). For example, released talented employees can either start their own firm or join other startups. Along similar lines, Neck et al. (2004) found that ‘critical moments’ in the life of a large enterprise, e.g. bankruptcy protection, were followed by higher rates of new venture formation in the region. Daniel Isenberg (2011b) refers to these large company failures enriching the ecosystem as ‘whale fall’.

In summary, to have a vibrant entrepreneurial ecosystem, there is a need for large corporations to cultivate it, intentionally or otherwise (Daniel Isenberg, 2011b).

2.2.7. Markets

Strong local markets often act as a catalyst for the development of an entrepreneurial ecosystem (Spigel, 2015), as domestic customers with specific and specialized needs create opportunities for startups and ignite entrepreneurial spinoffs (Foster et al., 2013; Spilling, 1996). These local customers include individuals, governments, SMEs and large corporations (Foster et al., 2013). Local entrepreneurs are in the perfect position to identify these opportunities within the local marketplace, because they are in close contact with these potential customers, enabling them to do vigorous market research (Spigel, 2015).

Along similar lines, Motoyama and Mayer (2016) found that customers act as a company’s major source of information. Moreover their research revealed that a company’s growth mainly came from its ability to find a market niche by identifying problems and solutions. The ways to discover these market niches are extremely heterogenous. For example, some entrepreneurs find a niche within a specific market, while others identify their niche between markets. In line with Motoyama and Mayer (2016), S. C. Parker,
Storey, and Van Witteloostuijn (2010) argue that high-growth firms are characterized by a strong market orientation and customer engagement.

As already explained in the section above, especially large enterprises can play an important role as customer, for example by enhancing the credibility of these young firms (Foster et al., 2013). Moreover, large companies encourage the creation of new markets (Moore, 1993), as they require mutually complementary products/services to foster their own (business) ecosystem (Clarysse et al., 2014).

Furthermore, a well-functioning financial market, which enables local growing firms to go public (through an IPO) or makes financial capital available (e.g. via bonds or bank loans), is crucial for the development of an entrepreneurial ecosystem (C. Mason & Brown, 2014). These financial markets may prevent that high-potential enterprises are acquired by large multinationals, which are less committed to the local area, and hence, less effective in stimulating the ecosystem than locally headquartered companies.

In addition to these domestic markets, international markets can have an impact on the development of the entrepreneurial ecosystem (Foster et al., 2013). Especially in regions with small domestic markets, internationalization becomes a necessity rather than a choice (Autio et al., 2007). Next to expanding the potential customer base for high-potential firms, internationalization may also become a source of competitive advantage (Autio, Sapienza, & Almeida, 2000).

Section 2.3.3.1. further elaborates the impact of markets and shows how they can ignite the development of the ecosystem as a whole.

**2.2.8. Only one piece of the puzzle**

Although the above listed elements and their contributions to entrepreneurial ecosystems provide some insights, there are limits to their value, since they are often prescriptive and retrospective (Mack & Mayer, 2016; C. Mason & Brown, 2014). Most of these studies are based on components of successful entrepreneurial ecosystems, excluding ‘second tier’ entrepreneurial ecosystems (Mack & Mayer, 2016). Moreover, these approaches often lack a time dimension, as if these components emerge fully developed and do not evolve. Hence, they give little understanding of the initiation process of these entrepreneurial ecosystems (M. Feldman et al., 2005; C. Mason & Brown, 2014) and implicitly assume that all these elements are equally important in each phase of the development of the ecosystem (Mack & Mayer, 2016).
Therefore, it is of crucial importance to develop theoretical frameworks that provide insights in the processes through which ecosystems emerge, evolve and affect the entrepreneurial actor’s behavior (Spigel, 2015). Without these frameworks, “research on ecosystems risks devolving into simple description of successful regions without any claim to more generalizable findings about the ecosystem’s internal dynamics or its role in economic development” (Spigel, 2015, p. 67).

In summary, the identification of the most important components is just the first step in a much bigger research process. There is also a need to investigate the relationships between these elements. Furthermore, researchers must take into account the dynamic perspective of these components to provide insight in the evolutionary dynamics of ecosystems. Lastly, academics should develop metrics, which will enable comparison among different ecosystems and theory validation.

The relationships between these components are investigated in the next chapter, while chapter 2.4. examines the ecosystem’s dynamic nature. The provision of the metrics is more complicated, as already explained in the subchapter ‘ecosystem’. This will be the subject of chapter 2.5.
2.3. Relationships within an entrepreneurial ecosystem

“An ecosystem’s attributes do not exist in isolation but rather develop in tandem, helping to influence and reproduce another” (Spigel, 2015, p. 55). Spigel (2015) further states that examining the reciprocity among elements is essential to understanding the larger role of entrepreneurial ecosystems. An entrepreneurial ecosystem is not defined by high rates of venture creation; this mistakes the effect for the cause. Instead, entrepreneurial ecosystems are defined by the relationships between the elements that produce them and the advantages they provide. Also Daniel Isenberg (2011a) underscores the importance of the interrelated character of the ecosystem. According to him, piecemeal policy interventions may lead to reversed consequences. One should intervene holistically, hereby taking the complex relationships within the entrepreneurial ecosystem into account. Similarly, Napier and Hansen (2011) argue that single actors have no value working alone; it is the collaboration between those actors that characterize the ecosystem. This chapter starts with examining four important relationships within the entrepreneurial ecosystem. The next section takes on a broader approach, recognizing multiple relationships. Based on these relationships, two theoretic frameworks are developed. The chapter ends with the a critical view on the applicability of these frameworks.

2.3.1. Four important relationships
Motoyama and Knowlton (2014) identified four key relationships within the ecosystem.

1. Connections between entrepreneurs
The presence of entrepreneurs is important for creating an entrepreneurial ecosystem, but the interaction between those entrepreneurs has an even greater significance. Entrepreneurs learn from other entrepreneurs, since they acquire practical knowledge, applied on real life cases, by communicating with each other (Motoyama & Knowlton, 2014). There are two kinds of relationships. Firstly, the mentor-mentee relationship. In their case study, Motoyama and her colleague purely focus on the advantages for mentees within this relationship. They declare that most mentors work on a voluntarily basis, because they want to give something back to the society. This is in accordance with Feld’s ‘give before you get’-mentality for mentors (Feld, 2012). Nonetheless Feld emphasizes the mutual learning of these relationships. He argues that in many situations, the mentor can learn more from the mentee than the other way around. According to him the most powerful relationships are those in which both are mentors to each other. In other words, they have become peers.
Speaking of peers, peer relationships are the second kind of connections between entrepreneurs (Motoyama & Knowlton, 2014). These are relationships between entrepreneurs who are operating in comparable industries or who are experiencing a similar stage of growth. They often originate from entrepreneurs following the same support programs (e.g. an accelerator program). “The experience of starting in the program the same time fosters uncommonly strong bonds and communal identity” (S. Cohen & Hochberg, 2014, p. 10). The graduates from such a program often create a community of learning and support, in which they perceive each other’s progress, assess other’s businesses and receive feedback on their own (Motoyama & Knowlton, 2014). Next to learning from each other, they also support each other emotionally through the uncertain and difficult journey of becoming a successful entrepreneur.

2. Connections between support organizations

According to Motoyama and Knowlton (2014), these can be functional and strategic, e.g. shared board members, or informal, such as attending events organized by others or jointly organizing entrepreneurial events. Frequent communication with other support organizations is important because it aids to identify areas in which there is still a gap in service. Moreover, they can examine whether they provide unnecessary overlapping support to the same enterprises. Note the use of the word ‘unnecessary’. Some support and training do not take place in isolation, but occurs continuously through various support organizations. In other words, overlapping is sometimes beneficial for entrepreneurs to navigate through several development stages (e.g. expanding the customer base and reformulating the business model are not one-time processes, financing occurs in several stages, etc.). Hence, a good communication between support organizations is essential to better complement each other’s services. Furthermore, support organizations should have open boundaries, which is in accordance with the earlier-mentioned open culture aspect. In this way, they are able to share information about ventures to prevent that entrepreneurs abuse the overlapping support functions by ignoring due diligence, committing to none or visiting different organizations until they find the least painful advice. To end, their case study revealed plenty of reformations in the support organization, which could suggest a constant reorganization of support organizations, at least for early stage ecosystems. This demonstrates that injecting new ‘missing’ elements of support is insufficient for creating a vibrant ecosystem, as every injection causes adjustments to other elements and changes the interplay between those elements. These interrelated changes underscore that the relationships between the supporting organizations are more important than the individual supporting elements.
3. **Connections between entrepreneurs and key support organizations**

The relationship between entrepreneurs and key organizations often enhances the credibility of the firm. New ventures receive two non-mutually exclusive types of support from these organizations (Motoyama & Knowlton, 2014). Firstly, broad types, such as mentoring and connecting. The mentor-mentee relationship, which is already explained when examining the relations between entrepreneurs, is seen as their primary service by many support organizations. Furthermore, support organizations enlarge the entrepreneurs network. Accelerators, for example, connect them to potential investors (S. Cohen & Hochberg, 2014). Secondly, support organizations provide functional and financial types of support, such as incubation/space and pitch practicing (Motoyama & Knowlton, 2014).

4. **Miscellaneous support connections**

These are other types of support in which/with whom entrepreneurs should engage. Examples are media, universities and entrepreneurship events. Especially organizing and/or attending catalytic events are very important for creating a vibrant ecosystem. These events should be in an entrepreneurial context (e.g. a startup weekend), and no purely networking events (Feld, 2012; Motoyama & Knowlton, 2014). Motoyama and Knowlton (2014) further state that the local media can act as a validation medium. This enables enterprises to attract new customers and to form new business relations. They can also play a role in (over)celebrating the success of exceptionally good performing companies which fosters the entrepreneurial mind of the community (confer infra). Also universities do support entrepreneurs. For example: they connect students with local entrepreneurs.

Motoyama and her colleague chose to examine only four connections. Following paragraph takes a broader approach and examines how several relationships between all the possible components in the ecosystem reproduce the ecosystem as a whole.
2.3.2. A theoretic framework

Spigel (2015) proposes a theoretic framework that describes the relational configuration in an entrepreneurial ecosystem. Figure XX exhibits the basic idea.

![Diagram of ecosystem attributes]

**Figure XX.** Relationships Among Ecosystem Attributes (Spigel, 2015)

The relationships between the participants of the ecosystems are not hierarchical. This is in line with Feld’s (2012) conviction that entrepreneurial ecosystems should operate as networks, not as hierarchies. Likewise, Saxenian’s (1994) comparison of Silicon Valley and Boston advocates for a more open, information-exchanging structure rather than a hierarchical one. As shown in figure XX, the relational configuration in the ecosystem can be viewed as a viscous circle (Spigel, 2015). At the root of the entire ecosystem are some local specificities. Subsequently some complementary attributes emerge to support these local specificities until a self-sustaining, self-generating ecosystem arises, in which each group of attributes is conducive to the other groups. More specifically, there is an interplay between the elements of the ecosystem, which on the one hand enables other attributes to emerge, and on the other hand reinforces the already existing attributes. For instance, the public opinion on entrepreneurship influences the eagerness of entrepreneurial actors to endorse/support other’s entrepreneurial activities. By normalizing aid and support for venture creation within the ecosystem, the cultural elements create an environment in which supportive social attributes can emerge. Both, these supportive social attributes and the entrepreneurial culture that facilitates them, are crucial for material attributes to be successful. These material attributes, on the other hand, reinforce the social attributes, which in turn strengthens the entrepreneurial culture. For example, strong local networks, investment capital and mentor-mentee relationships can arise from support organizations. These social attributes help then to strengthen and
reproduce the ecosystem’s already existing culture by “normalizing these practices and creating new stories of successful entrepreneurs that enter in the region’s history” (Spigel, 2015, p. 56).

This framework indicates that entrepreneurial ecosystems can be configured in multiple ways. In sparse ecosystems, one element drives the production of the other elements, e.g. a strong local market that catalyzes the development of the entire entrepreneurial ecosystem and all its components. The reproduction of the attributes in ecosystems with dense relationships is more complex. It is driven by the reciprocity between a risk-taking culture; networks of entrepreneurs, mentors, worker talent and investors; and public initiatives, support organizations and universities.

This demonstrates the need for a more nuanced comprehension of the ecosystem as whole which takes into account the local specificities. Following section illustrates this by comparing two differently composed ecosystems.

2.3.2.1. Two examples to underpin the theory

Spigel (2015) applies his framework on two different ecosystems to illustrate the various types of connections between elements within an entrepreneurial ecosystem and how this structure influences the possibility of entrepreneurs to make use of the localized resources within their region10.

The first region is characterized by a large local market, namely natural gas and petroleum reserves. Many of the county’s ventures are oriented towards this industry, indicating that most of the region’s entrepreneurship is due to this strong local market. Also the region’s cultural attitudes towards entrepreneurship are heavily affected by the norms of the gas and oil industry. A culture with an emphasis on wealth creation emerged. Other aspects of entrepreneurship, e.g. developing new technologies, were regarded as less important. These cultural believes affected the ecosystem’s other attributes directly and/or indirectly. Firstly, new ventures experienced difficulties in hiring and retaining talented workers because of the low social prestige placed on entrepreneurship and because of the high wages payed by the large energy firms. Secondly, it influenced the tendency of entrepreneurs to form strong social ties within the region. Most entrepreneurs only developed networks within the oil and gas industry. Hence, they did not share experiences with entrepreneurs outside the sector, nor did they share advice with other nascent entrepreneurs to develop new business skills. This resulted in strong social networks within the energy industry but weak ones outside it. This conception of networking impeded the effectiveness

10 The first example is the market-driven ecosystem in Calgary, Alberta; the second is the dense and innovative ecosystem in Waterloo, Ontario
of support programs and policies within the ecosystem, since there were no complementary attributes to underpin them. Lastly, a large pool of potential investors, both angel investors and venture capital firms, is attracted to the region because of the local resource industry. This enables enterprises to quickly expand or to fund ongoing research and development. However, most of these investors have backgrounds in the energy industry, limiting their ability to assess and invest in other industries. Consequently, one can state that there is plenty of investment capital within the ecosystem, but that not everyone has equal access to it. Figure XXI summarizes the relationships within the ecosystem.

Figure XXI. Relationships In A Sparse Ecosystem (Spigel, 2015)

In summary, this entrepreneurial ecosystem is driven by the strength of its local energy industry. This industry gives birth to lots of niches which entrepreneurs can exploit, thereby increasing the supply of entrepreneurs and investors in the region. Additionally, this market attracts skilled workers to the region. Some of these eventually leave, to found their own business or work at startups. Furthermore the high wages aid to form potential investors, but also create a challenge for entrepreneurs in other sectors to acquire skilled employees. Nonetheless, cultural structures of this industry have resulted in an underrating of several entrepreneurial activities, such as developing social ties with other entrepreneurs, working for new ventures rather than large corporations and focusing on innovation instead of quick growth. As a result, mainly firms within the oil and gas industry benefit from the ecosystem. Startups outside this sector, on the contrary, experience more difficulties in gaining access to the ecosystem’s investment capital, labor pool and networks.
The second region lacks a strong local market as in the first example. Nonetheless, a thriving ecosystem has emerged. Histories of entrepreneurship and the local university have created an entrepreneurial culture that promotes innovation and that encourages students and faculty members to spinoff their knowledge into new enterprises. This strong cultural support also convinces entrepreneurs to accept failure and see it as a part of the entire entrepreneurial process. Hence, entrepreneurship in itself has already social prestige. This outlook towards entrepreneurship supports dense social networks among entrepreneurs in different sectors, employees and capital providers. This networking and risk-taking ethos is self-reinforcing, as it encourages many successful entrepreneurs to engage in these networks, which in turn strengthens the high perceived value on these networks and the entrepreneurial culture. Furthermore it facilitates the quest for mentors and advisors. By sharing experiences, entrepreneurs can learn from each other and improve their business skills. The entrepreneurial attitude has given managers the opportunity to offer lower salaries in favor of more flexible working conditions and the possible revenue sharing. Additionally, the social prestige of working in innovative firms serves as substitute for monetary interests. Also the material attributes of the ecosystem are benefiting from this entrepreneurial and networking mindset while at the same time they are reinforcing it. Lots of support organizations, such as accelerators and incubators, are very successful in fostering the innovative and entrepreneurial culture. They offer incubation space, early stage funding, mentorship, etc. to selected local ventures. One aspect worth emphasizing is the organizing of networking events. Hereby, new entrepreneurs can connect with peers, more experienced entrepreneurs as well as mentors, executives from larger firms and possible investors. However, these events do more than facilitating networking: by connecting nascent entrepreneurs with successful businessmen, these support organizations promote a particular vision of rapidly growing high-tech firms. “This vision helps reproduce the cultural importance of technology entrepreneurship within the region’s ecosystem by celebrating successful entrepreneurs and normalizing particular practices like young university graduates founding growth-oriented companies” (Spigel, 2015, p. 64). In Conclusion, these support organizations are able to influence the general view on entrepreneurship, i.e. strengthening the ecosystem’s cultural and social attributes; reversely, it is due to these cultural and social attributes that they are able to do this. Figure XXII summarizes the connections within the ecosystem.
One can derive the region’s strong cultural and material elements reproduce this ecosystem by normalizing venture creation and by encouraging networking.

This comparison has shown that ecosystems can be configured in multiple ways and that there is a strong connection between the characteristics of an ecosystem and the way in which ventures derive resources from their surroundings. Moreover it emphasized the importance of the interplay between the attributes. For instance, new material elements such as support organizations, startup events or university technology transfer programs are unlikely to be effective if they are not underpinned by complementary cultural and social elements. Consequently, one should focus on developing underlying support for these programs instead of just implementing ‘ecosystem components’ without considering the relationships within the ecosystem. This is also in line with the previously mentioned separation of engineered parts of the ecosystems and the self-development characteristics (Ritala & Almanopoulou, 2017). The interaction between the several attributes as described by this model refers to the self-correcting, self-developing characteristics of the entrepreneurial ecosystem and the co-evolution aspect. The creation of some of these supportive attributes (sometimes by external institutions) on the other hand, can be assigned to the designing part.
2.3.3. Cause and effect relationships

The previous relationships and approaches lack insight in the fundamental causes of entrepreneurial ecosystems (Stam, 2015; Stam & Spigel, 2016). They state one must distinguish between the requisite and contingent conditions when explaining an entrepreneurial ecosystem. For instance, the study of the World Economic Forum argues that funding, workforce and market accessibility are the most critical components to foster entrepreneurship within a region (Foster et al., 2013). However, one can remark that these components can be best viewed as superficial causes, and thus not as fundamental causes, since human and financial capital are predominantly dependent on the institutions that underlie them, i.e. education and financial markets (Acemoglu, Johnson, & Robinson, 2005). Therefore, Stam (2015) provides a new model for entrepreneurial ecosystems which contains insights from previous studies, such as the most important components, but most importantly which also provides a reasoning of cause and effect.

As shown in figure XXIII, his model comprises four ontological layers: framework conditions, systematic conditions, outputs and outcomes. Furthermore there are three types of causal relations in his framework, namely upward causation, downward causation and intra-layer causation.

The upward causation shows that intermediate causes occur in the process from fundamental cause towards value creation. The downward causation, on the other hand, reveals a feedback mechanism: the outcomes and outputs of the entrepreneurial ecosystem become inputs over time. For example, more value creation results in more potential investors in the region; or more entrepreneurial activity is beneficial for creating an entrepreneurial culture. Finally, The intra-layer causal connections refer to the relationships between the different components of the ecosystem, as described in the paragraph above. Moreover, it also addresses how the several outputs and outcomes of the ecosystem interconnect.

The components of the entrepreneurial ecosystem are categorized in framework conditions and systemic conditions. The framework conditions comprise the social conditions, which consist of formal institutions and culture (i.e. informal institutions), physical conditions facilitating or inhibiting the social interactions in the region, and access to buyers, both endogenous and exogenous, for new goods and services. One should note that this access to (external) demand is likely to be more dependent on the relative position of the ecosystem than to its internal conditions. These fundamental conditions are the fundamental causes of value creation in the entire ecosystem. Nonetheless, in order to better comprehend entire ecosystems, one should examine the intermediate causes, i.e. the systematic conditions and the entrepreneurial activity. Support services, networks, funding, worker talent, leadership (mostly in the
form of dealmakers and entrepreneurs leading the ecosystem), and knowledge lie at the heart of the ecosystem. “The presence of these elements and the interaction between them predominantly determine the success of the ecosystem” (Stam, 2015, p. 66). The influence of each of these elements as well as their contribution to entrepreneurship has been already explained in the previous chapter.

![Diagram of Entrepreneurial Ecosystem Elements](image)

*Figure XXIII. Key elements, outputs and outcomes of an Entrepreneurial Ecosystem (Stam, 2015)*

The attentive reader notices that the above framework is in accordance with Spigel’s (2015) framework. More precisely, Spigel’s relational configuration describes the intra-layer causal relationships between the systemic and framework conditions, i.e. he describes the relationships between the elements of ecosystem. But one can state that Stam’s (2015) model extends Spigel’s one. He introduces cause and effect relationships, which imply a starting point of the entrepreneurial ecosystem. More specifically, he argues that framework conditions are the building blocks of the entire ecosystem. Concretely, he specifically mentions entrepreneurial activity and aggregate value creation as outcomes of the ecosystem and the feedback loop they cause. Spigel, on the other hand, only records this implicitly in his cultural aspect (histories of entrepreneurship and attitudes towards entrepreneurship). He should have implemented entrepreneurship as an attribute, since entrepreneurship is not only a result of the ecosystem, but also becomes an important input factor (Feld, 2012; Stam & Spigel, 2016). Furthermore Spigel’s (2015) relational configuration does not have a starting point. The ecosystem can emerge through any attribute, depending on the local specificities of the region and the hereby following interactions of support and reinforcement between the existing attributes. In other words, Spigel does not distinguish between necessary framework conditions and systematic conditions.
Yet, it is not all roses. Daniel Isenberg (2011a) disagrees on the notion of cause and effect relationships within an ecosystem. As shown in figure XIII, his diagram of an entrepreneurial ecosystem consists of six domains which lack causal relations. According to him, the six domains consist of hundreds of elements interacting in very complex and peculiar ways. He therefore argues that it is of little value to identify cause and effect relations within the ecosystem. Subsequently, he underlines the importance of context: each ecosystem is an outcome of a unique set of circumstances.

Both, Spigel’s (2015) theory and Stam’s (2015) theory, include feedback relations. This implies that an entrepreneurial ecosystem can be seen as a dynamic mechanism rather than a static one. This dynamic character will be the subject of the next chapter. However, before explaining the dynamic structure, this paper wants to add one important note on these theoretic frameworks.

### 2.3.4. An important comment

The above explained theoretic frameworks look very promising. However, the reader should still review them critically. In their paper ‘Ecosystems: systematic literate review and framework development’, Kortelainen and Järvi (2014, p. 8) state that research on ecosystems, in particular business and innovation ecosystems, “is still far away from the stage of testing theory, i.e., with multivariate statistical models, and further from the stage of replication studies”. According to them, current theory development falls somewhere within theory initiation and theory validation. The main reason for this is that most existing empirical studies are qualitative, while the amount of quantitative research oriented towards theory validation, is very limited (Kortelainen & Järvi, 2014). These qualitative studies, they argue, are useful as groundwork for theory building, since they provide deeper insights in the phenomena. However, the lack of quantitative research prevents that ecosystem theories are properly validated and tested.

Ritala and Almpanopoulou (2017) in the subchapter ‘ecosystem’, advocate to utilize simulation and agent-based modeling to improve current research on ecosystems, since these methods can provide superior insights when empirical data limitations exist (Zott, 2003). However, empirical data are still required to proceed to the stage of theory validation. Kortelainen and Järvi (2014) argue that the necessary data collection for the simulated model should be longitudinal and on the level of the individual actor with multiple measures, which implies serious challenges for data collection. They see possibilities in the use of digital data, for example email data, to overcome these challenges. This data is becoming more and more available, but research based on this kind of data is still very scarce. Furthermore, digital data can provide information on both, the individual actors in the ecosystem and the interplay among actors.
In conclusion, one cannot assume the correctness of the frameworks since their validity is not yet tested. This is because they are mostly based on case studies. Therefore, the reader should critically review these theoretic frameworks. Nonetheless they are still valuable, as they provide a good foundation for understanding the ecosystem phenomena.
2.4. Dynamic nature of ecosystems

The ecosystem’s present condition and future state are influenced by its past decisions and present actions, since these decisions serve as raw material for ensuing actions (Valkokari & Valkokari, 2014). This is illustrated by the feedback relation in the two above elaborated theoretical frameworks. Hence, an ecosystem can be viewed as a dynamic structure, which evolves through interconnections among its actors (Wallner & Menrad, 2011). Partially drawing on the experience of Ottawa, which has been called ‘Silicon Valley North’ (Harrison, Cooper, & Mason, 2004; C. Mason, 2008; C. Mason et al., 2002; Novakowski & Tremblay, 2007; Shavinina, 2004), C. Mason and Brown (2014) discuss this dynamic nature of entrepreneurial ecosystems. They try to provide a deeper understanding of their initiation process by identifying several prerequisites.

First, EE do not appear just anywhere. “They need fertile soil” (C. Mason & Brown, 2014, p. 13) and often emerge in attractive regions to live which have place-specific assets. As already described in the subchapter ‘related concepts’, entrepreneurial ecosystems act as integrating mechanism between the exploration and exploitation of knowledge (Clarysse et al., 2014; Valkokari, 2015). Hence, they develop in regions that already have developed a knowledge base, i.e. knowledge ecosystems. These regions are characterized by the attendance of one or more knowledge institutions, such as PROs, research universities or corporate R&D labs, which often act as talent magnets, attracting talented students, prominent academics and ambitious scientists and engineers (Feld, 2012; Motoyama, 2014; Neck et al., 2004). Furthermore their research generates knowledge that forms the building blocks of new innovations (Clarysse et al., 2014; Neck et al., 2004). Also Florida (2002) has given a geographical explanation for the emergence of EE. According to him, innovation is created by the so-called creative class individuals, including scientists, engineers, entrepreneurs, professors, artists and anyone else whose job is to create new ideas. These individuals prefer to live in desirable places characterized by an open minded culture, and /or attractive physical and cultural attributes. Furthermore fellow creative class individuals often attract each other, resulting in high concentrations of graduates within these regions and the creation/development of knowledge-intensive sectors.

A second important prerequisite is the presence of incubator organizations, defined as the organization in which the entrepreneur worked before beginning his or her own enterprise (Cooper, 1985). According to C. Mason and Brown (2014), these are essential in the development of an EE, as future entrepreneurs gain technical skills, product and market knowledge in here. Moreover, due to these incubator organizations, entrepreneurs are able to improve their understanding about relevant systems, strategies
and organizational structures. It is also the place where they identify new market opportunities and learn ways to exploit them (C. Mason & Brown, 2014). In short, these incubator organizations enable future entrepreneurs to develop practical/management experience and identify new market opportunities. High-tech, rapidly growing enterprises which are active in the beginning stage of a new industry and have many opportunities to exploit, are the most effective incubators (C. Mason & Brown, 2014). Conversely, branch plants (Malecki & Nijkamp, 1988), government research laboratories (Lawton Smith, 1996) and universities (Harrison & Leitch, 2010) are ineffective incubators, as these are often not exposed to markets or for the case. Moreover, branch plants often lack Research & Developments and are characterized by few management functions (Malecki & Nijkamp, 1988). University research often is not commercially applicable and if they do spin-off, they typically achieve limited growth (Harrison & Leitch, 2010).

The choice to start a new venture is mostly triggered by the incubator organizations themselves (Saxenian, 1994). In particular, negative reasons often underlie the individual’s motivation, with as most cited reason that their initiatives did not get approval from management. Clustering arises due to the tendency of spin-off firms to locate near to their incubator organizations (C. Mason & Brown, 2014; Neck et al., 2004). Literature provides three reasons for this. The first and most important one is that individuals start companies where they have social networks, which enables them to access knowledge, human capital and other resources elementary/necessary for starting and growing a new venture (Romanelli & Feldman, 2004; Sorenson, 2005). Furthermore, entrepreneurs are constrained by family mobility and may have location preferences (M. Feldman et al., 2005), as already indicated by Florida (2002) in the section above.

C. Mason and Brown (2014) further state that exogenous or even accidental reasons may underlie the emergence of entrepreneurial ecosystems. Similarly, M. Feldman et al. (2005) argue that a combination of external events ignites the entrepreneurial process. For example, the downsizing of the government and the introduction of technology transfer policies were key factors for the creation of the ecosystem in the Capitol region (M. P. Feldman, 2001). Along complementary lines, Neck et al. (2004) their research reveals that ‘critical moments’ during the life of the incubator organizations triggered employees to leave the incubator firms, intentionally or by force, and to start a new company. It is during and after these critical moments that the spin-off rates peak. In line with these findings, Daniel Isenberg (2011b) argues that corporate failure is an important input of entrepreneurship rise.

“Once the spin-off process gathers momentum it sets in motion a virtuous, self-reinforcing process which leads to the creation of an ecosystem that nurtures and supports further entrepreneurial activity” (C. Mason & Brown, 2014, p. 15). This implies that the creation of an enterprise during the first phases of
ecosystem development is something completely different than founding an enterprise when the ecosystem is already established (Bresnahan, Gambardella, & Saxenian, 2001). First, successful entrepreneurship can act as role model, hereby igniting entrepreneurship, since risk-aversity becomes lower and entrepreneurship becomes more legitimized (Daniel Isenberg, 2010). Second, spin-offs cause dissemination of know-how and competencies within the region as individuals move to new enterprises (as employee or as founder), hereby transferring both tacit and technical knowledge they gained in other local organizations (Keeble & Wilkinson, 1999). This mechanism results in a process of regional learning (Keeble & Wilkinson, 1999). Third, through the creation of the critical mass, spin-offs directly and indirectly result in the emergence of an entrepreneurial support network (Kenney & Patton, 2005). These support organizations nurture and encourage growth and development of new ventures by providing them specialist service and support on top of their own area of expertise (Saxenian, 1994). They consist of three service types: technical services, financial services and specialist business services (C. Mason & Brown, 2014). It is important to note that “the supportive conditions for entrepreneurship spontaneously follow the process in which entrepreneurship takes hold in an ecosystem” (C. Mason & Brown, 2014, p. 16). The availability of venture capital is a good illustration of this (confer supra), as it rather lags than leads entrepreneurship emergence (M. P. Feldman, 2001; C. Mason et al., 2002; Saxenian, 1994).

Next to the momentum, entrepreneurial recycling phenomenon (confer supra) will take place as entrepreneurs sell their business and reinvest their wealth and feedback their expertise as serial entrepreneurs, mentor or advisors, business angels and venture capital (C. M. Mason & Harrison, 2006). Especially ‘blockbuster entrepreneurs’ are very important for the entrepreneurial recycling process, for their spillover effects (C. Mason & Brown, 2014).

![Figure XXIV](image-url) Blockbuster entrepreneurs re-invest back into the ecosystem (Napier & Hansen, 2011)
However, both the spin-off momentum and virtuous self-reinforcing process do not necessarily take place (C. Mason & Brown, 2014). There can be multiple reasons for the spin-off poverty/shortage, such as no spin-off tradition among the major firms in the ecosystem or small firm sales which result in a limited generation of wealth and a lack of managerial experience. Furthermore, if these small exits are viewed as the norm, then entrepreneurial ambition will be limited. The same applies to early stage investors. The virtuous processes can quit, at least for a certain period, due to broader industry or technology changes or due to a lack of recycling individuals (C. Mason & Brown, 2014).

In sum, C. Mason and Brown (2014) tried to include a time dimension into the discussion on entrepreneurial ecosystems based on existing literature. Due to the shortage of evolutionary perspectives in literature, their findings did not reveal an explanation on how entrepreneurial ecosystems are created or generate momentum, nor did they solve why some ecosystems cease to exist. However, they show that there are many prerequisites for the emerging of EE, thus providing more insight in the initiation process of EE. Literature reveals that EE often emerge in specific places, which are perceived as attractive, and have one or more knowledge institutions. Entrepreneurship propagation and growth emerges through a spin-off process, which eventually develops a momentum on its own, hereby creating waves of entrepreneurship and developing a supportive entrepreneurial community. Furthermore the entrepreneurial recycling process is of critical value, in which exited entrepreneurs (via failure or acquisition) introduce their experience and expertise into the entrepreneurial ecosystem by acting as mentors, business angels, serial entrepreneurs, etc. Nonetheless, one should note that these self-sustaining processes and/or momentum can only take place to a limited extent; or may even quit at some point, causing ecosystem contraction, until a new period of ecosystem fostering emerges.

Based on these findings, the six domains of Isenberg (2011a) and some complementary insights, Mack and Mayer (2016) provided a theoretic framework of the evolutionary dynamics in an EE (see figure XXV for a more thorough view). They identify four stages: the birth phase, the growth phase, the sustainment phase and the decline. Important to note is that not all EE elements are equally important in each phase. During the beginning phase, many elements are underdeveloped. Therefore, key components such as human and financial capital, market opportunities and culture are crucial during this phase. The growth phase is characterized by a shift towards a more entrepreneurial mindset. For example, universities and other educational organizations begin to offer entrepreneurship-specific programs and the first serial entrepreneurs arise. Hence, specialized policies and refined support infrastructure serve as good

11 Some of these issues are nowadays solved by Stam’s (2015) model, such as causality issues
nutrition. During the maturity phase, leadership, entrepreneurial-oriented policies and success stories are the driving forces of the ecosystem. The decline phase will start when entrepreneurial actors fail in extending the sustainment phase, resulting in an environment that is not contributory for entrepreneurship. Thus, the EE ceases to exist and a new cycle can begin. These differences also imply that different stages require different policy measures. Hence, the framework provides policymakers and stakeholders action points to help sustain the ecosystem or propel it to a next phase (see figure XXV, lowest row). Another important comment is that not every ecosystem goes through all the stages. This framework can help identify why particular regions stay trapped within a certain phase and others continue to grow. Moreover, the framework can also be useful in comparing evolutionary trajectory of different ecosystems.

One should note that Stam’s (2015) framework and Spigel’s (2015), to a lesser extent, could also have had a place in this chapter, since the chapters are not mutually exclusive. The relationships within an entrepreneurial ecosystem and its dynamic character are intertwined and interrelated. This chapter tried to give a first impression on the dynamic structure of EE. However, lots of future research is still required on this topic and validation systems of the above elaborated frameworks have to be developed.

\[\text{Their research also reveals the existence of an interesting related topic: a tier structure of EE. This reputational effect (i.e. ‘tiering’ effect) may have an influence on the entrepreneurial recycling process and entrepreneurial success within a region. First-tier ecosystems have emerged due to a first-mover advantage.}\]
Figure XXV. Evolution of an EE (Mack & Mayer, 2016)
2.5. Measuring an entrepreneurial ecosystem

As widely explained throughout this thesis, there is a huge need to develop metrics, especially for theory testing (Kortelainen & Järvi, 2014) and the evaluation of policy measures (Lerner, 2013; C. Mason & Brown, 2014). Furthermore metrics allow the identification of the strengths and weaknesses of the individual components and the ecosystem as a whole, hereby providing insights in its specific qualities and shortcomings (Vogel, 2013). By means of this, new and complementary programs can be put in place and existing programs can be improved (Vogel, 2013). From an external viewpoint, measuring entrepreneurial ecosystems enables the comparison between different ecosystems, within the same country and around the world (Mack & Mayer, 2016; Ritala & Almpanopoulou, 2017). Lastly, an evaluation over time is made possible (Mack & Mayer, 2016).

Some scholars advocate for the use of simulation and agent-based modeling (Kortelainen & Järvi, 2014; Ritala & Almpanopoulou, 2017). However, these options have been suggested very recently (2014 and 2017), which is one of the possible reasons why literature has not responded yet. Conversely, practitioners and/or academics have provided some other methods to measure an entrepreneurial ecosystem.

As the prevalence of dealmakers is more important for entrepreneurial success than measures of aggregate regional entrepreneurial and investor networks (M. Feldman & Zoller, 2012), Napier and Hansen (2011) examine the applicability of dealmaker data as proxy for entrepreneurial ecosystem performance by using fraction of employment in young enterprises (0-10 years old), invested venture capital and patenting application as indicators for the ecosystem strength. Their research revealed that dealmaker data have potential to quantify and benchmark ecosystems, and to serve as proxy for ecosystem performance. Future research is required to investigate this in depth. However, it also had some limitations, regarding appropriate data identification. Especially the lack of regional-based performance data and issues related to the internal and external validity of the databases used to collect the dealmaker data. So, improvements have to be made on dealmaker data and regional performance data.

Vogel (2013), on the other hand, has used a mixture of primary data collection and a variety of national economic indices derived from established resource projects and secondary data sources, such as GEM, GEDI, GII, the UN Human Development index and the World Bank Doing Business Index. He created 20 indices to measure entrepreneurial ecosystems, based on three levels: individual, organizational and the community level. An ecosystem index is generated from these 20 indices, enabling comparison of ecosystems around the globe. Figure XXVI provides a detailed overview of the different indices.
In contrast to what Vogel’s (2013) study implicitly suggests, ecosystem measurement is far from straightforward (C. Mason & Brown, 2014). According to a study of the OECD, ecosystem measurement “poses challenges both in terms of defining what and how to measure, and identifying appropriate data which may not be available at the necessary level of geographical disaggregation” (C. Mason & Brown, 2014, p. 25). Because the availability of appropriate data sources is scarce, researchers often make use of proxy measures. This incited various organizations to develop their own metrics of ecosystem behavior. These different approaches enable ecosystem evaluation over time, but at the same time impede against benchmarking. Policy-relevant entrepreneurial ecosystem metrics should, therefore, be developed under surveillance of an international organization such as the OECD, as it enables a collaborative basis and ensures consensus (C. Mason & Brown, 2014).

Another ecosystem measurement tool useful for policy makers, is created by MIT (Levie et al., 2013; C. Mason & Brown, 2014). Its ‘Regional Entrepreneurship Accelerate Program’ (REAP) combines objective data with perceptual measures. The objective data are used to gauge the ‘activity pillars’, while the perceptual metrics identify bottlenecks, weaknesses and strengths. The REAP is built around six domains: people, funding, policy, rewards and norms, infrastructure and demand. The networks that link these
domains are also assessed. As shown in figure XXVII, a spider diagram is used to compare different ecosystems. The second stage of the analysis concerns the gathering of experts to investigate those pillars of the ecosystem that have been identified as bottlenecks. During these stakeholder meetings, summary reports are made. Smaller short term task groups then develop solutions based on these summary reports.

![Spider diagram](image)

*Figure XXVII. REAP analysis: Scotland vs. 27 innovation-driven economies (Levie et al., 2013)*

However, the study of the OECD also criticizes this approach. Once again, they identify data-driven problems. For instance, C. Mason and Brown (2014) argue that some pillars of the ecosystem can be gauged more easily than others. On top of that, most of the data are not available on the regional level. Consequently, the approach is quite robust and mainly emphasizes input factors as risk capital, rather than output factors, e.g. the number of high-potential firms or levels of aspiration. The authors, therefore advocate for more research and enhancement, before determining which criteria are best to use.

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Disregarding the policy measures, the Global Entrepreneurship and Development Index (Zoltán J Acs, Szerb, & Autio, 2016) covers all the components of the REAP framework. Furthermore it includes multiple input and output measures, which are both necessary for the measurement of an ecosystem (Levie et al., 2013). Therefore, a REAP Scotland team has used the main pillars in the Global Entrepreneurship and Development Index (GEDI) and adapted it to the regional level of the REAP. Furthermore, the methodology had to be extended to reveal gaps between the current policy emphasis and the weaknesses in the EE revealed by the GEDI analysis. The 14 GEDI pillars are illustrated in figure XXVII. For a more detailed overview of the methodology this paper refers to (Levie et al., 2013) and for more information on the GEDI in particular, the reader could consult (Zoltán J Acs et al., 2016).
Lastly, the Kauffman Foundation has introduced metrics for the overall performance of the ecosystem in terms of outcomes and vibrancy (Stangler & Bell-Masterson, 2015). They propose four indicators - density, fluidity, connectivity and diversity - with each three different measures. Moreover, they provide possible statistical sources for each of these metrics (see figure XXVIII). The authors argue that these measurement indicators should be tracked across time and suggest an annual (and if possible semiannual) collection of data. They also emphasize the need for a comparison group, preferably regions that are equal in size and that are geographically proximate. What follows is a short reasoning behind each of these metrics\textsuperscript{14}.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measure</th>
<th>Possible Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density</strong></td>
<td>New and young firms per 1,000 people</td>
<td>Census Bureau, Business Dynamics Statistics (BDS)</td>
</tr>
<tr>
<td></td>
<td>Share of employment in new and young firms</td>
<td>Census Bureau, BDS</td>
</tr>
<tr>
<td></td>
<td>Sector density, especially high tech</td>
<td>National Establishment Time Series (NETS)</td>
</tr>
<tr>
<td><strong>Fluidity</strong></td>
<td>Population flux</td>
<td>Internal Revenue Service</td>
</tr>
<tr>
<td></td>
<td>Labor market reallocation</td>
<td>Quarterly Workforce Indicators (QWI)</td>
</tr>
<tr>
<td></td>
<td>High-growth firms</td>
<td>Inc. 5000 and NETS</td>
</tr>
<tr>
<td><strong>Connectivity</strong></td>
<td>Program connectivity</td>
<td>Under development</td>
</tr>
<tr>
<td></td>
<td>Spinoff rate</td>
<td>Possibly: CrunchBase; LinkedIn</td>
</tr>
<tr>
<td></td>
<td>Dealmaker networks</td>
<td>Private databases, including Capital IQ</td>
</tr>
<tr>
<td><strong>Diversity</strong></td>
<td>Multiple economic specializations</td>
<td>Quarterly Census of Employment and Wages (QCEW)</td>
</tr>
<tr>
<td></td>
<td>Mobility</td>
<td>Equality of Opportunity project</td>
</tr>
<tr>
<td></td>
<td>Immigrants</td>
<td>American Community Survey (ACS)</td>
</tr>
</tbody>
</table>

\textit{Figure XXVIII. Measuring entrepreneurial ecosystem vibrancy (Stangler & Bell-Masterson, 2015)}

\textsuperscript{14} For a more detailed overview, this paper refers to (Stangler & Bell-Masterson, 2015).
The first indicator, density, includes three metrics: entrepreneurial density, employment impact and the impact of a particular sector. Since entrepreneurs are the heart of the ecosystem (Feld, 2012; Stam & Spigel, 2016) and especially young firms cause growth (Stangler & Litan, 2009), entrepreneurial density is measured as the amount of new and young companies (1-5 years old) per 1000 people in the area. Furthermore it is important to measure how much jobs these new and young ventures create (employment impact). Lastly, some sectors may have a greater influence in the ecosystems than others, hereby acting as one of the driving forces of the ecosystem. This is measured by the sector density.

Fluidity, the second indicator, is related to the so-called ‘bricolage’ entrepreneurship, i.e. the recombination of existing resources into new creations (e.g. Senyard, Baker, & Davidsson, 2009), since human capital is one of the key resources entrepreneurs require and this entrepreneurial bricolage is enhanced by the constant (re)mixing of people (Stangler & Bell-Masterson, 2015). This fluidity is further identified by Saxenian (1994) as one of the key drivers of Silicon Valley. It is measured by the movement of individuals between regions (population flux), within regions (labor market allocation) and the density of high-growth firms (Stangler & Bell-Masterson, 2015). The movement within regions is important as a higher pace of worker churning results in a better match between workers and firms (Haltiwanger, Hyatt, McEntarfer, & Sousa, 2012). The density of high-growth firms indicates whether entrepreneurs were able to exploit these resources effectively.

The significance of the third indicator, connectivity, is illustrated by the notion that relationships between the elements of an ecosystem are at least as important as the elements themselves (Napier & Hansen, 2011; Spigel, 2015). Stangler and Bell-Masterson (2015) recommend to estimate this connectivity by measuring the relationships between programs, because the relationships between support organizations are essential in developing an ecosystem (Motoyama & Knowlton, 2014), by observing the spinoff rate, as they want to measure the connectivity over time and incubator organizations often act as fertile source of new venture creation (Neck et al., 2004) and by gauging the dealmaker network, since dealmakers are more important for entrepreneurial success than measures of aggregate regional entrepreneurial and investor networks (M. Feldman & Zoller, 2012).

The last indicator of entrepreneurial vibrancy, diversity, comprises economic diversification, immigration and income mobility. The authors advocate for a ‘diversity of specializations’, because cities with many specialized clusters are very conducive for entrepreneurial innovation (Desrochers & Sautet, 2008). The second measure of diversity, assimilation of immigrants, is important due to the observation that immigrants have a higher entrepreneurial propensity (Foundation, 2014). The last measure, economic
mobility, refers to the probability of climbing the career ladder and should indicate to what extent the ecosystem diversifies opportunity (Stangler & Bell-Masterson, 2015).

It should be noted that these metrics are postulates that still require rigorous testing at different geographical levels. Future work may further develop these measures, add additional metrics or revise the existing ones. As this study provides measurement indicators for the ecosystem as a whole, future work still needs to develop metrics for specific programs, organizations and actions within the ecosystem. Consistent with all the other measurement approaches, more and better data is also essential. Lastly, the presumed connections among these metrics need further testing.

Measuring an entrepreneurial ecosystem is a complicated issue, that still requires lots of research. Especially the gathering of appropriate data causes lots of problems. Regional data are scarce and scholars are incapable of measuring the co-evolution aspect related to the network characteristics of the ecosystem. Kortelainen and Järvi (2014) see possibilities in the use of digital data, for example email data, to overcome this last problem. Digital data can provide information on individual actors in the ecosystem as well as on the interaction between these actors. Nonetheless, it can be concluded that ecosystem measurement still requires lots of future work.
2.6. Future perspectives

Throughout this thesis, some possible subjects of future research have already been highlighted. First, literature on comparing the different ecosystem analogies is scarce. Various ecosystem terms are used interchangeably, which results in ambiguous interpretations on these different ecosystem approaches. Especially literature on the difference between innovation, entrepreneurial and startup ecosystems is underdeveloped. The system boundary definition can prove to be useful in distinguishing these. Moreover, a more rigorous and careful usage of the ecosystem concept is required.

Secondly, most previous studies focus on one specific type of ecosystem. In reality, different ecosystems approaches are not mutually exclusive. Most actors have interests in multiple ecosystems and hence, these different ecosystems approaches are partially overlapping. Future research is required to investigate the relationships and dynamics between these overlapping ecosystems more thoroughly. In particular, research is needed to examine how ecosystem participants perceive their contemporaneous roles in these overlapping ecosystems and how these actors can leverage their roles in these ecosystems more effectively. Scholars should also create tools to facilitate crossing borders between different ecosystems. According to Valkokari (2015), food webs may provide a useful framework for this issue.

Thirdly, entrepreneurial ecosystem as a theoretical concept remains underdeveloped. Some scholars advocate to utilize simulation and agent-based modeling as tool for theory development as it can provide superior insights when data limitations exist. Furthermore, the several theoretic frameworks that already have been proposed require testing and validation. Empirical data are essential for this theory validation.

Fourthly, current research has the tendency to assume that ecosystems already exist. Consequently there is an engrossing avenue for necessary future research in examining an ecosystem’s temporal dimension. Some examples of pressing questions that still need to be answered are: what is the importance of several EE components during each development stage? Are certain elements more important than others? How do ecosystems emerge? Is there a temporal dependency of the importance of several elements (i.e. the so-called ‘chicken and egg’ question)? Why do some ecosystems remain trapped in a specific phase and others even wither away? It should be noted that some authors (e.g. Mack & Mayer, 2016; C. Mason & Brown, 2014; Stam, 2015) have attempted to answer some of these questions. However, this is just the beginning. The dynamic character of ecosystems should be one of the most important topics on the future research agenda.
The last topic, ecosystem metrics, probably requires most future research. The metrics proposed by Stangler and Bell-Masterson (2015) still require stringent testing at different geographical levels. Furthermore future work still needs to develop metrics for specific programs, organizations and actions within the ecosystem, as most metrics are focused on the overall performance of the ecosystem. The most important aspect however is the gathering of appropriate data. Regional data are scarce and researchers encounter problems measuring the co-evolution aspect related to the interconnected character of the ecosystem. Current datasets should be improved and new datasets should be created. Furthermore, Kortelainen and Järvi (2014) see opportunities in the use of digital data (e.g. email data) to investigate the network characteristics of an ecosystem. In conclusion, there is a huge need for more and better data.

It should be emphasized that much more future research is necessary. Examining the exact content of mentoring, further elaborating the effectivity of entrepreneurship in generating sustainable economic growth or more thoroughly investigating the role of TTOs in facilitating entrepreneurial activity are just some examples of this notion. This section, however, does not pursue these subjects as it primarily focuses on the questions concerning the entrepreneurial ecosystem phenomenon, not entrepreneurship in general. In particular, it focuses on the ecosystem as a whole.
3. Summary, conclusion and ambition

3.1. Summary

The first section of the literature review delineates the subject. Innovation and growth-ambition are identified as the two main characteristics of entrepreneurship. Hence, traditional indicators as self-employment and SMEs are not included in its definition. This innovation-driven entrepreneurship, is one of the key drivers of economic growth.

A critical examination of the ecosystem analogy reveals that a more careful use of the ecosystem concept is required. Therefore, entrepreneurial ecosystems are compared with more established concepts as clusters, innovation systems and industrial districts. Three distinctive features are identified:

1. High-potential startups lie at the heart of the ecosystem (not large corporations nor SMEs)
2. Entrepreneurs are the core actors of the ecosystem
3. In addition to market and technical knowledge, entrepreneurial knowledge is crucial

Additionally, different ecosystem logics are compared. Management studies often focus on one specific type of ecosystem, while in reality these different approaches are partially overlapping. Startup ecosystems should be viewed as a segment of entrepreneurial ecosystems, while entrepreneurial ecosystems represent the entrepreneurial subset of innovation ecosystems. These innovation ecosystems, on the other hand, act as integrating instrument between the generation of new knowledge in knowledge ecosystems and the exploitation of it in business ecosystems. It should be noted that literature is very scarce on this topic. Therefore, the author believes that by connecting the dots, this dissertation fills an important gap in literature. However future research is still required.

The comparison of several entrepreneurial ecosystem definitions reveals that the entrepreneurial ecosystem phenomenon refers to a network of interacting components within a region of which both the individual contribution as well as the interactions between those elements are essential to foster entrepreneurial growth. One definition even emphasizes the temporal dimension of entrepreneurial ecosystems. These insights became the foundation of the rest of dissertation.

Section 2.2. explores the components of an EE. Culture, human capital, universities, support organizations, policy, large corporations and markets were identified as important elements. Drawing on the existing literature, each of these elements is investigated more thoroughly. Furthermore, examination of the
several components revealed that ecosystems are heterogeneous rather than homogenous. This implies that different regions can have different ecosystem structures.

Section 2.3 investigates the relationships within an ecosystem, as ecosystem components do not exist in isolation. Conversely, it can be stated that these develop in tandem, hereby influencing and reproducing each other. Four key relationships are identified: connections between entrepreneurs, connections between support organizations, connections between entrepreneurs and support organizations and miscellaneous support connections.

Moreover, two theoretic frameworks are analyzed. The first framework indicates that entrepreneurial ecosystems can be configured in multiple ways. This is further exemplified by two examples. What also struck the eye, is the inclusion of feedback loops in both models, which underscores the dynamic character of the concept. The second framework even introduces cause and effect relations by which it implicitly assumes a starting point of ecosystem development. In particular, formal institutions, culture, physical infrastructure and market demand - the so-called framework conditions - are identified as building blocks. The other components emerge from these framework conditions and represent the heart of a developed ecosystem.

The time-dimension of entrepreneurial ecosystems is described in chapter 2.4. Four ecosystem stages are identified: the birth phase, the growth phase, the sustainment phase and the decline. Important to note is that not every ecosystem goes through all the stages. Furthermore, the model implies that not all EE elements are equally important in each phase. This requires different policy measures in different stages.

Section 2.5. explores the ecosystem metrics. Most existing metrics focus on ecosystem performance measurement. However, the ultimate challenge for researches remains the gathering of appropriate regional data. Additionally, researchers encounter problems measuring the co-evolution aspect related to the interconnected character of the ecosystem. Consequently, it is argued that current theory development falls somewhere between theory initiation and theory validation. Agent-based and simulation modeling could partially complement this. Another interesting possibility to investigate these network characteristics is found in digital data analysis.


3.2. Conclusion

The science of entrepreneurial ecosystems has been in full development for the last decade. At the level of describing and inventorying the phenomenon a lot has been accomplished. There has been plenty of qualitative and case related research. The outline of the discipline is becoming clearer every day.

Still research and analysis within the subject of entrepreneurial ecosystems show a very disparate image at this moment. There are many pieces of a puzzle that haven’t been put together yet. Some components and/or interrelationships have already been elaborately investigated and described, for instance in the field of policy. On the other side of the spectrum, on components such as accelerators and dealmakers or on cause and effect relations, hardly any systematic empirical research has been done.

Other little explored domains can be situated in ecosystem evolution. Additionally, not only evolutions and connections within one ecosystem should be explored, also the research of connections between overlapping ecosystems should be intensified.

Concerning the phases in the research on entrepreneurial ecosystems, the phase of measurement is the least explored. There are hardly any measuring methods, not even in the field of the effectivity and efficiency of policies. As a result, current theory development falls somewhere between theory initiation and theory validation.

On the whole, an integral and integrated approach concerning the research on entrepreneurial ecosystems is still in its infancy. The results of many related studies are fragmented, unprecise and dispersed. There is still a lot to be desired on the fields of consistency, coherency and transparency. Therefore, a more rigorous alignment of general knowledge and definitions in particular is paramount. This should be one of the priorities preceding and ameliorating further investigations.

In short: it is the highest time for a framework of the existing frameworks...
3.3. Ambition

The scope of this dissertation is wide and deep at the same time, witness the 200+ references made. Ultimately it aims to provide a comprehensive framework of the fields, elements, relations and phases on which future research in the field of entrepreneurial ecosystems can be based and oriented. Its ambition is to serve as a guidebook for researchers that can help them in situating the research they are doing in relation to other fields of research.

Future research will have to demonstrate if we have succeeded in doing so.
4. References


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