

Change and path dependence in entrepreneurial  
ecosystems: Comparison of emerging bioeconomy  
in two Finnish case regions

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Tiivistelmä – Referat – Abstract <p>Unprecedented environmental challenges require new entrepreneurs who develop disruptive ideas, products and services. These entrepreneurs are becoming increasingly dependent on their surrounding context and the other actors situated within this context. Against this background, this research focused on the emergence of bioeconomy entrepreneurial ecosystems in two Finnish regions: Lahti and Tampere, and investigated regional differences in entrepreneurial ecosystem emergence, evolution and legitimacy.</p> <p>This research was based on an iterative process of theory elaboration. Spigel's relational perspective to entrepreneurial ecosystem attributes was used as the main guiding perspective. An integrative literature review conceptualized and synthesized literature around the topic. A comparative case study design was applied, and case regions were selected based on theoretical relevance. The primary data consisted of 21 interviews which were analyzed using thematic analyses.</p> <p>The results showed contrasting development paths for ecosystem emergence: the Lahti ecosystem was emerging from established and maintained arrangements, whereas the Tampere ecosystem was emerging from change processes; the change seemed to be easiest for those areas within cities that do not suffer from path-dependent arrangements.</p> <p>The findings challenge standard evolutionary models and bottom-up models of entrepreneurial ecosystems. When successful, changing ecosystems could potentially reduce the timespan for ecosystem development. Moreover, different ecosystems had different implications for legitimacy. In conclusion, the public sector and research institutions should play a more prominent role in the development of entrepreneurial ecosystems in the bioeconomy and work towards a more inclusive collaborative process. Nonetheless, the dichotomy between change and path dependence in entrepreneurial ecosystems was based on preliminary categorizations that can be elaborated in further study and broader empirical data.</p>		
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Tiivistelmä – Referat – Abstract <p>Ennennäkemättömät ympäristöhaasteet edellyttävät uusia yrittäjiä, jotka kehittävät disruptiivisia ideoita, tuotteita ja palveluita. Kyseiset yrittäjät ovat yhä riippuvaisempia ympäröivästä kontekstistaan ja muista lähiympäristön toimijoista. Tätä taustaa vasten tämä tutkimus keskittyi biotalouden yrittäjyyskosysteemien syntymiseen kahdella Suomen alueella: Lahdessa ja Tampereella, ja tutki alueellisia eroja yrittäjyyskosysteemien synnyssä, kehityksessä ja legitimitetissä.</p> <p>Tämä tutkimus perustui iteratiiviseen teorian kehittelyprosessiin. Spigelin relationaalista näkökulmaa yrittäjyyskosysteemin attribuutteihin käytettiin pääasiallisena ohjaavana näkökulmana. Integroiva kirjallisuuskatsaus käsitteellisti ja syntetisoi aiheeseen liittyvää kirjallisuutta. Menetelmänä käytettiin vertailevaa tapaus tutkimusta ja tapausalueet valittiin teoreettisen merkityksen perusteella. Primäärinen tutkimusdata koostui 21 haastattelusta, jotka analysoitiin temaattisilla analyyseillä.</p> <p>Tulokset havainnollistivat vastakkaisia kehityspolkuja ekosysteemien syntymiselle: Lahden ekosysteemi syntyi vakiintuneista ja ylläpidetyistä järjestelyistä, kun taas Tampereen ekosysteemi nousi muutosprosesseista; muutos vaikutti olevan helpointa niillä kaupungin alueilla, jotka eivät kärsi polkuriippuvaisista järjestelyistä.</p> <p>Tulokset haastavat yrittäjyyskosysteemien tavanomaiset evoluutiomallit ja alhaalta ylöspäin suuntautuvat mallit. Mikäli ekosysteemi onnistutaan toteuttamaan muutosprosessina, tämä voi mahdollisesti lyhentää ekosysteemin kehitysaikaa. Lisäksi eri ekosysteemeillä oli erilaiset vaikutukset legitimiin. Yhteenvedon voidaan todeta, että julkisella sektorilla ja tutkimuslaitoksilla voisi olla merkittävämpi rooli biotalouden yrittäjyyskosysteemien kehittämisessä ja he voisivat pyrkiä osallistavampaan yhteistyöprosessiin. Yrittäjyyskosysteemien muutoksen ja polkuriippuvuuden dikotomia perustui alustaviin luokituksiin, joita voidaan elaboroida tulevaisuudessa tutkimuksissa ja laajemmilla empiirisillä aineistoilla.</p>		
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# 1 Introduction

## 1.1 Background

Different scientific fields have contributed to the theories of entrepreneurship; these include, for example, economic perspectives (e.g., Kirzner 1973; Schumpeter 1934), sociological perspectives (e.g., Thornton 1999), psychological perspectives (e.g., McClelland 1961), and anthropological perspectives (e.g., de Montoya 2000). While the business school tradition has been dominant (Swedberg 2000), it has been argued to be narrow and inadequate (Gibb 2002). Traditional literature on entrepreneurship has a bias toward focusing on individual characteristics and behaviors of successful entrepreneurs which neglect the influence of the external environment upon entrepreneurship (Spilling 1996; Thornton 1999; van de Ven 1993).

Thus, several authors have suggested that entrepreneurship research should pay more attention to context (e.g., Stam & van de Ven 2021; Ucbasaran et al. 2001; Zahra 2007). Entrepreneurs are affected by policies, markets and infrastructures of the location where they are situated (Thornton 1999). In order to take surrounding contexts into account, recent approaches have investigated entrepreneurial environments from the perspectives of regional innovation systems, entrepreneurial ecosystems and clusters (Autio et al. 2018; Spigel & Harrison 2018; Stam 2015). Social sciences can look at entrepreneurship from new angles and from the perspectives of several actors (Swedberg 2000). However, sociologists have mostly refrained from serious study of “market processes”, while economists have simultaneously presupposed that social relations do not play a central role in modern societies (Granovetter 1985).

Entrepreneurship is not only an economic phenomenon (Audretsch et al. 2019). It can also support goals such as sustainability (Cohen 2006; Shepherd & Patzell 2011). Due to widespread environmental challenges, societal transformation process from an oil-based economy to a bioeconomy may be necessary (Aguilar et al. 2018a). Entrepreneurship could help achieve this transformation. The emergence of the bioeconomy involves several sectors, such as health, chemical industry, agriculture, forestry and bioenergy (Bugge et al. 2016). In urban areas bioeconomy could, for example, shift a food system towards urban agriculture (e.g., aquaponics, indoor agriculture, vertical farming); this shift would contribute to material and resource recycling in cities, minimize the effects of climate change and improve quality of life (Skar et al. 2020). These challenges add to

policy interest, which has for decades attempted to promote a shift to an entrepreneurial knowledge economy (Audretsch et al. 2013; Autio et al. 2014; Guth 2005; Rampersad 2016).

## **1.2 Statement of the problem**

The world is currently witnessing dramatic and unprecedented challenges related to climate change, biodiversity loss, land and ecosystem degradation, water pollution, food security, energy supply, resource efficiency and increasing world population. Some of the problems are aggravated by urbanization (Skar et al. 2020; UN 2021). International actors and organizations such as the European Commission and the International Advisory Council on Global Bioeconomy have therefore emphasized the potential of cities in driving the sustainability agenda by becoming circular bioeconomy hubs that allow experimentation and development of new solutions (EC 2018; IACGB 2020). The potential of the bioeconomy (i.e., circular bio-based products, processes and related services) in providing solutions for grand environmental challenges has been recognized in international and national bioeconomy policies and strategies (Aguilar et al. 2019; EC 2018; OECD 2018; Sanz-Hernández et al. 2019; Wesseler & von Braun 2017).

With the foregoing considerations in mind, this thesis takes the emergence of bioeconomy entrepreneurial ecosystems as a starting point and provides several new insights and knowledge for creating more effective strategies for sustainable and healthy urban development. Deeper understanding is necessary because recent policies are not sufficient to achieve a sustainable bioeconomy (Hausknot et al. 2017; Urmetzer et al. 2018; Vivien et al. 2019). The strategies to solve global problems need to be adapted to local conditions (Urmetzer et al. 2018), and thereby urgent societal and policy challenges require comprehensive and context-specific systematic frameworks in order to enable ecosystems and platforms for startups in bioeconomy (IACGB 2020).

Top-down attempts to create entrepreneurial ecosystems have been ineffective and inadequate (Isenberg 2010; Isenberg 2016; Spigel & Harrison 2018; Thompson et al. 2018). At the same time, new radical disruptive technologies lack legitimacy which hinders their adoption (Kuratko et al. 2017), even though the bioeconomy involves a pressing need to adopt new technologies (EC 2018; IACGB 2020). The following section provides a justification for this study. It explains the reasons and importance of this topic. It also highlights the need for undertaking this research and its potential to contribute to knowledge.



### 1.3 Justification of the study

This research focuses on bioeconomy entrepreneurial ecosystems in two Finnish regions: Lahti and Tampere. In this research, region refers to sub-national entities (Carayannis et al. 2017), i.e., local areas in and around specific cities. Comparative studies have been lacking in entrepreneurial ecosystem research (Alvedalen & Boschma 2017; Roundy & Bayer 2019; Theodoraki et al. 2018), and the heterogeneous nature of entrepreneurial ecosystems has also been overlooked (Brown & Mason 2017). Entrepreneurial ecosystems are often defined by successful regions (Roundy & Bayer 2019; Spigel & Harrison 2018; Stam 2015), even though different regions vary in their capabilities to be successful in entrepreneurship (Spigel & Harrison 2018; Vedula & Kim 2019). For example, measuring the success of an entrepreneurial ecosystem by the number of unicorn companies (i.e., start-ups with higher than \$1 billion valuation, many of which have digital platform business models) will direct attention to places such as Silicon Valley, Beijing, Greater New York area and Shanghai (Acs et al. 2017). Practices and policies to develop an entrepreneurial ecosystem in large urban areas may be ineffective or unsuitable for small cities; therefore, a nuanced comparative approach is necessary to understand entrepreneurial ecosystems in small cities (Roundy 2017).

Moreover, previous research mostly focuses on these ecosystems in their mature development phase (Alvedalen & Boschma 2017; Mack & Meyer 2016; Roundy 2017; Roundy et al. 2018; Spigel 2017). Due to resource constraints, many entrepreneurial ecosystems in small cities are in the birth or early-maturation phase. For this reason, small cities provide a context in which researchers can study these ecosystems in their formative stages. (Roundy 2017.) By researching bioeconomy entrepreneurial ecosystems in Lahti and Tampere regions, this research can create new knowledge related to new bioeconomy entrepreneurial ecosystems which are in the beginning of their lifecycle and have so far had limited success in bioeconomy entrepreneurship.

Yet, research on the topic is necessary to support a shift to bioeconomy (Adamowicz 2017; Ingrao et al. 2018), while research in the area of sustainable entrepreneurial ecosystems remains limited (Bischoff & Volkmann 2018; DiVito & Ingen-Housz 2021; Neumeyer & Santos 2018; O'Shea et al. 2019). More specifically, there is a need for research investigating how entrepreneurial ecosystems can create favorable environments for sustainable entrepreneurship (Neumeyer & Santos 2018; Theodoraki et al. 2018; Volkmann et al. 2021).

Previous research has emphasized the need for social science research for bioeconomy (Bryden et al. 2017; Bugge et al. 2016; Ingrao et al. 2018; Kleinschmit et al. 2014; Priefer et al. 2017; Sanz-Hernández et al. 2019; Toppinen et al. 2020). At present, a narrow techno-economic dimension of bioeconomy is overemphasized in the European Union (EU) and national bioeconomy policies. This overemphasis implies insufficiency of systems knowledge; therefore, social and ecological dimensions need to be considered in order to radically change European societies towards sustainability (Urmetzer et al. 2018). Thus bioeconomy, which has traditionally been dominated by natural and engineering sciences, could be connected to its wider economic and social implications (Bugge et al. 2016; Kleinschmit et al. 2014; Priefer et al. 2017; Sanz-Hernández et al. 2019).

Many countries around the world have developed their own bioeconomy strategies (Aguilar et al. 2018a; OECD 2018; Sanz-Hernández et al. 2019; Wesseler & von Braun 2017). Although bioeconomy is an important concept for specialization in regional development in the EU and its individual member states and regions (Adamowicz 2017), regional perspectives have remained scant in bioeconomy research (De Besi & McCormick 2015), and there is a need for comparative analyses of bioeconomy in different regional contexts (Sanz-Hernández et al. 2019). After all, bioeconomy is territorial in its nature; it is embedded in local communities and social systems within a region. These social systems depend on natural resources that have many cultural and social uses which have a long history and cannot be changed easily. (Bryden et al. 2017.)

Hence, there is a need for more comparative research across regions that pays attention to variation in entrepreneurship cultures and the specific characteristics of each region (Theodoraki et al. 2018), and whether there could be specific regional cultures that can overcome institutional resistance in different places (Alvedalen & Boschma 2017; Mack & Meyer 2016), especially when an entrepreneurial ecosystem should support sustainable entrepreneurship (Cohen 2006; Neumeyer & Santos 2018; Volkmann et al. 2021). The research context selected for this study, Finland, is relevant here since the context of the country has a tendency for business-as-usual due to the key role of the forestry sector in Finnish history, leading to path dependence and limited capability for radical innovation (Bosman & Rotmans 2016).

#### **1.4 Aims, research questions and scope of the study**

In this research, the overall aim is to investigate what kind of factors could support (or restrain) entrepreneurial ecosystem emergence and how these ecosystems could (or could not) establish

legitimacy for sustainable technologies. More specifically, the aim of the study is to create new scientific knowledge about the emergence of bioeconomy entrepreneurial ecosystems in two different regions. According to research literature, entrepreneurial ecosystems do not have a commonly accepted definition (Alvedalen & Boschma 2017; Brown & Mason 2017; Stam 2015), and it is not clear what these ecosystems are exactly and what they consist of (Audretsch et al. 2019). Entrepreneurial ecosystems remain under-theorized (Audretsch et al. 2018; Autio et al. 2018; Brown & Mason 2017; Spigel 2017), and there is a lack of theoretical frameworks and empirical insights of sustainability in entrepreneurial ecosystems (Volkman et al. 2021). By answering the research needs in Table 1, it is possible to contribute to the scientific discussion regarding the character, features and development of these ecosystems.

**Table 1. Research needs stated in previous research**

Needs for research	References
Comparative entrepreneurial ecosystem research	Alvedalen & Boschma 2017; Roundy & Bayer 2019; Roundy 2017; Theodoraki et al. 2018
Comparative bioeconomy research	Sanz-Hernández et al. 2019
Recognize heterogeneous nature of entrepreneurial ecosystems	Brown & Mason 2017
Entrepreneurial ecosystem research in small cities	Roundy 2017
Emergence of entrepreneurial ecosystems	Alvedalen & Boschma 2017; Mack & Meyer 2016; Roundy 2017; Roundy et al. 2018; Spigel 2017
Sustainability in entrepreneurial ecosystems	Bischoff & Volkman 2018; DiVito & Ingen-Housz 2021; Neumeyer & Santos 2018; O’Shea et al. 2019; Theodoraki et al. 2018; Volkman et al. 2021
Social Science research in bioeconomy	Bryden et al. 2017; Bugge et al. 2016; Ingraio et al. 2018; Kleinschmit et al. 2014; Priefer et al. 2017; Sanz-Hernández et al. 2019; Toppinen et al. 2020

By providing social science research on entrepreneurial bioeconomy ecosystems, this thesis contributes practical policy advice to support entrepreneurial ecosystems and the creation of bioeconomy companies in regions. This is relevant since entrepreneurial ecosystem narratives often center around creating suitable conditions for entrepreneurial ecosystems through regional public policy (Hakala et al. 2020). At the same time, policy makers need to recognize the heterogeneity of entrepreneurial ecosystems (Brown & Mason 2017). This research accounts for the heterogeneity and provides implications for governance of entrepreneurial ecosystems.

This thesis attempts to find answers to three research questions:

- 1) What are the differences between entrepreneurial ecosystems in the two case regions?
- 2) How do the entrepreneurial ecosystems emerge and evolve? and

- 3) How do the entrepreneurial ecosystems support the legitimacy of new entrepreneurs and new bioeconomy innovations?

This research builds on a comparative case study design, which can provide deep understanding in situations where standardized metrics are limited, i.e., in the case of entrepreneurial ecosystems which are complex (Nylund & Cohen 2017; Roundy et al. 2018; Spigel 2017; Theodoraki et al. 2018). The unit of analysis consists of an ecosystem community, i.e., new companies and facilitative actors from the public sector and research institutions. Since entrepreneurial ecosystems are a new emerging topic and previous research that investigates bioeconomy entrepreneurial ecosystems is lacking, integrative literature review was chosen as an approach to integrate fragmented literature around the topic. Empirical data consists of 21 interviews from the case regions. Thematic analysis was the analysis method in this research.

## **1.5 Structure of the thesis**

The second chapter 'Integrative literature review' provides theoretical foundations for this research. The literature review was updated after initial phases of data analyses (see also appendices A and B). After literature, the third chapter 'Research design and methods' (see also appendices C, D and E) introduces the case regions, describes how data was collected and how it was analyzed.

The fourth chapter 'Results' presents empirical results. The structure of the results is based on case regions and their cultural, social and material attributes. The fifth chapter 'Discussion' discusses the results relating back to research questions and literature. It also discusses implications, limitations and presents ideas for further research. In the end, brief 'Conclusions' are provided in sixth chapter.

## 2 Integrative literature review

### 2.1 Introduction

The entrepreneurial ecosystem literature lacks a common integrative framework (Audretsch et al. 2019), and this is even more so the case for bioeconomy entrepreneurial ecosystems. Hence, integrative literature review was selected to conceptualize and synthesize the literature (Snyder 2019; Torraco 2005; Torraco 2016; Zahra 2007). The structure of this literature review is thematic (Torraco 2016). The review includes several topics that are justified in Table 2 which also presents the structure of the integrative review.

**Table 2. Justification for different sections of this literature review**

Title	Section	Justification to include these topics
Key concepts	2.2	Defines the concepts of entrepreneurial ecosystem and bioeconomy.
Embeddedness of economic activity	2.3	Theoretical foundations of the thesis from social science perspective, e.g., legitimacy, the dichotomy between path dependence and change.
Regional ecosystem perspective	2.4	Regional perspective includes local conditions and possibilities for governance of entrepreneurial ecosystems which are important themes in the scientific discussions of entrepreneurial ecosystems. These are relevant in shaping entrepreneurial ecosystems.
Ecosystem attributes	2.5	Cultural, social and material attributes are local inputs for the entrepreneurial process within an entrepreneurial ecosystem. These form a backbone for this thesis because these fit well with the empirical findings (i.e., themes) of this research.
Ecosystem emergence and evolution	2.6	Emergence and evolution are important topics in scientific discussions of entrepreneurial ecosystems. The entrepreneurial ecosystems in the case regions were at the beginning of their lifecycle and thus it is relevant to include these perspectives.
Synthesis and analytical framework	2.7	The purpose of this integrative literature review is to synthesize literature into an analytical framework.

Typically, the conceptual structuring of this type of literature review requires a guiding theory, a set of competing models or a certain point of view about the topic (Torraco 2005). In this review, Spigel's (2017) relational perspective to entrepreneurial ecosystem attributes is used as the main guiding perspective. This decision was made based on tentative analyses of research data, i.e., inductive reasoning (see Chapter 3 and appendices A and B for more information). Attributes of entrepreneurial ecosystem can be considered as local inputs for the entrepreneurial process. Based on a classification by Spigel, attributes are divided into three categories: cultural attributes (e.g., regional beliefs and cultural attitudes of entrepreneurship), social attributes (social networks and resources these provide, e.g., knowledge, funding, collaborations), and material attributes (e.g., physical infrastructure, universities and support facilities) (ibid).

The articles for the review were mainly located with the following keywords and their combinations: entrepreneurial ecosystem, social system, governance, bioeconomy and sustainability. The literature was examined in a staged review, i.e., reviewing abstracts first and then the main content when relevant. Literature was collected in three different rounds: before collecting empirical data, in the middle of thematic analyses, and after analyses (see Chapter 3). The relevance of literature was assessed, and literature was added and discarded in each round. In integrative literature review, the purpose is to synthesize literature to provide new viewpoints on the topic (Snyder 2019; Torraco 2005; Torraco 2016). Based on concepts, thematic topics and other theoretical foundations, an analytical framework was created. The framework is provided at the end of this literature review.

## **2.2 Key concepts**

### **2.2.1 The entrepreneurial ecosystem concept**

In this research, ecosystem thinking functions as a general framework which will be complemented with other relevant concepts. Ecosystem theory originates from scientific literature in which business environments were compared with ecological systems (Hannan & Freeman 1989; Moore 1993). The most relevant concept for this research is the entrepreneurial ecosystem (Spigel & Harrison 2018; Stam 2015). According to bibliometric evidence, entrepreneurial ecosystem concept has become dominant since 2016 and has overtaken other concepts such as environments for entrepreneurship which also focus on contextual factors including institutions, cultures and networks (Malecki 2018). Entrepreneurial ecosystems are reconfigurations from previous theories, such as regional innovation systems and clusters (Spigel & Harrison 2018). They are social systems in which actors, functions and institutions collaborate and interact to support the creation and growth of new companies (Isenberg 2010). Definitions of an entrepreneurial ecosystem often stress the interaction or combination of different elements, commonly via networks, in a process that produces shared cultural values supporting entrepreneurship (Mack & Mayer 2016; Malecki 2018; Spigel 2017; Stam 2015).

A sociological perspective of entrepreneurship as a context related phenomenon has a central role in this research (Lindgren & Packendorff 2009; Thornton 1999). According to this perspective, entrepreneurs operate within a certain place and time, and their action is shaped by contextual attributes such as markets, infrastructure, policy, culture and institutions. The attributes constrain and enable entrepreneurial action and the ways a company can be created and developed. Since the interest

in this study is in social contexts, individual characteristics of entrepreneurs and other related actors are excluded from the scope of this research (Hakala et al. 2020; Lindgren & Packendorff 2009).

In general, entrepreneurial ecosystems are not dependent on one industry and transcend individual technologies and industrial sectors (Autio et al. 2018; Malecki 2018; Spigel & Harrison 2018); this contrasts with clusters and learning regions, in which companies are based in the same industry (Spigel 2016a). Companies within an entrepreneurial ecosystem do not compete and this enables cooperation, mutual learning and sharing entrepreneurial knowledge about general business process between these companies (Autio et al. 2018; Spigel & Harrison 2018).

In this research, a bioeconomy entrepreneurial ecosystem is defined as cultural, social and material attributes which act as local inputs for the entrepreneurial process (Spigel 2017). Bioeconomy transcends individual technologies and industrial sectors (Besi & McCormick 2015; Birch 2016; Bugge et al. 2016), which fits well with conceptualizations of entrepreneurial ecosystems. A bioeconomy entrepreneurial ecosystem is a specific type of an ecosystem which may have different characteristics when compared with conventional entrepreneurial ecosystems. For example, bioeconomy is highly resource intensive (e.g., may require infrastructure, laboratory and piloting equipment, and managing material flows), and the shift to bioeconomy may require radically new technologies which do not fit into prevailing arrangements. Collaboration between different actors is also important in bioeconomy (Giurca & Späth 2017; Ludvig et al. 2016; McCormick & Kautto 2013; Pfau et al. 2014), and thus bioeconomy entrepreneurial ecosystems can be expected to have collaboration between different actors and sectors.

### **2.2.2 The bioeconomy concept**

The term ‘bioeconomy’ has been interpreted in various ways by different entities. Different actors understand and define the concept differently (Korhonen et al. 2020; McCormick & Kautto 2013), and there is a huge diversity in bioeconomies depending on context (Aguilar et al. 2018a; Aguilar et al. 2018b; Aguilar et al. 2019). The concept is also constantly evolving (Adamowicz 2017; Aguilar et al. 2018a; Aguilar et al. 2019; McCormick & Kautto 2013).

The Finnish Ministry of the Environment (2014) defines bioeconomy as “*an economy that relies on renewable natural resources to produce food, energy, products and services.*” It is characterized by the strive to “*reduce our dependence on fossil natural resources, to prevent biodiversity loss and to*

*create new economic growth and jobs in line with the principles of sustainable development*” (ibid). By comparison, European Commission’s bioeconomy strategy defines bioeconomy as “*economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services*” (EC 2018, 4), while the Organization for Economic Co-operation and Development (OECD) places more emphasis on biotechnology (OECD 2006, 3). All three definitions emphasize the potential for economic growth and refer to sustainability. However, Bugge et al. (2016) claim that the bioeconomy visions of EC and OECD are mainly technology focused and have a global R&D focus. Hence, these two visions are not primarily concerned with sustainable circular processes at a regional level (Bugge et al. 2016; Vivien et al. 2019).

The lack of a commonly recognized definition might also be because different locations vary in terms of their natural resources, economies and geography; for example, Finland has much forest resources which are lacking in some other countries (Bosman & Rotmans 2016). Thus, many EU regions have launched their own bioeconomy strategies which consider their local biomass potential (Bell et al. 2018). Despite differences in bioeconomy strategies, consensus exists on the need to switch from a fossil fuel economy to bioeconomy (Aguilar et al. 2018a).

Furthermore, the definitions of bioeconomy are also converging with other related concepts such as circular economy and cleantech. Circular economy encompasses all materials, including fossil and mineral ones, while bioeconomy focuses on renewables (Ingrao et al. 2018). Cleantech is posited as a technological revolution, a solution for climate crisis, and a market-driven sector which can make profit from climate risk and environmental externalities (Caprotti 2012).

None of these definitions addresses the specific characteristics and needs of bioeconomy for urban areas. In this work, bioeconomy is defined as circular bio-based products and processes and related services at local and global levels that contribute to sustainability in urban environments or are being developed in these environments and used elsewhere. Based on the scientific bioeconomy debate, bioeconomy is not always self-evidently sustainable (Pfau et al. 2014).

### **2.3 Embeddedness of economic activity**

The special role of entrepreneurs in economic development has been debated since Schumpeter, whereas the role of context in promoting entrepreneurship has been discussed since Weber and Durkheim (Swedberg 2000). More recently, Mark Granovetter has rejuvenated research on the



embeddedness of economic activity in social relations by claiming that social relations influence economic behavior, despite the consideration by economic theory that social relations should no longer define economy in modern society (Granovetter 1985). The effects of an action are uncertain, and in sociology uncertainty can be reformulated as a problem of order. Instead of calculating probabilities to control uncertainty, agents rely on social “devices” when determining their actions. (Beckert 1996.) When action is based on rules, conventions, habits, routines and other standard practices, the behavior of agents becomes predictable for other actors, and this stabilizes social interaction and reduces uncertainty (Beckert 1996; Biggart & Beamish 2003).

Thus, conventions have a central role in maintaining market order. Capitalism works best under regular, steady and predictable conditions in which actors can make reliable decisions for investment, savings, production and purchase; however, the price of stability is resistance to change (Biggart & Beamish 2003; Freeman & Hannan 1989; Hannan & Freeman 1984; Hannan 2005). Political pressures, problems with legitimacy, responding to uncertainty, and following state regulation and industry standards enhance lock-in and adoption of similar procedures by all companies which compete with each other; thus, leading to bureaucratization, i.e., rational actors make their organizations similar to each other without making these organizations more efficient (DiMaggio & Powell 1983). Aforementioned bureaucratization and homogenization emerge from the structuration of organizational fields (Giddens 1979), eventually leading to Weber’s (1952, 181–182) “iron cage” which might imprison organizations to work with outdated, fossil-era practices and technologies.

Conventions emerge and develop historically and locally, and the same industry can be organized differently in other regions (Biggart & Beamish 2003). The local contexts can be defined as ‘fields’. Bourdieu (1977) defines fields as social spaces with their rules, traditions and power relations which are historically produced at a specific environment. Patterns of interaction form through conventions and shared meanings (Biggart & Beamish 2003), and actions are an outcome of these patterns of challenging and supporting existing structures (Barley & Tolbert 1997; Giddens 1979). Hence, field theory highlights defining patterns of interaction regarding how shared systems of meanings and language are defined (Berger & Luckmann 1966).

According to Spigel (2013) who used a Bourdieuan approach in entrepreneurship research, entrepreneurs may try to break the rules of their field to open up new market opportunities; however, deviating too much from cultural norms makes it difficult for entrepreneurs to access resources they need for starting and growing their company. The paper also recognizes the potential for change and

path dependence within a field. On the one hand, fields can change and new fields can be created, e.g., by changes in political regimes, disruptive technologies, when new industries emerge, and when new companies take a dominant role. On the other hand, powerful and dominant players such as companies or institutions including universities and networks of entrepreneurs, maintain and reproduce the local order. (ibid.)

Another theoretical perspective, sociological institutionalism defines fields as constituting of two elements. The first is material, referring to patterns of continuous interactions between numerous actors in the field; and the second is cultural-cognitive, which refers to shared understanding between actors who interact (DiMaggio & Powell 1983; Scott 1995). In this interactive process, shared socio-material practices and symbolic meanings are created and stabilized to define the social system, such as an entrepreneurial ecosystem, and provide its members a common goal, identity and schemas to guide collaborative action (Berger & Luckmann 1966; Roundy et al. 2018; Thornton et al. 2012).

In the entrepreneurial ecosystem formation process, interaction eventually leads to established conventions which organize economic and social initiatives and creation of shared meanings, infrastructures, and resources. Through an interactive process, an entrepreneurial ecosystem could evolve from distributed and disparate structure towards a more coordinated social order. (Thompson et al. 2018.) Therefore, in this research it is presumed that an interactive emergence of an entrepreneurial ecosystem would be associated with path dependencies and changes within a field.

Structuration theory by Giddens (1979) suggests that structure (i.e., institutions) can be changed, maintained and created by human action; institutional change can be achieved by, e.g., disruptive technology, changes in regulation and economic shifts. However, changing formal institutions may require adjustments in conventions, informal rules and norms. The adjustments can be difficult to make because of resistance to change, and because they are usually not under the direct influence of public policy (Colombelli et al. 2019).

Technological transition often conflicts with established practices and institutions, and structures for alternative technologies may be weak and have underdeveloped markets, fragmented policies, immature technology, and incomplete actor networks (Giurca & Späth 2017). Thereby, new social arrangements may be required to support the development of these technologies (Freeman 1995). Social arrangements may help policymakers to provide solutions for grand challenges such as climate change. Second and third sector actors could have a leading role as an enabler for experimentation

when new social arrangements are searched for and developed. (van der Have & Rubalcaba 2016.) The concepts such as ‘entrepreneurial ecosystem’ are social arrangements which organize and constrain action, and change and define the ways of collaboration among involved actors.

Legitimacy is a central question in the acceptance of social arrangements (Cajaiba-Santana 2014). When considering whether a new social organization is accepted, it is relevant how a new organization is presented, how it is being talked about and argued about. To succeed, consent (i.e., legitimacy) is crucial, because people can resist the identity offered to them if it is not in line with their expectations and needs. (Harrison & Laberge 2002.) Similarly, legitimacy is required for the acceptance of new technologies (Kuratko et al. 2017; Liao & Welsch 2008).

Organizational ecology research has shown how new organizations lack legitimacy and public support (Hannan & Freeman 1984; Hannan 2005) which are necessary to attract sufficient resources for starting operations. Developing routines, social relations with other organizations and gaining legitimacy take time (Hannan & Freeman 1984). From the perspective of organizational ecology, new organizational forms rise and existing ones demise or transform in the process of competition among organizations for resources such as membership, legitimacy and capital (Hannan 1988; Hannan 2005).

Yet, new organizations are necessary for continuous change. For instance, in the food industry, large multinational corporations have been conservative and have lagged innovativeness, while small companies have tended to create new radical innovations (Ettlie et al. 1984; Kristinsson & Jorundsdottir 2019). This study takes a stance that new sustainable companies and their entrepreneurs could disrupt the status-quo of path-dependent arrangements and established industries with their radical innovations; under these circumstances, sustainable entrepreneurs may have to engage in institutional entrepreneurship (i.e., changing prevailing systemic arrangements) in a greater extent than traditional entrepreneurs (DiVito & Ingen-Housz 2021).

## **2.4 Regional ecosystem perspective**

### **2.4.1 Regional conditions**

Innovation processes rely on inputs from outside the company, which is highlighted by authors speaking of open and distributed innovation (von Hippel 2005; Chesbrough 2003; Chesbrough 2006). However, distributed innovation is not a new phenomenon. The companies in the 1800s’ iron and

steel industry shared knowledge among each other which benefited the whole sector (Allen 1983). For another historical example, Alfred Marshall (1890) analyzed Victorian England and saw benefits in co-location of firms, such as the development of pools of human capital and creation of shared infrastructure. This tendency for entrepreneurial activity to concentrate in specific geographical areas has also been recognized in more recent research (Arikan 2009; Audretsch et al. 2011; Baptista & Swann 1998; Birch 2009; Crevoisier 2004; Delgado et al. 2010; Rocha 2004; Tallman et al. 2004). Silicon Valley is a commonly researched example of this kind of concentration (Adams 2011; Klepper 2010; Patton & Kenney 2005).

Furthermore, different contexts tend to become increasingly specialized (Autio et al. 2014; Isenberg 2010; Kenney & Von Burg 1999). Different environments differ in terms of the entrepreneurial resources, opportunities and the presence of regional actors, including licensing offices, venture capital firms, new venture accelerators and so forth; certain environments influence individuals and may help them become an entrepreneur and establish a company. (Thornton & Flynn 2003.) Local conditions such as geographic location, culture and natural resources are a starting point for entrepreneurial ecosystem emergence (Isenberg 2010).

The quality of an entrepreneurial ecosystem and its elements varies in different areas (Spigel & Harrison 2018; Vedula & Kim 2019). Weak ecosystems may lack some elements; in these contexts, lacking elements can be compensated for by various other elements. For example, The Greater Reading region in the UK has a relative absence of local role model entrepreneurial actors and limited entrepreneurial orientation. The need was compensated with high concentration of entrepreneurial resource providers which include proximate venture capital in London, private R&D from incumbent multinational companies, and local entrepreneurship hubs and incubators. (Godley et al. 2021.) Entrepreneurial ecosystems in small cities (population below 250,000) with limited population and potentially lacking their own university could attract human capital by leveraging their infrastructural advantages (e.g., lower living costs, cheaper office space, and no congestion in transportation infrastructure), and their limited local market could be compensated by less intense competition, thus creating a nurturing environment (Roundy 2017).

Yet, compensating may not always be sufficient. An investigation of entrepreneurial ecosystem in Phoenix in the US showed that this entrepreneurial ecosystem cannot advance from the birth to growth phase because some elements remain missing or underdeveloped. In the case of Phoenix, these included limited networks between entrepreneurs and mentors, and limited local success stories

to develop regional entrepreneurship culture. But likely benefits also exist in lower-tier entrepreneurial ecosystems, such as Phoenix; entrepreneurs may get more attention and support in comparison to places such as Silicon Valley; it is a lower stress environment in which less competition may help to overcome initial hurdles. (Mack & Meyer 2016.)

#### **2.4.2 Possibilities for governance of entrepreneurial ecosystems**

The policy maker, local government or other governmental authority is considered as the main emplotted character in narratives about entrepreneurial ecosystems (Hakala et al. 2020). In entrepreneurial ecosystems, entrepreneurs are organized through various enabling and limiting governance measures, in a specific institutional context, and these governance modes are always imperfect (Stam 2015).

In research literature, there has been debate whether entrepreneurial ecosystems emerge naturally through bottom-up evolution similar to natural ecosystems and benefit from specific local cultures and path dependencies (e.g., Silicon Valley) or are created through a top-down process in which government provides the necessary resources and creates the ecosystem from scratch based on strategies and plans of decision makers (Colombo et al. 2019). Despite different stances and empirical findings around this issue (e.g., Colombelli et al. 2019; Du et al. 2018; Isenberg 2010; Isenberg 2016; Rampersad 2016; Spigel 2016a; Stam 2015), in general, authors agree that the state should undertake a facilitative role in an entrepreneurial ecosystem (Isenberg 2016; Spigel & Harrison 2018), implying a combination of bottom-up and top-down approaches; in this combined approach, governing an entrepreneurial ecosystem is mostly about governing relationships and networks, coordinating, and motivating (Colombo et al. 2019). Most importantly, the local government should find a balance between top-down and bottom-up to avoid potential mistakes associated with central planning and top-down decisions (Foray 2016). Too much specialization limits seeing and acting upon new opportunities, many of which stem from interindustry linkages and combinations of technologies (Andersen & Markard 2020; Desrochers & Sautet 2008).

The presence of a main actor, ecosystem coordinator or network orchestrator could be necessary especially when the ecosystem promotes sustainability, e.g., in the case of circular economy ecosystems (Konietzko et al. 2020; Zucchella & Previtali 2019), and sustainable entrepreneurial ecosystems (Cohen 2006). Authors have stressed the need for participatory governance and dialogue in developing the bioeconomy (Aguilar et al. 2019; Bosman & Rotmans 2016; McCormick & Kautto

2013; Urmetzer et al. 2018), and thus the combined governance approach of bottom-up and top-down may be suitable for the needs of entrepreneurial ecosystems in bioeconomy. In this combined approach, public authorities strive to facilitate inclusive innovation processes to support learning by creating shared norms, rules and visions (Guth 2005) as well as the recognition of regional strengths (Carayannis & Rakhmatullin 2014; Foray 2014; Foray 2016). Required knowledge is dispersed in a variety of different fields of science, and the development of needed knowledge requires cooperation between different actors (Van Lancker et al. 2016).

In addition to facilitating collaboration and striving for coherence, injection of resources has been found to influence entrepreneurial ecosystem emergence (Roundy et al. 2018). Public finance is an important instrument in commercialization of the new bioeconomy innovations, and it has an important role in the EU, national and regional strategies (De Besi & McCormick 2015). Governments can shelter firms against resource scarcity and resource dependencies by providing resources such as financial subsidies, low-cost office space, consulting and training services, privileged access to public sector contracts and tax breaks (Autio & Rannikko 2016). The public sector has also had a major role in the development of several entrepreneurial ecosystems through the creation or financing of entrepreneurship support organizations, e.g., incubators and accelerators (Colombelli et al. 2019; Du et al. 2018; Spigel 2016a). Moreover, public procurement can offer platforms for piloting, obtaining home market references and best practice experiences. These investments can be large and complex and require an ecosystem approach involving interaction between several actors. (Alhola & Nissinen 2018.)

Since the sustainability of global biomass-based bioeconomy has been questioned (Vivien et al. 2019), the role of the public sector in a bioeconomy transition might have to be stronger than suggested in most of the policy papers and industry-oriented stakeholder positions; more planning may be needed instead of relying on the market, and the narrative may need to shift towards a more planning- and sufficiency-oriented narrative (Hausknost et al. 2017). Despite this need, some authors claim that public sector may have limited motivation for collaboration with entrepreneurs (Audretsch & Belitski 2017), or may even be risk-averse; for example, an investigation of Smart City emergence in Kansas (i.e., an entire city becomes an experimental setting for open data experiments) showed that city officials might not trust high-risk startups, and may favor companies that will survive for decades and continue their maintenance and support services for infrastructures, although these old companies often lack capability for innovation (Sarma & Sunny 2017).

## **2.5 Ecosystem attributes**

### **2.5.1 Cultural attributes**

The research of Neck et al. (2004) on entrepreneurial systems suggests that culture might be the most important element of the system and most difficult element to replicate. Mack and Meyer (2016) suggest that in order to develop necessary aspects of an entrepreneurial ecosystem, such as local networks and regional culture which is tolerant towards entrepreneurship, it is important to work within the institutional and cultural context of the region (Mack & Meyer 2016). Even though entrepreneurs are often regarded as agents of change (Schumpeter 1934), their behavior is shaped by regional cultures and norms; thereby, in addition to acting as agents of change, entrepreneurs also function as carriers of regional legacy (Aoyama 2009; Spigel 2013).

Policymakers have understood the importance of context and have attempted to change the environments to being more entrepreneurship friendly by developing ‘entrepreneurial cultures’ in society through policy, educational institutions and media (Autio et al. 2014). Mason and Brown (2014) recognize three policy approaches: 1) The strong focus on enterprise education to promote positive attitudes towards entrepreneurship and to create entrepreneurial campuses to support students become entrepreneurs; 2) Many regions have supported in-migration of entrepreneurially talented and creative people; 3) Events have been arranged to support and celebrate local entrepreneurship. In order to develop an entrepreneurial culture, cultural facilities, such as coffee shops, bars, theatres, green areas and parks could also be improved (Audretsch & Belitski 2017). Over time, entrepreneurial culture is solidified, and this culture can sustain and attract more entrepreneurs, workers and resources into the entrepreneurial ecosystem (Spigel & Harrison 2018).

The existence of small companies is reliant on a supportive culture towards entrepreneurship (Carlsson & Mudambi 2003; Isenberg 2010). Entrepreneurship is constrained in societies where it is not valued, where entrepreneurs have a low social status or where financial success and failure are viewed negatively. For example, in Singapore, the social status of entrepreneurs is not high, for this reason foreigners have established most of the new start-ups in the country (Mason & Brown 2014).

Florida (2002) argued that regions with open and welcoming cultures can attract highly skilled talent and new ideas. The significance of cultural openness and closeness has also been noticed in another research. Saxenian (1994) compared the historical trajectories of Silicon Valley and Boston in the US

and found that Silicon Valley had an open entrepreneurial culture, while Boston's culture was more closed and risk-averse and therefore Boston missed the PC revolution. Aoyama's (2009) case study in Japan shows that culture in Hamamatsu was tolerant to outsiders and had an international orientation, whereas Kyoto had a closed, indirect and secretive culture which was based on family enterprises. Spigel's (2017) comparison of two entrepreneurial ecosystems in Canada implies that Waterloo had a strong orientation towards high-growth entrepreneurship, entrepreneurs had social prestige and region's entrepreneurial culture promoted dense networking, learning from others and sharing experiences. By contrast, Calgary's ecosystem had developed around large gas and oil companies and had limited social value for entrepreneurship, prioritized personal profit maximization and entrepreneurs had limited interest in developing strong social ties among each other.

The question of supportive culture becomes even more relevant when entrepreneur is innovating something completely new. According to Kuratko et al. (2017), lack of legitimacy is a problem for radical disrupting technologies. Activities of these companies may not be well-understood or accepted, and entrepreneurs with radically new approaches from the perspective of technology and market face more difficulties to gain legitimacy within an entrepreneurial ecosystem; in contrast, entrepreneurs utilizing existing technologies or aiming for existing markets acquire legitimacy more easily because they only need to conform with existing norms and rules of an industry, and hence interventions or changes in the external environment are not required. New innovations may have to gain legitimacy by locating in favorable environments and when these do not exist, gaining legitimacy may require changing an entrepreneurial ecosystem or establishing a new ecosystem with new norms, rules, values, beliefs and models; for example, new terminology and language may be necessary to explain this technology. This is evident when new industries emerge. (ibid.)

Based on these findings, differences between entrepreneurial ecosystems could be related to differences in cultural artifacts, such as narratives. Some entrepreneurial ecosystems are successful while some others struggle because narratives in efficient entrepreneurial ecosystems are more effective and more likely to influence actors within an entrepreneurial ecosystem (Roundy & Bayer 2019). Roundy's (2016) article makes a typology of narratives in entrepreneurial ecosystem: historical accounts, success stories, and future-oriented narratives. Hence, narratives also communicate the actors' vision of the future of an entrepreneurial ecosystem. In this stance, entrepreneurial ecosystems can be viewed as design artifacts which evolve in future-oriented world-making processes (O'Shea et al. 2019). Developing common language is necessary to move towards concrete action and to create a community with shared ambitions and goals (Loorbach 2007; Roundy



et al. 2018; Thompson et al. 2018). Furthermore, shared sustainability intention and a supportive emotional climate are necessary in the initial process of creation of sustainable entrepreneurial ecosystem (O'Shea et al. 2019). For instance, reframing the meaning and possibilities of resources can open new possibilities in handling these resources; this is important for achieving an innovative circular ecosystem (Konietzko et al. 2020). Cultural arrangements thus define the ecosystem and where it is headed, and there is also a possibility for cultural change and redefinition.

### **2.5.2 Social attributes**

Research on entrepreneurial ecosystems typically stresses the localized and interdependent social relations between actors within an entrepreneurial ecosystem (Brown & Mason 2017; Mack & Mayer 2016; Malecki 2018; Pittz et al. 2019; Spigel 2017; Stam 2015). Companies utilize networks to cope with uncertainty, and economic action is therefore embedded in these social networks (Beckert 1996; Granovetter 1985; Leyden et al. 2014). Networking and collaboration among organizations is important for them to learn and gain new knowledge (Etemad & Lee 2003; Hoang & Antoncic 2003; Leyden et al. 2014; Ludvig et al. 2016; Lundvall 1988; Lundvall & Johnson 1994; Powell 1998), and access resources (Autio et al. 2018; Hoang & Antoncic 2003; Spigel & Harrison 2018; Stam 2015). It has been argued that entrepreneurial ecosystem and network literature should be more connected to recognize different entrepreneurial ecosystem types since the structure of knowledge network and its openness to outsiders could impact entrepreneurship (Alvedalen & Boschma 2017; Brown & Mason 2017; Spigel & Harrison 2018).

Network research is often undercontextualized and overlooks the influence of wider cultural and institutional context (Granovetter 1985; Phelps et al. 2012), and the unique social structure of a given social system (Provan et al. 2007). Yet, research shows that social relations differ in different contexts. In small towns, networks may be smaller, less flexible, have older and stronger connections, and actors might be connected in multiple ways (e.g., business, civic, religious, and family ties). In these places, common values may be stronger than in large cities because most inhabitants spend their whole lives in these small towns and therefore have shared experiences and values. (Roundy 2017.)

Some studies have found significant contextual differences regarding openness to new social relations. Spigel (2016b) investigated mentorship in Ottawa and Waterloo, Canada and found that in Ottawa, mentors were mostly friends or family members who were known prior to starting business. In these cases, the relationship was strong and long-lasting. In Waterloo, experienced investors and

entrepreneurs predominated among mentors; these people were often not known prior to founding the business, and relationship with them was relatively weaker. Expanding social networks through informal conversation and networking events was more likely in this area. For another example, which was already discussed in cultural attributes (subsection 2.5.1), the culture of gas and oil industry in Calgary, Canada did not encourage formation of social ties, whereas entrepreneurial culture in Waterloo, Ontario promoted dense networking and learning from others (Spigel 2017).

Another example of specific cultural and institutional context which influences network structure is university setting (Hayter 2016; Leyden et al. 2014; Sadek et al. 2015). Social networks are especially important in academic entrepreneurship because these entrepreneurs often lack the knowledge of commercialization process while these networks provide access to expertise, advice and financial capital (Leyden et al. 2014). This specific setting has distinct implications for network structure. Hayter's (2016) research on social networks between university faculty entrepreneurs, students and intermediaries in New York found that most contacts of academic entrepreneurs are typically located within the home institution; whereas in later stages of spin-off development, boundary-spanning individuals or network intermediaries can socialize academic entrepreneurs to market-oriented values, practices and motivations and related contacts to access additional contacts and resources.

Co-location of companies is considered beneficial for new companies because this helps them form social relations and access external knowledge (Lorenzen 2007; Maskell & Malmberg 1999; Spigel & Harrison 2018). Interdisciplinary interactions are a crucial factor for entrepreneurial ecosystems; they contribute to diversity and number of start-up companies (Nylund & Cohen 2017). Bioeconomy is claimed to be strongly knowledge-based (Aguilar et al. 2018a; Aguilar et al. 2018b; Dunham et al. 2012; Van Lancker et al. 2016). People who make new scientific and technological discoveries have a significant role in bioeconomy (Aguilar et al. 2018a; Aguilar et al. 2018b; De Besi & McCormick 2015). The knowledge base of the bioeconomy is also heterogeneous (O'Shea et al. 2019; Urmetzer et al. 2018; Van Lancker et al. 2016), and to manage the dispersed knowledge, actors use dedicated organizations such as demonstration and pilot plants or partnerships between companies and knowledge producers (Fevolden et al. 2017; Hedeler et al. 2020; Hellsmark et al. 2016; Vivien et al. 2019). Furthermore, regional knowledge is often too limited, especially in small cities (Roundy 2017), and the process towards bioeconomy may require knowledge sharing in an inter-regional and international level (Ahn et al. 2010; Autant-Bernard et al. 2013; De Besi & McCormick 2015). However, studies of entrepreneurial ecosystems generally lack recognition of importance and balance between non-local and local linkages (Alvedalen & Boschma 2017).

Returning to the discussion about the influence of context upon entrepreneurship and the openness towards relations with strangers, establishing new relations may not be easy. On the first hand, actors tend to rely on prevailing relations because formally constructed networks which are not based on previous relationships have more tendencies to fail (Human & Provan 2000). Formally constructed networks may lack trust and close bonds, which emerge from repeated interaction between actors (Granovetter 1985; Gulati 1995). According to Konietzko et al. (2020) partner selection for a circular economy ecosystem can be based on existing relations and proven capabilities to ensure cultural fit and similar values that are aligned towards the same normative goal; otherwise, different values and interests may lead to conflicts.

On the other hand, prevailing relations could, in some cases, limit success. Firstly, strong socioemotional relations could blind an entrepreneur from making judgement of the partner's abilities (Marion et al. 2015). Secondly, successful innovation may require collaboration between previously unconnected actors from private and public sectors, academia and civil society (Konietzko et al. 2020). In addition, there might be a need for new relations to be successful in a bioeconomy and to create a successful bioeconomy entrepreneurial ecosystem. Nevertheless, prevailing and new relations are not mutually exclusive. Ludvig et al.'s (2016) case study of entrepreneurship in the non-wood forest sector shows that personal networks were crucial but institutional relations with regional research organizations and regional development organizations were also an important source for information. Hence, it may be necessary to rely on both prevailing and new relations on a case-by-case basis

Network brokers and third parties may have an important role in creating new ties and providing access to knowledge and resources, thereby contributing to innovation development within bioeconomy entrepreneurial ecosystems (Barrie et al. 2019; Pittz et al. 2019; Urmetzer et al. 2018; Van Lancker et al. 2016). Intermediaries have a critical role in gathering actors together and providing them a forum to communicate, exchange and refine entrepreneurial ecosystem narratives and make collective sensemaking possible (Roundy 2016). Main actors and ecosystem coordinators could act as potential network brokers for entrepreneurial ecosystems (see subsection 2.4.2). After all, as mentioned previously in sections 2.3 and 2.4, interaction is necessary for successful emergence and functioning of an entrepreneurial ecosystem. For example, DiVito and Ingen-Housz (2021) investigated a sustainable entrepreneurial ecosystem in the denim industry in the Netherlands and found that opportunities are created and recognized in interaction within the entrepreneurial ecosystem, and recognizing sustainable opportunities is dispersed among ecosystem actors.

Especially in the case of small towns and cities, technological development allows actors to form connections with companies and individuals outside the region, and as a result, entrepreneurial ecosystem can define its boundaries more broadly and access resources outside the city boundaries (Roundy 2017). Digitalization also makes coordination in geographically dispersed areas possible (Yoo et al. 2012; Nambisan 2017). Thus, some authors consider information domain, i.e., ICT, and access to Internet and connectivity, as an essential mechanism that supports entrepreneurial ecosystem framework by increasing the capability for knowledge sharing (Audretsch & Belitski 2017; Autio et al. 2018; Goswami et al. 2018; Thompson et al. 2018).

### **2.5.3 Material attributes**

Bioeconomy is highly dependent on the physical realm. It relies on biomass, waste streams and regional infrastructure (De Besi & McCormick 2015), and a transition to bioeconomy requires changes in infrastructure (Herrera-Gomez et al. 2017). A shift to bioeconomy requires transforming cities and forming sustainable city metabolisms by closing nutrient and material loops; this could include, for example, rainwater collection, nutrient recovery, and urban farming (Skar et al. 2020; Wesseler & von Braun 2017). For instance, urban agriculture requires space and new infrastructure in cities to make urban farming possible. To enable change, urban food production and other food system activity should be integrated into urban planning to develop infrastructure for circular resource processes and sustainable food provision. (Skar et al. 2020.)

In entrepreneurial ecosystems, physical infrastructure also includes roads, traffic, housing, real estate and office space (Cohen 2006). In some cases, these infrastructures may be limited; a study by Neck et al. (2004) investigated Boulder County in the US which was not perceived as supportive in terms of its infrastructure due to high living costs, and thus locating there was becoming increasingly expensive for people who cannot afford housing. Lack of infrastructure is considered a major problem for entrepreneurship in some developing countries, such as Nigeria where entrepreneurs have difficulties competing with other entrepreneurs in countries with developed infrastructure. Operation costs can be high when infrastructure is missing. (Akpor-Robaro 2012.)

The structures of cities and infrastructures create path dependencies. Geels (2002) refers to deep sets of structural trends and their relative hardness, e.g., material and spatial arrangements of cities, highways, factories and electricity infrastructures. A shift in these systems is limited by prevailing

structures in transportation, infrastructure, streets, shops, and pipes. For example, food systems have been globalized and structured to conform to the needs of global value chains (Skar et al. 2020). In the same way, the existing long-time structure of the oil-based industry is expected to hinder the transformation to bioeconomy (Giurca & Späth 2017; Meyer 2017). In addition to sticky infrastructure, regulatory framework may favor a linear economy model and be bureaucratic for new circular solutions (Zucchella & Previtali 2019). Bioeconomy faces complex regulations, such as food safety regulation, waste legislation, renewable energy targets, and standards for bio-based products (Bell et al. 2018). Consequently, bio-based substitutes remain in laboratory and pilot scale, although they have been in development for decades (Giurca & Späth 2017).

Some inventions do not require changes in infrastructure. Biofuels are a good example of this approach. In biofuel development, research outputs are considered useful if they reduce costs, and compatibility with the existing infrastructure is important because distribution would be hard without fossil fuel infrastructure (Alhassan et al. 2019). Nevertheless, inventions which do not change deep running structures of cities may deliver limited sustainability outcomes (Geels et al. 2015; Vivien et al. 2019).

In addition to the city structures, entrepreneurial ecosystems in bioeconomy are also dependent on physical infrastructure which facilitates connectivity among actors and enables knowledge exchange (Audretsch & Belitski 2017; De Besi & McCormick 2015; Goswami et al. 2018). For example, Hildebrandt et al. (2019) show that in Germany, wood and chemical industries were encouraged to form symbiotic relationships such as sharing pilot facilities, combining processes, and cascading wood feedstock; according to their study, this was achieved by retrofitting existing infrastructures (e.g., refinery sites were modernized into “eco-industrial parks”), and by creating new shared pilot plant facilities with government funding. Desrochers and Sautet (2008) have claimed that the most conducive place for entrepreneurship is a diversified city consisting of many specialized clusters. This setting allows interindustry linkages and industrial symbiosis such as waste recovery linkages (i.e., waste of one is an input for another), and knowledge sharing between different industries which can lead to new technology combinations. Additionally, infrastructure such as business accelerators can facilitate the development of networks which is beneficial especially when entrepreneurial support ecosystem is underdeveloped (Pustovrh et al. 2020).

In some cases, universities can act as hubs or central actors in entrepreneurial ecosystems (Giurca & Metz 2018; Malecki 2018; Miller & Acs 2017). Prior research suggests that universities need creative

spaces for generating and experimenting ideas for entrepreneurship (Curley & Formica 2013; Kruger & Steyn 2020), and facilities such as university business accelerators and incubators have an important role in creation of university-based entrepreneurial ecosystems (Boh et al. 2016; Miller & Acs 2017; Nicholls-Nixon et al. 2020; Theodoraki et al. 2018).

## **2.6 Ecosystem emergence and evolution**

While research literature recognizes that entrepreneurial ecosystems are evolving and have a lifecycle (Autio et al. 2018; Mungila Hillemane 2017; Roundy et al. 2018; Spigel & Harrison 2018), current work on entrepreneurial ecosystems lacks an understanding of evolutionary dynamics and emergence of entrepreneurial ecosystems (Alvedalen & Boschma 2017; Mack & Meyer 2016; Roundy 2017; Roundy et al. 2018; Spigel 2017). The existential purpose of an entrepreneurial ecosystem is its reproduction through continuous formation of new companies supported by the entrepreneurial ecosystem and its prior and existing companies (Malecki 2018). Entrepreneurial ecosystems are thus characterized by causation; outcomes and outputs of the system feed back into the system and this circulation explains entrepreneurial ecosystem evolution and transformation over time (Brown & Mason 2017; Spigel & Harrison 2018; Stam 2015).

The emergence of entrepreneurial ecosystem takes time and involves critical factors that lay its foundation steadily and gradually (Mungila Hillemane 2017). An entrepreneurial ecosystem is sensitive to initial conditions and behavioral responses can become locked-in on a trajectory based on historical experience. For instance, an entrepreneurial ecosystem which has historically focused on certain types of entrepreneurship or technology cannot easily change its focus to entirely different types of entrepreneurship or different technology. After an accelerator has been created, it can be stopped, but invested resources and time and the overall impact and influence on an entrepreneurial ecosystem is not reversible. (Roundy et al. 2018.)

Furthermore, the attributes of the system represent an evolving process, in which attributes come into existence over time and continue evolution. For example, Neck et al. (2004) describe an evolutionary path which starts with an establishment of university and several anchor organizations, building of a highway and an airport, and continues with some bankruptcies and layoffs which have motivated employees to leave and establish companies. Mack and Meyer (2016) argue that when an entrepreneurial ecosystem evolves, the importance of attributes within an entrepreneurial ecosystem changes. In the birth phase, policy should help entrepreneurs in networking and build support

infrastructure, whereas in the decline phase policy should avoid lock-in by infusing new ideas and connections to other entrepreneurial ecosystems. In the beginning of evolution, key factors include human and financial capital, market opportunities, and culture. In later stages, more specialized policies and refined support infrastructure are necessary. (ibid.)

Different authors have created their own models of evolution of entrepreneurial ecosystems (Mack & Meyer 2016; Spigel & Harrison 2018; Thompson et al. 2018); in general, the models start with small amount of companies with limited networks, limited resources and a culture that has not yet become supportive towards entrepreneurship. Eventually, the system becomes more specialized, support organizations such as incubators and other entrepreneurial infrastructures are created. In more mature phases, policies become more tailored, there is more networking, more companies are created, and culture becomes more supportive towards entrepreneurship. After maturation, if the entrepreneurial ecosystem cannot maintain itself, the system starts to decline. During its evolution, the entrepreneurial ecosystem establishes its conventions and shifts from disparate structure towards a more coordinated social order (Thompson et al. 2018; see also section 2.3).

Pre-existing clusters are often a basis for the formation of entrepreneurial ecosystems (Autio et al. 2018), but the emergence of completely new entrepreneurial ecosystems is also possible. For example, an entrepreneurial ecosystem can emerge from a mega-event. An illustrative example of this is provided in the paper of Spilling (1996) which describes the industrial changes related to organizing of the 1994 Olympic Winter Games in Lillehammer, Norway. This mega-event triggered new economic opportunities in the region and changed its entrepreneurial climate. Many internal and external actors were recruited, new thinking and learning flourished, networks and alliances were created, new companies interacted with each other and environmental factors. Investment spurred sports facilities, infrastructure, accommodation and consulting services. (ibid.)

There are some specific requirements for the emergence of sustainable entrepreneurial ecosystems. DiVito and Ingen-Housz (2021) studied a single collaborative innovation project in denim industry, and they found four factors that promote these sustainable entrepreneurial ecosystems: i) sustainability orientation among actors; ii) actors recognize sustainability opportunities and mobilize resources while risks and benefits are shared; iii) actors collaborate in innovative ways and learn from each other to be sustainable; and iv) actors create or find markets for sustainable products.

Moreover, new sustainable companies have a challenge in establishing their legitimacy in entrepreneurial ecosystems which often focus on profit and revenue growth. On the one hand, sustainability represents a competitive advantage, but on the other hand it is a liability because other ecosystem actors may not have similar values or be familiar with sustainable business models which may limit acquiring resources from these actors (Cohen 2006; Neumeyer & Santos 2018). In some cases, when the innovation of a sustainable company is something completely new, a company must create its own ecosystem which defines relations and acts as a mechanism for cultural socialization and change; in research literature, there are a few case studies in which innovative companies had to establish their own ecosystems in order to facilitate collaboration with farmers and disseminate their innovative approaches and solutions (Lehtimäki et al. 2019; Zucchella & Previtalli 2019).

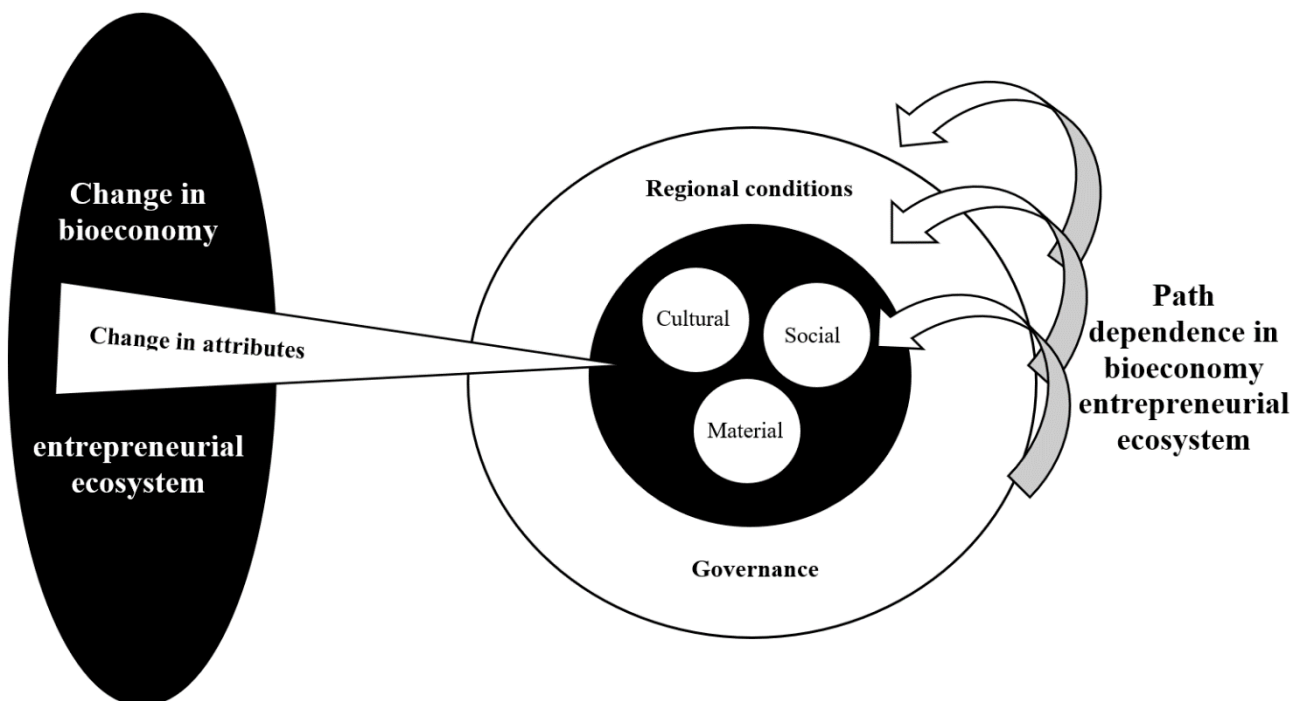
‘Entrepreneurial ecosystem’ and ‘bioeconomy’ are both systemic concepts. Thus far, the emergence and change of entrepreneurial ecosystems has been discussed. This theorizing can be connected to a related process: emergence of bioeconomy and the related societal transformation. Bioeconomy is technology and science based, but its implications are much wider; it is a dynamic and complex process of societal transformation, with an aim to gradually facilitate a shift from fossil-based economy to sustainable bioeconomy (Aguilar et al. 2018a). The required change is systemic (Barrie et al. 2019; Konietzko et al. 2020; McCormick & Kautto 2013). In these transitions, radical new organizations, business models, services and products emerge and complement and substitute existing ones (Bosman & Rotmans 2016; Farla et al. 2012).

The environment is hostile towards actors who pursue systemic change to initiate transition to sustainability, and for this reason, there is a need for supportive structures to make this change possible (Farla et al. 2012). One way to encourage transitions is to create ‘niches’ which offer initial protection for new radical technologies (Barrie et al. 2019; Bosman & Rotmans 2016; Geels 2002; Kemp et al. 1998; Leydesdorff 2000; Loorbach 2007; Schot & Geels 2008). ‘Niches’ are protected spaces which shelter radical new technologies from market selection criteria (Barrie et al. 2019), and therefore permit sufficient investment, resources, time and energy (Bosman & Rotmans 2016). This is necessary because these radical new technologies often initially have relatively low performance, are expensive and cumbersome. Public authorities or universities can proactively support the creation of the protected spaces for experimentation (Barrie et al. 2019; Kruger & Steyn 2020; Quitzao et al. 2012). One example of such a space is in Munich, Germany where local regulation was loosened to provide a flexible and open ‘experimentation zone’; in this space, different actors can test how co-specialized assets fit together and can be used by different actors (Konietzko et al. 2020).



## 2.7 Synthesis and analytical framework

This section provides a synthesis of the literature and an analytical framework for empirical analysis. This literature review started from the discussion of embeddedness of economic activity. The relevance of embeddedness for entrepreneurial ecosystems is that these entrepreneurial ecosystems are situated within wider social contexts (i.e., fields) which have their specific contextual attributes. These fields are susceptible to path dependencies and change processes. The fields are formed and shaped through regional conditions and governance. Public sector could be a central actor in entrepreneurial ecosystem emergence (Colombelli et al. 2019; Du et al. 2018; Spigel 2016a), but sometimes its role is rather limited; in some cases, universities and research organizations can act as main actors in these ecosystems (Giurca & Metz 2018; Malecki 2018). Regardless of who acts as a main actor, governance may be especially relevant for bioeconomy and circular economy (Aguilar et al. 2019; Bosman & Rotmans 2016; McCormick & Kautto 2013; Urmetzer et al. 2018). Based on the concepts of bioeconomy and entrepreneurial ecosystems, related thematic topics and other theoretical foundations, an analytical framework was created (Figure 1).



**Figure 1. Analytical framework for bioeconomy entrepreneurial ecosystems**

Ecosystem attributes were divided into cultural, social and material attributes (Spigel 2017). In some cases, lacking elements can be compensated for by various other elements (Godley et al. 2021;

Roundy 2017). In other cases, lacking elements may limit the growth of an entrepreneurial ecosystem (Mack & Meyer 2016). Social, cultural and material attributes evolve through time and their importance may change when the system evolves (Mack & Meyer 2016; Neck et al. 2004).

The investigation of attributes showed that each of the attributes could have a tendency for path dependence or change (Table 3). When a new entrepreneurial ecosystem emerges, the emergence of its attributes would be associated with path dependencies and changes within a field. Cultures, networks and infrastructures can be locked-in and when this happens, limited change occurs within a field; large companies dominate, the culture is risk averse, there are prevailing relations and infrastructure is mainly maintained. In contrast, change-oriented fields have open and change-oriented cultures which are characterized by acceptance towards new innovations, inclusive and open networks which create new relations, and evolving and new infrastructures. The development of an entrepreneurial ecosystem often requires changes in attributes; during the formative phases of an entrepreneurial ecosystem, there may be a need for policy to facilitate the creation of supportive culture, networks and infrastructures (Mack & Meyer 2016).

The latter part of the integrative literature review focused on emergence and evolution in entrepreneurial ecosystems (Table 4). This part of the literature review emphasized that an entrepreneurial ecosystem has tendency for causation and lock-in and it evolves towards specialized collaborative order; this evolution is path-dependent and based on establishing ecosystem conventions.

**Table 3. Path dependence and change in cultural, social and material attributes**

	Path dependence	Change	References
Cultural attributes	Risk-averseness, closed, limited tolerance towards entrepreneurship	Cultural change, developing common language, shared ambitions and goals, reframing meanings, tolerance towards entrepreneurship, tolerance towards new things	Aoyama 2009; Audretsch & Belitski 2017; Autio et al. 2014; Carlsson & Mudambi 2003; Florida 2002; Isenberg 2010; Konietzko et al. 2020; Loorbach 2007; Mack & Meyer 2016; Mason & Brown 2014; O'Shea et al. 2019; Roundy 2016; Roundy et al. 2018; Roundy & Bayer 2019; Saxenian 1994; Spigel 2017; Spigel & Harrison 2018; Thompson et al. 2018
Social attributes	Prevailing relations, limited interaction, limited knowledge exchange, lack of intermediaries, siloed relations	New relations, dense networks, dense interaction, collaboration, learning, resource sharing, network intermediaries, social events, shared forums, interdisciplinary collaboration	Aguilar et al. 2019; Ahn et al. 2010; Alvedalen & Boschma 2017; Autant-Bernard et al. 2013; Autio et al. 2018; Barrie et al. 2019; Beckert 1996; Bosman & Rotmans 2016; Brown & Mason 2017; De Besi & McCormick 2015; DiVito & Ingen-Housz 2021; Etemad & Lee 2003; Granovetter 1985; Gulati 1995; Hayter 2016; Hoang & Antoncic 2003; Human & Provan 2000; Konietzko et al. 2020; Leyden et al. 2014; Ludvig et al. 2016; Lundvall 1988; Lundvall & Johnson 1994; Mack & Mayer 2016; Malecki 2018; Marion et al. 2015; McCormick & Kautto 2013; Nylund & Cohen 2017; Pittz et al. 2019; Powell 1998; Roundy 2017; Sadek et al. 2015; Spigel 2016b; Spigel 2017; Spigel & Harrison 2018; Stam 2015; Urmetzer et al. 2018; Van Lancker et al. 2016
Material attributes	Path-dependent city structures and infrastructures, lacking infrastructure, lacking support organizations and facilities, bureaucratic regulation	New infrastructure, changing city structures, new support organizations and facilities, new regulation	Akpor-Robaro 2012; Alhassan et al. 2019; Audretsch & Belitski 2017; Bell et al. 2018; Boh et al. 2016; Cohen 2006; Curley & Formica 2013; De Besi & McCormick 2015; Desrochers & Sautet 2008; Geels 2002; Geels et al. 2015; Giurca & Späth 2017; Goswami et al. 2018; Herrera-Gomez et al. 2017; Hildebrandt et al. 2019; Kruger & Steyn 2020; Meyer 2017; Miller & Acs 2017; Neck et al. 2004; Nicholls-Nixon et al. 2020; Pustovrh et al. 2020; Skar et al. 2020; Theodoraki et al. 2018; Vivien et al. 2019; Wesseler & von Braun 2017; Zucchella & Previtalli 2019

**Table 4. Emergence and evolution in entrepreneurial ecosystems**

	Topics	References
Emergence and evolution	Sensitive to initial conditions, potential for lock-in, causation (i.e., outputs feed back as inputs), from dispersed to specialized collaborative order, need new attributes (cultural, social and material, e.g., 'protective spaces', 'experimentation zones'), can emerge from specific events, technological transition may require new ecosystems	Autio et al. 2018; Barrie et al. 2019; Bosman & Rotmans 2016; Brown & Mason 2017; DiVito & Ingen-Housz 2021; Farla et al. 2012; Geels 2002; Kemp et al. 1998; Konietzko et al. 2020; Kruger & Steyn 2020; Lehtimäki et al. 2019; Leydesdorff 2000; Loorbach 2007; Mack & Meyer 2016; Malecki 2018; McCormick & Kautto 2013; Mungila Hillemane 2017; Quitzao et al. 2012; Roundy et al. 2018; Schot & Geels, 2008; Spigel & Harrison 2018; Stam 2015; Thompson et al. 2018; Urmetzer et al. 2018; Zucchella & Previtalli 2019

A further challenge is the limited legitimacy for new companies (Hannan & Freeman 1984; Hannan 2005), and radical disruptive technologies which do not conform with existing norms, rules and practices (Giurca & Späth 2017; Kuratko et al. 2017; Lehtimäki et al. 2019; Zucchella & Previtalli 2019). Legitimacy is especially relevant in the case of sustainable entrepreneurial ecosystems (Cohen 2006; Neumeyer & Santos 2018; Volkmann et al. 2021). Lack of legitimacy may limit access to resources (Cohen 2006; Hannan & Freeman 1984; Neumeyer & Santos 2018; Spigel 2013), and the acceptance of new technologies (Kuratko et al. 2017; Liao & Welsch 2008). Legitimacy is also a central question in the acceptance of social arrangements (Cajaiba-Santana 2014; Colombelli et al. 2019; Harrisson & Laberge 2002), such as a bioeconomy entrepreneurial ecosystem and collaboration between different sectors. Different regions and social contexts have different implications for legitimacy (Kuratko et al. 2017). For instance, different regional cultures could lead to different outcomes in terms of institutional resistance (Alvedalen & Boschma 2017; Mack & Meyer 2016). In some cases, technological transition may require establishing new entrepreneurial ecosystems which project legitimacy to new entrepreneurs and technologies.

To conclude, the analytical framework in Figure 1 highlights that cultural, social and material attributes of a bioeconomy entrepreneurial ecosystem can be path-dependent or be created and developed under certain regional conditions and governance measures. The main question is how an entrepreneurial ecosystem and its surrounding context support the legitimacy of new entrepreneurs and their new technologies. When a bioeconomy entrepreneurial ecosystem or the surrounding environment does not provide legitimacy to an entrepreneur or new technology, there might be a need to change the entrepreneurial ecosystem, i.e., its cultural, social and material attributes or to create a new entrepreneurial ecosystem.

The analytical framework focuses attention on path dependence and change processes in entrepreneurial ecosystem attributes when bioeconomy entrepreneurial ecosystems are being developed. Although previous research has recognized supportive cultures and social settings, it has not recognized an entrepreneurial ecosystem itself as a potential change agent which can change material attributes (e.g., structures of cities). The analytical framework also shows the contrasting perspective which highlights the path dependence of a bioeconomy entrepreneurial ecosystem. Both processes may have implications for legitimacy within bioeconomy entrepreneurial ecosystems.

## **3 Research design and methods**

### **3.1 A social constructionist approach to entrepreneurship**

In this thesis, the interest lies in ‘embeddedness’ of economic behavior (Granovetter 1985; Swedberg 1997) and ‘the social construction of the economy’ (Berger & Luckmann 1966). Hence, the interest, in line with social constructivism (Lindgren & Packendorff 2009) is on how actors create meaning in social context. In line with Fletcher (2006) and in contrast to structural-deterministic and cognitive-agency oriented views of entrepreneurship, this research takes a stance that entrepreneurial opportunity formation is communally and relationally constituted. Therefore, realizing a business idea is connected to other things that are occurring historically, at present, or in the future.

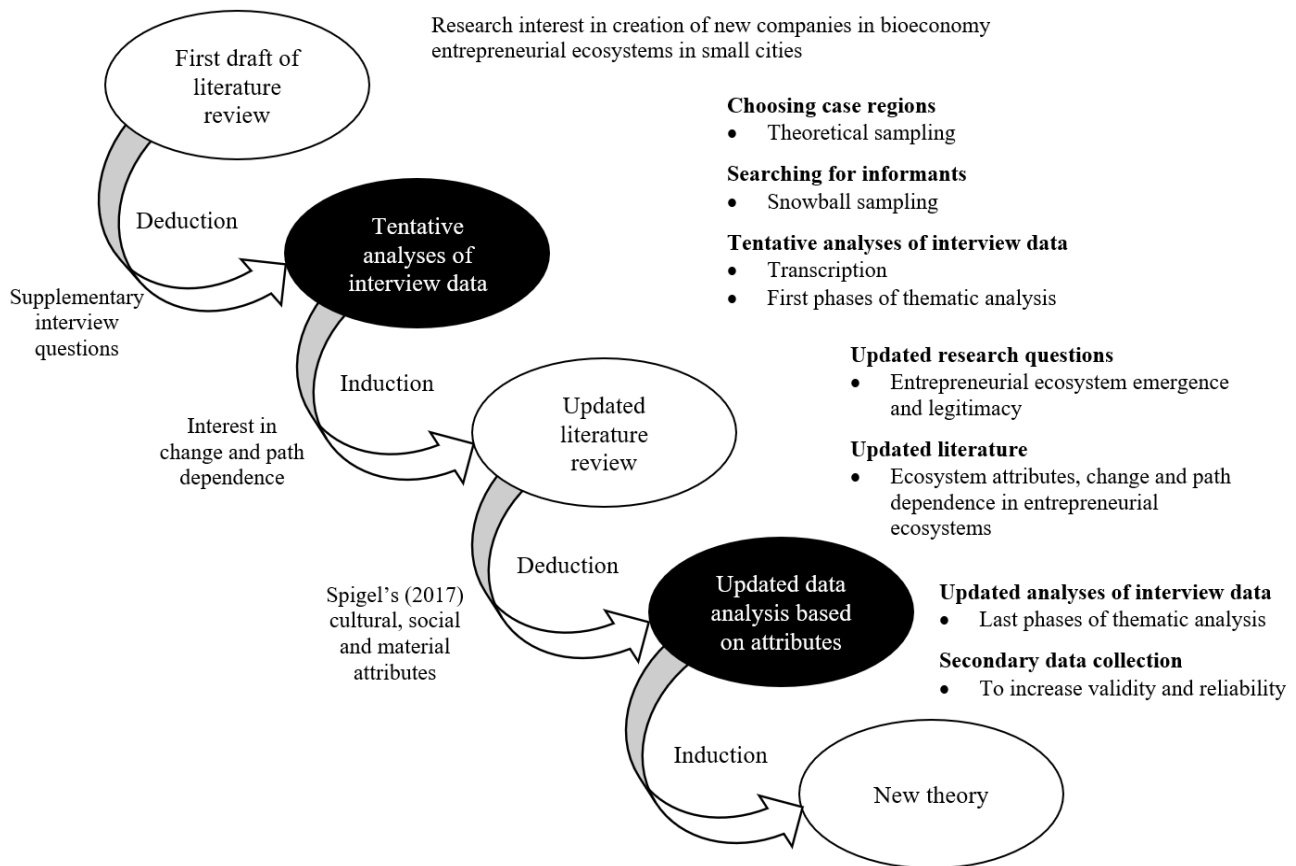
Empirical research shows that entrepreneurship is a much more complex and heterogeneous phenomenon than was thought in the 1980s. Even defining the term ‘entrepreneur’ has proven problematic. (Bruyat & Julien 2000.) In entrepreneurship research, the tendency to simplify complex reality into generalized variables and analyzing these with statistical analyses deprives the richness and ambiguity of these phenomena, and this has been a weakness of entrepreneurship research (Lindgren & Packendorff 2009; Zahra 2007). Due to the complexity of the phenomenon, research should take a constructivist stance in order to understand entrepreneurship.

It has been argued that qualitative methods should be given priority because they can grasp entrepreneurship as dynamic, variable, heterogeneous and complex phenomenon that is unpredictable (Bruyat & Julien 2000). Qualitative methods can make deep understanding of an entrepreneurial ecosystem possible (Roundy et al. 2018; Spigel 2017); this is beneficial because standardized metrics to analyze entrepreneurial ecosystems are lacking (Spigel 2017; Theodoraki et al. 2018). Qualitative and interpretivist methods work well for studying entrepreneurial ecosystems as complex systems because these ecosystems consist of complex interactions (Roundy et al. 2018).

### **3.2 Comparative case study design**

This study compares entrepreneurial ecosystems in the regions of Lahti and Tampere in Finland. Both regions have bioeconomy, circular economy or cleantech as their regional policy priority. As mentioned in section 1.3, in this research, region refers to sub-national entities (Carayannis et al.

2017), i.e., local areas in and around specific cities. This study has received Horizon 2020 funding from Online S3 project at Aalto University, Espoo, Finland. The research data collected in this study is larger than conventionally collected for master's thesis work owing to research funding and ambitious plans set in the research group. In this study both primary and secondary data were gathered. The primary data was collected by qualitative interviews (section 3.4). The secondary data was gathered from relevant literature, databases and internet sources (section 3.7).



**Figure 2. Iterative process of theory elaboration based on literature and empirical data**

A comparative case study design was applied (Eisenhardt 1989; Eisenhardt & Graebner 2007; Yin 2018), which took into consideration the richness and complexity of research context (Davison & Martinsons 2016). Comparative case study approach is appropriate for investigating complex emerging phenomena (Eisenhardt 1989; Yin 2018), such as entrepreneurial ecosystems which are currently undertheorized (Autio et al. 2018). This research was based on an iterative process of theory elaboration (Eisenhardt 1989; Eisenhardt & Graebner 2007; Ketokivi & Choi 2014), which was achieved by inductive and deductive cycling between literature and interview data (see Figure 2 and Appendix A). The progression of different phases of this iterative research process such as searching for informants will be described in the following sections.

The case regions were selected based on theoretical relevance, i.e., by theoretical sampling (Eisenhardt 1989); small cities of varying sizes and circumstances allow cross-case comparison. Case study approach can develop new theories and descriptions of the phenomena (Eisenhardt 1989; Eisenhardt & Graebner 2007; Ketokivi & Choi 2014; Theodoraki et al. 2018; Yin 2018; Zahra 2007). In case study research, data is generalized into theory (Eisenhardt 1989; Ketokivi & Choi 2014; Yin 2018). The findings of this research are not generalizable to other entrepreneurial ecosystems since entrepreneurial ecosystem in each region is a unique outcome of the region's historical and economic development (Spigel 2017). The following section will briefly introduce Finland as a research context and provide short introduction to each case region.

### **3.3 Two case regions in Finland**

Nordic countries are mostly remotely populated, geographically large and have a rich stock of biomass. However, the countries vary in their bio-based resources: Finland and Sweden have strong forestry sectors, Denmark has a strong agriculture sector and Norway and Iceland have strong marine sectors (Kristinsson & Jorundsdottir 2019). Finnish bioeconomy strategy has set a vision for Finland to become a pioneer in bioeconomy, circular economy and cleantech with an output of 100 billion euros and creation of 100,000 new jobs by 2025 (Finnish Ministry of the Environment 2014). However, Finland's bioeconomy transition is still in a pre-development phase. The transition has not yet taken off due to lack of urgency, ownership and common understanding (Bosman & Rotmans 2016), and achieving results will likely take a long time (Tahvanainen et al. 2016). The key role of forestry in Finnish history and economy has a tendency for path dependence toward incremental innovation in bulk biomass production. Finland has many bottom-up pilots and innovations, but these remain small in scale and fragmented, and still lack interconnectivity and coherence. (Bosman & Rotmans 2016.) Nevertheless, more recently platforms and innovation ecosystems have inspired policy (Sotarauta & Suvinen 2019), universities have been encouraged to create spin-off companies and new startup promotion agencies have been established (Carayannis & Rakhmatullin 2014).

The two case regions, Lahti and Tampere, are relatively small cities. The Lahti region is an important eco-innovation cluster in Finland. The city had approximately 120,000 inhabitants in 2018. Lahti faced critical challenges since the 1990s when its old industrial region began to decline, and during that time, a consensus about strong promotion of innovativeness and knowledge creation in the region emerged (Harmaakorpi 2006). Despite the presence of its own university of applied sciences and the

Lahti university campus, which hosted branches of the University of Helsinki and LUT University, Lahti has a limited number of knowledge-producing institutions and thus practice-based innovation plays a key role in the region (Panapanaan et al. 2014). After the research period, work materialized e.g., in Lahti being nominated European Green Capital for 2021.

Tampere is the original birthplace of Finnish heavy industry. It had a population of approximately 235,000 in 2018. The City of Tampere seeks new ways and radical innovations to green the economic development by using existing and building new infrastructure and establishing platforms. The idea is to mobilize actors to create ecosystems in areas such as land-use planning, infrastructure projects and waste management. The main platforms in Tampere are Kolmenkulma and Hiedanranta. Hiedanranta is a new residential area which is supposed to serve as a development platform for experiments and projects to create new sustainable solutions. (Sotarauta & Suvinen 2019.) In Tampere, the scope of this research is mostly restricted to Hiedanranta. Kolmenkulma was not included in this research because it did not have new companies at the time informants were sought. In contrast to Lahti, Tampere is a university city, and it has more knowledge producing organizations.

### **3.4 Searching for informants**

In order to investigate ecosystem dynamics in detail, as suggested by Bruyat and Julien (2000), Spigel (2017) and Roundy et al. (2018), a collection of wide and diverse explorative data is required. For instance, an earlier study by Thompson et al. (2018) interviewed 25 people, and their study concentrated on the Seattle area only. Since this study investigates two different regions, it was necessary to interview enough people from different sectors and backgrounds in each region.

Entrepreneurial ecosystems consist of many actors including companies, public authorities, research organizations, and so forth. Although an entrepreneur is the central actor in entrepreneurial ecosystems (Brown & Mason 2017; Spigel & Harrison 2018; Stam 2015), it is a mistake to analyze entrepreneurial ecosystems primarily from the perspective of an entrepreneur (Becker 1998, 54–61; Isenberg 2016). In prior research, for example, entrepreneurs' perceptions about abundance or scarcity of capital have been mistakenly taken as evidence of the "presence of financial resources" or considered more important than perceptions of investors (Isenberg 2016).

Since the interest in this study is in regional needs and priorities (Carayannis & Rakhmatullin 2014; Hakala et al. 2020), recognizing only the thinking and needs of the companies may not provide



throughout picture of how these ecosystems work and what their importance for the region is. Other actors were included as informants in order to gain broader understanding of the whole entrepreneurial process (Lindgren & Packendorff 2003). In addition, several phone calls and discussions with experts from different institutions (e.g., public sector, universities) helped in gaining a better understanding of the bioeconomy in the case regions before the interviews were conducted. These phone calls were not recorded or used in analyses.

**Table 5. Numbers of interviews by organization type for each region**

	Lahti region	Tampere region	Both areas
Companies	2	4	6
University professors	1	1	2
Other university staff	1	1	2
City officials	1	2	3
Waste management organization	1		1
Water supply organization		1	1
Regional development organization	2	1	3
Sustainability organization or foundation		1	1
Regional council	1	1	2
<b>Total</b>	<b>9</b>	<b>12</b>	<b>21</b>

The details regarding the interviewees are provided in Table 5 (see Appendix C for more details). The data consists of 21 interviews carried out in May–June 2018. In each interview, 1–2 individuals who represented their organization were interviewed following arguments by Davidsson and Wiklund (2001) for investigating regional differences in entrepreneurial activity via interviews with relevant individuals. The interviewees consist of A) entrepreneurial ecosystem facilitators and policy actors such as representatives from universities, city organizations and regional development organizations, and B) bioeconomy companies that have been established in the regions in 2014–2018. All companies which agreed to participate in interviews were interviewed. The companies that participated in the interviews represent the following sectors: bio-based fertilizers, bioenergy, food sector, remediation of polluted soils, and water sector. The total number of interviewed companies is 6; this quantity illustrates that companies established in bioeconomy were still scarce. Interviews lasted approximately 1–1.5 hours and were carried out face-to-face or by phone. The interviews were recorded (27 hours of recordings) and transcribed which resulted in 306 pages of text.

In social constructionism, instead of taking regional or national level of analysis as strictly defined, the network should be considered as it is perceived by the actors in entrepreneurial process (Lindgren & Packendorff 2009). Therefore, interview participants were mainly found by snowball sampling in

which informants were asked to identify other members within an ecosystem to be interviewed (Marshall 1996). This approach functioned well because bioeconomy was a small network in both case regions. In Finland, local governments, regional councils and regional development organizations often have a leading role in regional leadership (Beer et al. 2019; Sotarauta 2010; Sotarauta & Beer 2017; Sotarauta & Suvinen 2019). Public sector, academic institutions and third sector actors may also have an important role in bringing entrepreneurs together via forums and events (Spigel & Harrison 2018). Therefore, ecosystem facilitators were interviewed first because they had contacts to entrepreneurs and other relevant actors.

However, snowball-sampling can lead to biased results; informants found with this method were all involved in networks among other actors. In order to increase accuracy, regional actors were also searched for on the internet in order to include actors that could not be reached by snowball sampling. New informants were not found. In addition to searching for new informants, websites were also reviewed to cross-check that all relevant informants could participate in interviews.

### **3.5 Interview questions**

The purpose of the interviews was to gain knowledge of the emergence and current state (i.e., structure, dynamics and context) of the entrepreneurial ecosystem in both regions. The interviews were organized as open interviews which were supplemented by thematic interview questions (Appendix D). These supplementary interview questions were based on a first draft version of the literature review, i.e., on deductive reasoning (Appendix B; see Figure 2). Interview themes were put into use when the topics were not otherwise discussed. In the beginning of the interview, there were general questions about the actors and the regional context. Academic terminology was avoided or explained using other words when these words were not familiar to an interviewee. At the end of the interview, challenges and opportunities for the future of the entrepreneurial ecosystem were also discussed. The interviews were conducted in Finnish and in one case in English.

During the interviews, specific attention was paid to regional conditions. Context has often been overlooked in entrepreneurship research (Becker 1998, 75–83; Stam & van de Ven 2021; Ucbasaran et al. 2001; Zahra 2007), although local conditions have been emphasized in entrepreneurial ecosystem research as a starting point in entrepreneurial ecosystem formation (Isenberg 2010). For example, previous research has mentioned that regions without their own universities can be weak in creating new innovations (Kolehmainen et al. 2016). At the time the research was conducted, Lahti

had a university campus which was a unit of the university. The interviews imply that Lahti lacked high-skill workers. In contrast, Tampere had large universities and more skilled workers. Since ‘ecosystem’ concept appears to be unclear and incoherent, the interviews also included a question regarding the definition and relevance of ‘ecosystem’ concept.

### **3.6 Thematic analysis**

The research utilized thematic analysis to find common patterns, i.e., themes from the interview data. The advantage of this approach is theoretical flexibility for identifying, analyzing and reporting themes within research data. Ideally, the analysis should find number of occurrences of a theme across the interview data set, but the importance of a theme is not dependent on calculable measures (Braun & Clarke 2006; Vaismoradi et al. 2013). When thematic analysis is performed from a constructionist framework, the analysis tends to focus on structural conditions and sociocultural contexts and identifies underlying assumptions and ideologies; therefore, this form of thematic analysis could resemble some forms of discourse analysis (Braun & Clarke 2006).

The analysis was carried out following Braun’s and Clarke’s (2006) six phases of thematic analysis. In the first phase, the research data was reviewed during the interviews, transcriptions and the reading of the data after transcriptions were finished; during this phase, an initial list of ideas was written on paper. In the second phase of thematic analysis, initial codes were generated based on the initial list of ideas. Data extracts were copied from individual transcripts and categorized into separate files based on codes. In the third phase of analysis, tentative themes were searched for by combining codes together into meaningful groups (Appendix E).

After these initial codes and tentative themes were created, the whole literature review was updated based on inductive reasoning during a timespan of one year (see Figure 2). The updated literature review implied that the codes could be grouped into three main themes for each region based on Spigel’s (2017) cultural, social and material attributes (Table 6). Spigel’s attributes match well with a logical grouping of codes: local cultures (i.e., cultural attributes), interorganizational relations (i.e., social attributes) and differences in city planning (i.e., material attributes).

Thus, after the literature review was updated, thematic analysis shifted from inductive to more theoretical (i.e., deductive) thematic analysis (see Figure 2). This is possible because inductive and deductive logics are mirrors to each other, and both can contribute to developing theory in case

research (Eisenhardt & Graebner 2007). Spigel's attributes formed the backbone for the remaining phases of thematic analysis, i.e., theory is used to anchor the analytic claims (Braun & Clarke 2006).

In the fourth phase of analysis, themes were reviewed in relation to coded extracts and the entire data. Accuracy at the level of the entire data set was validated using previous literature (e.g., Spigel 2017), secondary data collection (section 3.7), and through property space analyses which were used to make typologies of different themes and differences between case regions (Becker 1998, 222–249). For example, property space analyses implied that the importance of contacts in other cities is relevant in both case regions, and thus it is not a feature that specifically applies to Lahti region. The dichotomy of change and path dependence in ecosystem attributes was also recognized through property space analyses, and this dichotomy also inspired the contents of the updated literature review.

**Table 6. Themes and sub-themes in the final phases of thematic analysis**

	Cultural attributes	Social attributes	Material attributes
Lahti	<b>Family entrepreneurship culture</b> <ul style="list-style-type: none"> <li>• Family business tradition</li> <li>• Large companies with a long-time presence</li> <li>• Long-term development</li> </ul>	<b>Prevailing social circles</b> <ul style="list-style-type: none"> <li>• Small circles</li> <li>• Prevailing networks</li> <li>• Need more interaction</li> </ul>	<b>Dispersed city structures</b> <ul style="list-style-type: none"> <li>• Dispersion</li> <li>• Difficulty in creating new areas</li> <li>• Available premises but limited entrepreneurs</li> </ul>
Tampere	<b>Culture of change</b> <ul style="list-style-type: none"> <li>• Culture of change</li> <li>• Openness</li> </ul>	<b>New relations and collaborations</b> <ul style="list-style-type: none"> <li>• New relations</li> <li>• Increased collaboration</li> <li>• Sharing international networks</li> </ul>	<b>Test areas</b> <ul style="list-style-type: none"> <li>• Test area</li> <li>• Area changes</li> <li>• Path-dependent city structures</li> </ul>
Other themes relating to ecosystem emergence and legitimacy			
Both regions	<b>Limited number of companies</b>	<b>Established conventions are missing</b>	<b>Legitimacy in entrepreneurial ecosystems</b>
Themes are in bolded font, sub-themes have a bullet point			

The fifth phase of thematic analysis was about generating clear names for themes and sub-themes, refining themes and the overall story that these themes tell. During this phase, the results chapter was written based on Table 6 and data extracts were arranged into tables while assuming coherence and consistency. In the last phase of analysis, specific extract examples were chosen while relating back to research questions and literature and assuring that the results provide sufficient evidence for themes; thus, results include several data extract examples for each theme or sub-theme to support the claims.

Some themes were discarded in the later phases of thematic analysis. These include various 'actor roles' and 'goals' which were less relevant for the results of this thesis. A deeper investigation of

specific actor roles and the significance of various shared and conflicting goals would be possible but that is too broad for the scope of this thesis; the results describe specific contextual attributes that are interesting from the scope of the research questions. The results do not therefore represent all insights from the interview data. The transcriptions were carried out precisely. However, in later phases of thematic analysis, unnecessary and repetitive words that had no significance for the results were omitted to improve comprehensibility of data extracts (Guest et al. 2012, 267). Irrelevant words in data extracts have been replaced with three dots (...). The organization types are attached to the data extracts as follows: C = company; P = public sector; R = research organization; O = other. The data extracts were translated into English when the interview was conducted in Finnish (see Appendix F).

The discovered themes should eventually represent something relevant from the perspective of the research questions (Braun & Clarke 2006). This relevance is justified in Table 7. The research questions became more precise during different phases of the analyses; the emphasis shifted from general investigation of entrepreneurial ecosystems to entrepreneurial ecosystem emergence and from creation of new companies to legitimacy within entrepreneurial ecosystems. These shifts were based on deeper understanding of research data and research literature around the topic.

**Table 7. How does thematic analysis answer the research questions?**

Research question	Results
1) What are the differences between entrepreneurial ecosystems in the two case regions?	Each region or ecosystem has its own themes. The resulting themes from both regions will be compared.
2) How do the entrepreneurial ecosystems emerge and evolve?	Change and path dependence in cultural, social and material attributes characterize the emergence and evolution of entrepreneurial ecosystems. Attributes are influenced by local conditions and governance in these entrepreneurial ecosystems.
3) How do the entrepreneurial ecosystems support the legitimacy of new entrepreneurs and new bioeconomy innovations?	Cultural, social and material attributes in certain ecosystems could be relevant when considering legitimacy towards new entrepreneurs and new bioeconomy innovations.

In social constructionism, empirical work is based on interactions between the researcher and interviewees. Knowledge is created in an interaction process and researcher becomes a part of the results (Lindgren & Packendorff 2009). Identifying themes in data was influenced by my interpretations and different theoretical positions (Braun & Clarke 2006). I have studied business administration prior to my social science studies, and therefore I have background knowledge about entrepreneurship. My social science background also influenced this research to a great extent and directed the focus on patterns such as change, legitimacy, embeddedness and contextual attributes. I lacked prior knowledge of bioeconomy which can lead to some limitations and blind spots; however,

this could benefit my capability to investigate the circumstances in bioeconomy as a neutral outsider who does not have strong opinions about bioeconomy in Finland. I have lived in Tampere and thus I am familiar with this case region. In order to increase the validity and reliability of my interpretations, the results were confirmed by several key informants after the analyses were done and supported by secondary data collection (section 3.7).

### **3.7 Secondary data collection**

Secondary data collection was carried out during this study to increase the validity and reliability of the interview data and the interpretations during the analyses (Bryman 2015). As mentioned earlier, secondary data was gathered from relevant literature, databases and internet sources. The secondary data sources included policy papers, strategy documents, scientific journals, implementation plans and reports, and other published and unpublished literature.

Policy papers and strategy documents were collected to review regional priorities which was important for increasing validity of the case regions during theoretical sampling. Both regions had bioeconomy, circular economy or cleantech as their regional policy priority. Secondary sources of data were used to cross-check some details and claims made by interviewees and to confirm certain interpretations during the analyses.

### **3.8 Ethical issues**

Several ethical issues were taken into consideration in this research. Participation in the interviews was voluntary and all the relevant information was provided to the participants. Informants were able to ask questions regarding the research and they could cancel their participation when desired. The anonymized results were sent to informants who wanted to review them before publishing. The gathered interview data cannot be used for commercial purposes. The data can only be used for this research project, other related research projects and for teaching purposes.

Names of the people and companies were anonymized in the data extracts and in the results of this study. Due to the small number of actors in bioeconomy, there is still a high risk that some of the actors can be identified. However, since the scope and design of this study direct attention to the regional contexts instead of the actors and their personal characteristics, the information provided on the individuals is limited. This reduces the possible harm for the informants.

## 4 Results

### 4.1 Emergence of entrepreneurial ecosystems in the regions

Different regions differ in their local characteristics and cultural, social and material attributes. Lahti has limited material flows and a limited number of professionals. In contrast, Tampere is a university city, and a large proportion of citizens in the region have university background. At the time the interviews were conducted, entrepreneurial ecosystems in bioeconomy were at the beginning of their lifecycles in both regions. This was reflected in the interviews when informants noted the limited number of new bioeconomy companies in both regions.

The regional actors, especially in Tampere, mentioned that their attempts to create ecosystems are in an early stage and have not delivered results yet. In Tampere, several interviewees emphasized that more companies would be asked to join the ecosystem in the following years. In the Lahti region, interviewees stressed that there is a lot of knowledge about bioeconomy, but the potential had not yet been realized as new companies. Additionally, more companies would be established from research projects in the following 5–10 years. Table 8 provides examples of data extracts indicating that entrepreneurial ecosystems were at the beginning of their lifecycle.

**Table 8. Entrepreneurial ecosystems were at the beginning of their lifecycle**

Lahti	<p><i>“The university’s funding structure will perhaps generate more spin-offs in the future ... The mind-set may not be quite ready for it. We are moving in a good direction.” (P13, Regional development organization)</i></p> <p><i>“We are maybe critical because we do not see growth in this sector (bioeconomy). We have brilliant cases and the municipality could draw a badge on its chest. The waste treatment rate is high. But whether business is created and jobs are created, it is a completely different level.” (P18, Regional council)</i></p>
Tampere	<p><i>“We want to create an ecosystem of developers and new solutions for sustainable urbanization and those companies are there at the core of that ... Development program is new, started here and we for the whole time now that we got a project manager for this development platform who now pushes it, so that it could have a more formalized form. So we are just in early stages.” (P4, Tampere city)</i></p> <p><i>“Of course this could be even more of an ecosystem at a time when more companies are coming here, because now we still have a rather small group here.” (C9, Company, bioenergy)</i></p> <p><i>“Everything [is missing], when you saw that place there was nothing there yet. After all, there are still a lot of companies missing, and they can't be named yet.” (O10, Regional environmental services organization)</i></p>

Another aspect which implied that ecosystems were at the beginning of their lifecycle was the lack of established conventions. This was revealed through vague roles of the actors, unclear organization of activities, lack of systematic procedures, lacking descriptions of ecosystems, and attempts to design models that define procedures for the creation of new companies and collaboration within ecosystems. An interviewee from the regional development organization in Lahti talked about lacking conventions in the following way: *“The platform should have a purpose for what it does. Terms, platform or ecosystem or cluster of companies, how to define ... Challenge is the same type of tasks in different types of organizations.”* (P13) For another example, a company in Tampere mentioned that *“The challenge is, in a way, the vagueness of the organization ... It (the local network) is currently in a state that is not clear ... now it (Hiedanranta development project) is slowly becoming a city’s activity, I don’t know who will do what.”* (C7) There have also been attempts to create rules and conventions which define the steps for spin-off company creation in Tampere University of Technology.

In Tampere, the ecosystem was mostly defined as an industrial symbiosis (i.e., material sharing), and the interviewed companies had a goal to be self-sustained at a local level. In this view of an ecosystem, an ecosystem should sustain itself, increase resource efficiency and recycle resources and knowledge between actors. Interviewees in Tampere also stressed that an ecosystem is about being part of the natural environment; for example, a food sector startup talked about the ecosystem in the following way: *“As soon as we are all set up, we take the rain, snow whatever, we use everything that our resources allow us.”* (C8) Thus, implying the inclusiveness of the ecosystem, i.e., the interactions in Tampere cover a wide range of different stakeholders and the surrounding material reality. By contrast, Lahti faced more challenges to successfully embrace the ecosystem as a social arrangement among local actors. In Lahti, some of the actors stated that they prefer to rely on networks rather than be part of an ecosystem, i.e., cooperation was less inclusive. Differences in the interpretations of the ecosystem concept among interviewees were also noted.

## **4.2 Lahti**

### **4.2.1 Family entrepreneurship culture**

Lahti was characterized by family entrepreneurship culture (see Table 9). The city had many old family-owned enterprises that had ambitions to develop more sustainable products. According to interviews, this family entrepreneurship structure is exceptional in Finland, and it contributes to the



intensity and emotional bond in carrying out operations in the region. The culture of Lahti seems to emphasize sustaining the old way and preserving the prevailing patterns.

Large companies with a long-time presence controlled the material flows in the city, and a significant proportion of the development was done within these companies internally. Many of the interviewees mentioned that these old companies take leading positions and attract other actors to collaborate. The time horizon for developing the region was long-term.

**Table 9. Family entrepreneurship culture and companies with a long-time presence in Lahti**

Family business tradition	<p><i>“Companies are doing product development all the time, but [they] are family businesses that are already old companies. They develop products to be more environmentally friendly ... The corporate structure, which consists of family-owned enterprises, is exceptional in Finland. Then the intensity and carrying out operations is a little different, there is emotional involvement.” (P13, Regional development organization)</i></p> <p><i>“The tradition of family entrepreneurship is strong and we swear by it. We have partly adhered to the old ways ... Neglected some new sectors where we could succeed.” (P18, Regional council)</i></p>
Large companies with a long-time presence	<p><i>“Bigger companies are those around which things happen. It is more about doing with big partners ... The material flows are mainly held by large companies. Startup may not get in between easily.” (P11, Regional development organization)</i></p> <p><i>“There are big players in the area, could act as such that enable undergrowth ... Startups can be a gust of wind, go out of business. The presence of forerunners fuels the competition, others have to renew themselves ... Not necessarily those new companies are the main thing in it, even though it is really nice to have them ... also that the existing companies really develop their own business, that's what we also want.” (P12, Lahti city)</i></p>
Long-term development	<p><i>“It is long-term. Increasing the recovery of waste ... A recycling incentive scheme has been built since the early 1990s. Lahti was ahead of Helsinki. Things need to be done with a 20-year perspective. The responsibility for development must be really far-sighted.” (P12, Lahti city)</i></p>

#### 4.2.2 Prevailing small circles

Lahti is a small city which had a limited number of actors. The interviews imply that there were small social circles in Lahti. Due to small circles, getting to know the actors within the area was easy, and there was a high level of trust and a consensus among the actors. Prevailing networks were mainly strengthened and maintained, and the networks were based on personal relations of people who meet and collaborate with each other frequently. Collaboration was based on personal relations, which made it successful. However, as mentioned in several interviews, these prevailing networks could have restricted access for outsiders. According to interviews, some contacts were lacking, and some of the actors acknowledged the need for more openness and creation of new relations. Lack of interaction has also caused some problems. For example, when information did not pass from the

university campus to the business world, a company had used a wrong method to clean up contaminated land. Illustrative data extracts are provided in Table 10.

**Table 10. The characteristics of social relations in Lahti**

Small circles	<p><i>“People know each other in the area, it’s easy to gather them together. Always the same people, there are inward focused social circles. People have been introduced to new people, it is not so reclusive.” (R1, University campus staff)</i></p> <p><i>“Everyone knows everyone, it is the good side of a small community. And some business people are familiar, some politicians are familiar. Direct connections.” (R14, University campus professor)</i></p>
Prevailing networks	<p><i>“There is an entrepreneurial spirit in Lahti, but the weakness is in the trust between entrepreneurs. There are inward-looking social circles. When there are existing networks, it can be difficult to access these networks from the outside. Lots of entrepreneurs are alone still.” (P12, Lahti city)</i></p> <p><i>“Smart specialization groups seek to use existing networks, no extra meetings will be held, information will be shared there where there is already an agreed event there. We strengthen the existing structure.” (P18, Regional council)</i></p>
Need more interaction	<p><i>“This calls for a certain degree of openness ... Even more open platforms could be made. That’s where we have work to do.” (P12, Lahti city)</i></p> <p><i>“We should get environmental companies to rub shoulders, and there should be universities involved and polytechnics that. They should be properly mingled. Representatives of the city of Lahti should be listening and thinking about how they will take it for decision-making and guidance. If we talk about being a cleantech cluster, then there must be actions in that direction.” (C19, Company, energy from water)</i></p>

The regional development organization acted as a network intermediary and provider for general advice. The organization had helped new entrepreneurs to establish companies, helped the academic actors to get more contacts in industry, and had acted as a network intermediary for local waste management organization. Regional research organizations acted as knowledge sources for local companies and the waste management organization; however, according to interviews, research organizations may lack certain social ties. Contacts and collaborations with actors in other cities were also important because there was a limited number of actors in the region.

### 4.2.3 Dispersed city structures

Lahti had a dispersed city structure, i.e., bioeconomy companies were located throughout the city. Large companies and organizations with long-time presence dominated the city structure and the development occurred in and around these companies. Large companies were also linked to the public sector since they depend on urban planning. The prevailing city structure was strengthened in a path-dependent manner. For example, interviewees from the regional council highlighted the concentrating

activities and establishing business premises in Niemi, the location of Lahti university campus. At the time of the interviews, Lahti had its own university of applied sciences and the Lahti university campus, which hosted branches of the University of Helsinki and LUT University. Thus, it was not a university city, although LUT university had plans to increase its presence in Lahti in the future.

Some interviewees discussed that there are plans to establish a new area for circular economy and recycling in Lahti; however, the prevailing city structure made it difficult to establish this new waste management area. Another pivotal issue was the small entrepreneurial volumes. There were not enough new companies in bioeconomy, and this limited possibilities to situate them together. In the interviews, it was mentioned that Lahti had available premises (e.g., old factory buildings), but the number of entrepreneurs to occupy these premises remained limited; thus, space and premises were not constraining factors. Premises were generally cheaper in Lahti than in bigger cities in Finland. Examples of data extracts that show evidence for dispersed and path-dependent city structure in Lahti are provided in Table 11.

**Table 11. Dispersed and path-dependent city structure in Lahti**

Dispersion	<p><i>“There are no, for many industries such concentrations do not emerge, where there would be certain industry stuff in the same place. We have communal workspaces here ... but that's, probably the main focus is in media entrepreneurship and stuff like that. It is not bioeconomy.” (P11, Regional development organization)</i></p> <p><i>“There is no such reserved industrial area where these companies could be located. It is already reflected in the fragmentation, that these recycling companies go to old industrial areas. This creates disturbances such as noise, littering and traffic disturbances.” (P17, Waste management organization)</i></p>
Difficulty in creating new areas	<p><i>“The weakness is the lack of platforms. Kujala is starting to get pretty full, unable to expand the area. The recycling and circular economy sector is growing at a rapid pace. Where it is the upcoming platform. When unable to expand. The new area has been under consideration for five years, the establishment of a waste center area is so challenging, no one wants this as their neighbor. Now a new EIA process begins again.” (P17, Waste management organization)</i></p> <p><i>“Finding an area for the concentration of the circular economy seems difficult at the moment, it is suspected that it is some waste area. EIA is not a problem in itself. They have stumbled on complaints and have then had to go looking for another area.” (P18, Regional council)</i></p>
Available premises but limited entrepreneurs	<p><i>“There are underutilized industrial facilities still around the city. It is not dependent on the premises. As long as there is mass ... There is no mass, as in Helsinki and Tampere, where the universities are large and have been for a long time ... Yes we should think in the style of Tampere where they, those startups, could meet. Or do we have that kind of population base, now we're going to get to the provincial differences. We have a terribly low-educated population. Can you think of them creating bioeconomy startups so easily ... The knowledge environment is not as supportive as elsewhere. There are empty spaces but there is no buzz.” (P18, Regional council)</i></p>

Some actors from the public sector had important structural roles in Lahti. The waste management organization had driven the development of the circular economy and recycling in the region, and they acted as a platform for testing new technologies and providing references to companies. Some of these companies were startups. For instance, one of the interviewed companies tested their innovation at the site of the waste management organization. The City of Lahti was perceived as an important actor who could have more courage and implement more smart solutions through city planning. Availability of infrastructure also impacts where a company will locate its operations. Lahti had some laboratories and infrastructures, but according to interviews, availability of necessary infrastructure could be limited within the region.

## 4.3 Tampere

### 4.3.1 Culture of change

Based on interviews from Tampere the city was characterized by culture of change (see Table 12). The plan of the City of Tampere was to build a new sustainable urban area in Hiedanranta. The idea was to allow different actors to collaborate and create new circular economy and bioeconomy solutions that disrupt the operations and functions of the public sector. This culture encouraged actors to have an open-minded and innovative mindset, strive for change, and have positive attitudes towards change, continuous learning and innovation. In practice, this means having the courage to test and experiment in pursuit of creating something new, the success of which cannot be known beforehand. So, there should be creativity and *'some sort of craziness'* (R5).

In addition to a pursuit of change, this culture also emphasized openness. This cultural component was about openness towards new solutions and knowledge sharing, open ideation together and inclusiveness for different stakeholders. The interviews highlighted that Hiedanranta permits actors to do new things that may not be accepted in other places. For instance, legislation may hinder some radical solutions, but in Hiedanranta it was possible to bypass some of the strict regulations and test new things. One of the companies mentioned that before Hiedanranta, nobody wanted to know anything about the solutions that the company is developing. The company mentioned the changing mindset in Hiedanranta makes it possible to educate the public about the company's new solution and prove it works.

The positive attitude towards change and openness in Tampere may also stem from the city's historical roots. Tampere was recognized as a city with long industrial history and as a place where people are 'accustomed to get things done' (P15). This background, in combination with local universities acting as knowledge organizations makes the environment positive towards open collaboration. In addition, a long tradition of collaborative projects between industry and the local university of technology was mentioned. Even though Hiedanranta was recognized as an area that supports innovation, some interviewees argued that the city organization outside the development project and traditional sectors such as construction were not innovative.

**Table 12. Characteristics of culture of change in Hiedanranta, Tampere**

Culture of change	<p><i>"You get to do something that, [if] a conventional civil engineer or process engineer would be a project manager [they] would shoot you without difficulty when hearing what you're doing. But there has to be a certain madness and creativity ... a certain freedom, it belongs to those things." (R5, University, two professors)</i></p> <p><i>"There are, in a way, some people with the similar spirit, they are seeking that change and, not afraid to be a little different. In that sense, this is a charming area ... This is like, a test area. Here the theme is trying and making something new and not doing it like, not necessarily in those old ways but. Trying to change, finding new ways of doing things, better ways. Those that do support the circular economy." (C9, Company, bioenergy)</i></p> <p><i>"Because the district of the future is under construction. then, the intention is to develop just the kind of, technologies and practices that break current ways of doing things ... I also believe that it can change the way these public actors work, be it the bioeconomy or the rest of the circular economy ... It is a change in way of thinking. So that is the first thing that can then cause a change in the ways of doing things. First [we] should revise the mindset." (O10, Regional environmental services organization)</i></p>
Openness	<p><i>"I think there is certain openness and dialogue here and an active approach to seizing and exploring opportunities, so it is at least, positive." (C9, Company, bioenergy)</i></p> <p><i>"In Hiedanranta perhaps things have been set in motion very, openly, so that once the area was opened, it was opened open-mindedly ... This open approach has undeniably made Hiedanranta really attractive, for a year or two, groups of people have visited there." (P16, Tampere city, water sector project)</i></p>

#### 4.3.2 New relations and collaborations

In a circular bioeconomy, it is necessary to establish relations and links between actors, and it is easier to form these links when actors are located close to each other. The operational principle is that the waste of one actor is the resource for another actor. Based on the interviews, Hiedanranta was an area of new relations and collaborations (see Table 13). The place had an open atmosphere that encourages different actors to meet and collaborate with each other.

Hiedanranta had frequent seminars, events, discussions and workshops. These brought together the actors that were physically present at the site and other regional organizations outside Hiedanranta, i.e., universities, public sector actors, companies and other organizations. For instance, there had been a few Living Lab sessions for actors in Hiedanranta as part of various projects. Much of the communication was carried out personally; actors could maintain the ecosystem by interacting mainly via face-to-face and email, and this was still easy because the number of actors was small.

The City of Tampere acted as a facilitator which brought different actors together. All development trajectories were based on discussions in workshops. Strong emphasis on multidisciplinary was one benefit in the collaboration within Hiedanranta. Some of the companies did not have their premises in Hiedanranta, and thus their link to the area was functional.

New relations and collaborations created dense networks among organizations in the region, and thus main individuals from companies, research organizations, public sector and other organizations knew each other. New collaborations included learning from each other, sharing resources, and sharing networks. For example, one of the companies mentioned that they can get information about growing plants when they have friendly casual discussions with another company.

Shared resources included fertilizers, biochar (i.e., charcoal produced by pyrolysis from biomass without oxygen) and CO<sub>2</sub>, among others. For instance, there was a pipe which was dug underground to deliver excess CO<sub>2</sub> from one company to another, which could use the CO<sub>2</sub> to grow the plants. Sharing networks included, for instance, internationalization together. One of the companies had contacts in the Middle East, and thus another company could benefit from these contacts which can potentially lead to new business opportunities. The collaborations with the city also provided opportunities for references.

Hiedanranta needed new companies, but according to the interviews there were still no clear procedures for finding potential participants; it was discussed that regional development organization could play a more defined role in this matter. Research organizations acted as knowledge sources which provide information about different solutions. Tampere University of Technology (became a part of Tampere University in 2019) supported the structuring of the ecosystem by providing information and analyses. In addition to this support, the university operated some testing facilities in Hiedanranta which provided collaborative opportunities for companies and different projects.

In Tampere, there was also a public-sector owned sustainability organization which provided knowledge-based perspectives and helped different actors to get to know each other. This organization also carried out communication and awareness activities for Hiedanranta. However, according to the companies, this collaboration was limited. Furthermore, there was some discussion about involving the citizens of nearby areas. The interviewees also mentioned that the city is small enough so there are not many competing ideas, but the size is enough to have notable development; the city had enough companies and sufficient knowledge base. In addition to local relations, the companies and other actors had strong international orientations and links to other regions in Finland.

**Table 13. New relations and increased collaborations in Tampere**

New relations	<p><i>“We have been able to offer so that these our, companies meet each other ... In my opinion there is a fairly open atmosphere and these companies, these actors have, started to talk to each other.” (P4, Tampere city)</i></p> <p><i>“I have learned to know a large number of future actors. Yes, I believe that these people in the university will develop in this field, no matter where they will each get their jobs, but anyway. They will become the actors of the future.” (C7, Company, bio-based fertilizers)</i></p>
Increased collaboration	<p><i>“It has now been discussed with this [name of startup] that, these nutrients which we now take from there, so these could be utilized. But it's probably going to take this summer before we get there. In actions and. [name of a startup]'s product, biochar, we will probably use that.” (C7, Company, bio-based fertilizers)</i></p> <p><i>“I am very much connected with [name of startup]. That we are somehow friends and he comes here and helps me with the plants because I don't have much knowledge about plants. But I built the system, and now I need like biologists and he knows about plants. So he comes and tells me ... I said well I could use their CO<sub>2</sub>, so okay what do we have to do. I said okay we need to dig and bring a pipe from his place to my place. So we could use his excess CO<sub>2</sub> to give it to the plants. And that's what they did for us.” (C8, Company, food sector)</i></p> <p><i>“With everyone there is some, some kind of collaboration, perhaps most with [name of startup] now, on this stormwater issue, because that biochar would be tested in these stormwater solutions. [name of startup] would like to have a reference from that, making some kind of stormwater treatment solution that uses biochar and, and we also want to test that biochar.” (P16, Tampere city, water sector project)</i></p>
Sharing international networks	<p><i>“Yes, things seem to lead to others. [name of person] then has, for example, contacts in the Middle East ... there is a lot of demand, for example, for biochar in the Middle East, we will have a lot of added value when there is a shortage of water.” (C9, Company, bioenergy)</i></p>

### 4.3.3 Test areas

According to the interview with the City of Tampere representative, conventional ways are not sufficient if the city wants to become more sustainable and circular. The city had capabilities to plan and build new urban areas; the city can build roads and pipes and construction companies can build the buildings. However, when this should be done in a sustainable way from the perspectives of energy and nutrient cycles, it becomes a challenge. In order to find solutions for this challenge, the

City of Tampere had established test areas for demonstrating, piloting, experimenting and testing new sustainable solutions for urban development. Hiedanranta area was referred to as a development platform (Finnish: kehitysalusta).

The vision of Hiedanranta is to develop the area based on principles of circular economy. The place was planned to be a new urban area for 25,000 inhabitants and 10,000 jobs in the future. The plan was to create new opportunities to learn how to create sustainable urban areas with circular closed material loops, and technologies that were developed in Hiedanranta could be later implemented elsewhere in the city. In general, when the city was building something, it happened in a top-down fashion. In contrast, Hiedanranta was designed to be developed and built differently through an iterative process which can make change possible.

In the past, Hiedanranta was an industrial site, and consequently, it had many environmental problems, such as spoiled land areas and 'zero fiber' (i.e., unused, discharged fiber) sediment structures in a nearby lake. The land passed to city ownership and the city became responsible for finding solutions to the environmental problems. In Hiedanranta, the City of Tampere therefore acted as a facilitator and had a central role in raising questions that need sustainable solutions for urban development. Due to widespread contamination of the environment, new solutions were urgently needed. The city was also an early adopter of these sustainable solutions. Hiedanranta had old industrial buildings which were in bad condition. The companies in Hiedanranta could renovate them and use the premises for small rent. However, the premises were not suitable for all of the interviewed companies because of size and availability constraints. In addition to companies, there was a strong university presence and further plans to establish a university unit or a development center in the area.

Another central feature in Hiedanranta is that the area will change completely. The place will be created from nothing; everything needs to be built, including infrastructure, buildings, transportation system and energy infrastructure. Interviewees emphasized that doing something completely new in Hiedanranta is easy because of the change. As mentioned by interviewees from Tampere University of Technology, after infrastructure and other structural elements of the city have been built, changing these structures afterwards is not easy. In order to first know what is possible, the discussions for new solutions must start before any decisions have been made and before construction has started. Changing existing infrastructures is much more difficult. The interviews with the different companies suggest that Hiedanranta was exceptional in its flexibility – in other areas, the city organization was perceived as being bureaucratic.



In the interviews, it was recognized that the city has the power to influence city structures through urban planning, i.e., the city can force construction companies to build certain types of solutions. Yet, an interviewee from the city organization mentioned that the city is a risk averse institution which cannot change radically because the city takes care of fundamental services such as water supply, energy and traffic networks which could be endangered if the city became too innovative and changed too rapidly. Another interviewee from the city organization emphasized that testing new things is very difficult for the city. For instance, this interviewee mentioned that *“then if I were going to report that we spent five hundred thousand so we tried and failed, then that anyone would say it was a good thing, yes I would say it's still a long way to go.”* (P4) The actors in the university mentioned that it is not customary to see the city being involved in innovation activities and the innovation potential of the city is limited. Illustrative data extracts are provided in Table 14.

**Table 14. Test areas, i.e., development platforms in Tampere**

Test area	<i>“The City of Tampere sees Hiedanranta more as a development platform where you can pilot things and test things there ... We can learn how to build a residential area based on a circular economy that closes the material cycles, the great lesson that can be obtained and applied elsewhere.”</i> (P3, <b>Regional council</b> )
	<i>“I claim that we know how to build and design that city with current technologies, but when we want to do it in a new sustainable way, that is why we have such a development platform ... If we want to make radical changes we should have capability to test something the success of which is not yet known.”</i> (P4, <b>Tampere city</b> )
Area changes	<i>“Hiedanranta, it is an area where for the most part there is nothing but water, half water. It will be built from scratch, so of course there will be things in which there are an awful lot of actors involved. Permits, you need to build infrastructure, build real estate, mobility, energy and everything else.”</i> (P3, <b>Regional council</b> )
	<i>“Hiedanranta has such an operating environment which is quite typical. There are such old industrial properties in many cities in Finland, which are, old activities have ceased from there ... but then here is industrial heritage, all kinds of problems that have been left behind from there as industrial heritage so there is, varying polluted lands, there are all kinds of leaks that have happened there, there are lakes full of zero fiber or big landfills full of the same stuff ... construction will begin in a couple of years.”</i> (C9, <b>Company, bioenergy</b> )
Path dependent city structures	<i>“When you make a plans for such an area, then you will already lock-in a lot of things that makes it impossible to change them afterwards. If you make some guidelines or what structures are made there, gas lines or some electrical work or something, then it will not be changed very easily anymore.”</i> (R5, <b>University, two professors</b> )
	<i>“[By zoning] you can allow something, you can deny something and you can give carrots for something. So it's at least in this new area it's important. Then if you go to the existing infrastructure, then it's pretty much harder to get things in that.”</i> (O10, <b>Regional environmental services organization</b> )

#### 4.4 Legitimacy within and outside ecosystems

Many of the interviewed companies were the forerunners in Finland to be selling the product or service they were selling, and they strived to establish new better solutions and change infrastructures. In addition, many companies stated that they would not exist without specific organizations, including universities. The main challenge faced by the companies was the material intensity of the sector; establishing the company requires physical infrastructure and space, and this may entail high investment costs. Another challenge was the bureaucracy of the system and the need to establish legitimacy. This relates not only to the social acceptability of the company and its solution, but also to the problems posed by the legislation. Based on the interviews, legislation could cause bureaucratic impairments when standards are lacking and certification is required, and therefore be a limitation for market access, access to public funding, and creating new infrastructure. For example, one of the startups could not get subsidies because their solution was not recognized by legislation.

Regional differences in the legitimacy of new companies and their solutions were noted across regions. As mentioned earlier, the City of Tampere was searching for new solutions to rehabilitate contaminated environment in Hiedanranta and acted as an early adopter of these solutions. When the companies saw that the city was looking for new solutions, they wanted to do business in Hiedanranta. Since the Hiedanranta test area was '*created quite open-mindedly*' (C7), it offered opportunities for new companies; the companies mentioned that the area improved their chances for starting and carrying out their innovation activities. The area even allowed to pass some regulation in the name of experimenting. At least one of the companies would not exist without Hiedanranta.

Hiedanranta in Tampere appears to have at least some capacity to develop. When a specific new area (i.e., Hiedanranta) was formed and supported by a strong prevailing institutional actor (i.e., the City of Tampere), this area offered visibility and increased legitimacy to new companies and new technologies. Hiedanranta had a lot of visitors and the startups in Hiedanranta also had increased visibility in the media. The city enhanced the awareness of this area and promoted the area as a brand. The area was planned to include new urban areas for smart and circular solutions. The interviewees argued that this area could act as a showcase which teaches society and promotes change towards sustainability. However, the external bureaucratic organizational structures, path-dependent city structures, rigid surrounding environments and a wider change-resisting society were still a concern because these could hinder the change the actors are striving for.

By contrast, Lahti is an example of necessity for, or lack of, legitimacy. Several interviewees from the region mentioned that local actors should be braver and more open-minded in developing new innovations. These include interviewees from the university campus and public sector. For example, an interviewee from the university mentioned that *“there would be a need to try things more boldly. Courage is not allowed in the area, there are skeptics.”* (R1) For another example, an interviewee from the City of Lahti stated that *“one should think about how to be able to do things more open-mindedly. Such a role has been written in urban strategy.”* (P12) Additionally, both interviewed companies experienced limitations in gaining legitimacy, i.e., they had to spend a lot of effort to convince other actors that their solution works.

Hence, the Lahti ecosystem was a dispersed ecosystem in which new companies face more legitimacy challenges. The number of new bioeconomy companies was small, and this limited the possibility to locate them together. When there is not enough of a critical mass, it may be more convenient to rely on existing and prevailing cultural, social and material attributes, thus leading to more path-dependent arrangements in contrast to Tampere. Some examples of data extracts that illustrate the differences in legitimacy of the companies within and outside the ecosystems are provided in Table 15.

**Table 15. Differences in legitimacy of the companies and their solutions**

Lahti: More need for trying new things	<i>“There is opposition to things that actors have no knowledge of. For example, a new method. Awareness of the company is important for method acceptance. There have been disagreements between the views of Päijät-Häme waste management and the authorities. Often authorities see the new technology as a good thing, often getting excited at first, but this often remains on the level of speech.”</i> (C2, <b>Company, remediation of polluted soils</b> )
	<i>“It has been noticed that things go through more easily elsewhere than in Lahti ... In Lahti, okay. Construction or renovation, when energy efficiency is not required for example. Not making progress as effectively as we could ... environmental performance and requirements of real estate. That should be required. Helsinki is already demanding smart energy solutions in new residential areas. I have not heard of this in Lahti.”</i> (C19, <b>Company, energy from water</b> )
Tampere, Hiedanranta: Improved chances	<i>“Here we found the whole thing. This had a significant role in that. I do not think we would be in this situation without the Hiedanranta development platform. This made it possible, as well as allows for failure so you put into use something and test and see if it works ... Probably offers [more opportunities], because this has been created quite open-mindedly ... It doesn't immediately turn to, our legislation says so and so, we've been allowed to pass that in the name of experimenting.”</i> (C7, <b>Company, bio-based fertilizers</b> )
	<i>“This place was the huge beginning for me so imagine if I didn't have this place ... I still would be in my garage ... This made it much easier for me to jump start it.”</i> (C8, <b>Company, food sector</b> )
Tampere, outside Hiedanranta	<i>“I feel that even, the people that are involved here. The authorities part of it. Their hands are tied with the higher up ... So, again it goes back to the higher political things that they have no clue of this type of things ... They stall the whole process.”</i> (C8, <b>Company, food sector</b> )

## 4.5 Summary

Both entrepreneurial ecosystems in bioeconomy were at the beginning of their lifecycle, i.e., both still had a limited number of new companies and lacked well-defined conventions. The results have thus far provided descriptions of the case regions and their cultural, social and material attributes. Differences in the legitimacy of new companies and their solutions were also noted across regions. A summary of the results for the case regions is provided in Table 16. The results will be further discussed in the following chapter relating back to research questions and literature.

**Table 16. Summary of the results for the case regions**

	Description
Lahti	Lahti ecosystem emphasized maintaining traditions and long-term development. The area had a strong family entrepreneurship tradition and large companies with a long-time presence. In comparison to the other case region, Lahti was a smaller city with a more limited population and limited number of professionals. Social circles were small and prevailing networks were maintained and strengthened. The city structure was dispersed and much of the development occurred in and around companies that had a long-time presence in the area. There were available premises but there were not enough new companies in bioeconomy to fill all these premises. It was also not easy to make radical changes in city structure, and prevailing city structure was maintained. There were infrastructures, but it was not certain whether local infrastructure was enough for all companies. Some locals said that there should be more interaction and more courage for trying new things. Some new companies experienced limitations in gaining legitimacy.
Hiedanranta, Tampere	The ecosystem of Tampere was emerging in a new test area that had been established for testing new solutions for sustainable urban development. It was characterized by strong cultural emphasis on change, being open-minded and experimenting to create something radically creative and new. This emerging ecosystem embraced a positive mind-set towards change and openness. It was an inclusive ecosystem where new relations and collaborations were continuously being formed between new bioeconomy companies and other regional actors. Collaborations included knowledge sharing, sharing resources and sharing networks. The area strived to achieve radical changes. It was planned to change from an old industrial site with environmental problems to a new urban area which would be built in an innovative way utilizing circular solutions and infrastructures. There were not existing city structures that would hinder this radical change. The emerging test area offered visibility and increased legitimacy to new companies and new technologies.

## 5 Discussion

### 5.1 Differences between the case regions

The results show that even though both regions had policies to support bioeconomy and circular economy companies, these regions varied significantly. While Lahti had focused on strengthening the networks of existing actors, Tampere had created completely new areas for bioeconomy companies to test their technologies. The main differences of the entrepreneurial ecosystems have been listed in Figure 3 which shows a dichotomy based on path dependence and change.

	<b>Lahti</b>	<b>Hiedanranta, Tampere</b>
Cultural attributes	Family entrepreneurship Long-term development	Change Openness
Social attributes	Small circles Maintained networks	New relations Increased collaboration
Material attributes	Dispersed Sustained structures	Focused Area changes
Main actor		City
	◀ Most path-dependent	Most capability for change ▶

**Figure 3. The main differences of the entrepreneurial ecosystems**

According to previous research, supportive culture matters for entrepreneurship (Carlsson & Mudambi 2003; Isenberg 2010; Mack & Meyer 2016; Mason & Brown 2014). Both regions had entrepreneurial cultures, but these cultures were different. Lahti had a strong family entrepreneurship tradition, and there was more emphasis on maintaining the established companies and strengthening their networks. The region was characterized by limited change. In contrast, Tampere and the new experimental Hiedanranta area had a strong renewal-oriented culture, which emphasized trying new things and finding new better ways to do things. In this region, there was less emphasis on tradition and more emphasis on change. These differences are comparable to previous research which has found cultural differences in openness for attracting new ideas (Aoyama 2009; Florida 2002; Saxenian 1994).

Additionally, the findings imply that establishing an open culture may not be possible in Lahti because the city did not have a critical mass of new entrepreneurs; in such a case, depending on new

companies on a large scale may not be possible, and the ecosystem may be more inclined to emerge around prevailing actors, i.e., in a path-dependent manner.

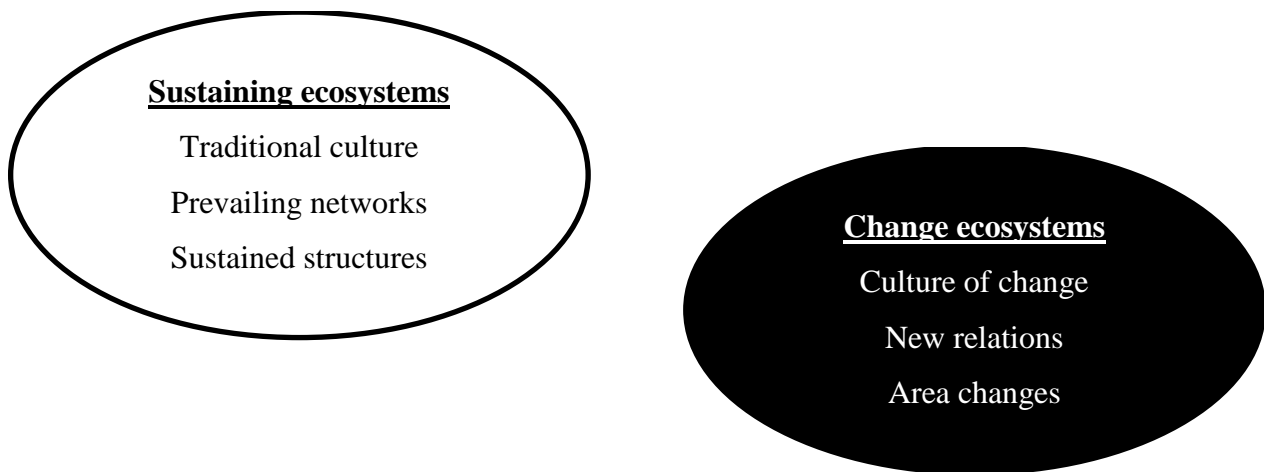
Whereas a tendency for prevailing relations has been recognized in research literature (Granovetter 1985; Gulati 1995; Human & Provan 2000; Konietzko et al. 2020), successful innovation may require collaboration between previously unconnected actors (Konietzko et al. 2020), especially because the knowledge base in bioeconomy is heterogeneous (O'Shea et al. 2019; Urmetzer et al. 2018; Van Lancker et al. 2016). Tampere seemed to create new collaborations through dedicated demonstrations. This is consistent with previous literature (Fevolden et al. 2017; Hedeler et al. 2020; Hellsmark et al. 2016; Vivien et al. 2019). Previous research has also suggested that there may be a need to rely also on prevailing relations (Ludvig et al. 2016). These relations were found in both regions, but their significance was less prominent in Tampere which had more emphasis on openness.

The findings do not completely support Roundy's (2017) claims that networks are less flexible and have stronger connections in small cities. Lahti had strong connections in its prevailing small circles. However, while Tampere also has a small city size, it had more emphasis on openness and the creation of new relations. Thus, city size as such may not determine the social structure within an entrepreneurial ecosystem.

Differences in city structure were the third defining factor in the regions. The significance of these prevailing structural arrangements has been emphasized in previous research (Geels 2002; Giurca & Späth 2017; Meyer 2017; Skar et al. 2020; Zucchella & Previtali 2019). In the bioeconomy, which is highly resource intensive (e.g., may require infrastructure, laboratory and piloting equipment, and managing material flows), city planning influences where companies can be and what they can do. This was noted in the contrasting findings of Tampere and Lahti. In Tampere, new companies were situated in the same area which made it easier for them to collaborate with each other and other regional actors. By contrast, Lahti strengthened its prevailing city structure in a path-dependent manner. Lahti had available premises (e.g., old factory buildings) that were dispersed around the city, while the number of new bioeconomy entrepreneurs to occupy these premises remained limited. In addition, the new companies had weaker or non-existent local ties with some regional actors.

## 5.2 Emergence and evolution of entrepreneurial ecosystems

Since the updated literature review, this research presumed that an interactive emergence of an entrepreneurial ecosystem would be associated with path dependencies and changes within a field (Spigel 2013). Lahti and Tampere illustrate contrasting development paths for entrepreneurial ecosystem emergence and evolution. Two different development paths are shown in Figure 4. An entrepreneurial ecosystem can thus emerge and evolve from established and maintained arrangements (e.g., Lahti), or from change processes (e.g., Tampere). The development paths had so far delivered limited success in bioeconomy entrepreneurship, and it is not possible to draw conclusions of their success in later ecosystem lifecycle phases based on this research.



**Figure 4. Sustaining ecosystems and change ecosystems**

Regional conditions and differences thus matter for entrepreneurial ecosystems, as emphasized in previous literature (Isenberg 2010; Spigel & Harrison 2018; Vedula & Kim 2019). Lahti could be presented as an ideal example of a sustaining entrepreneurial ecosystem. It is characterized by traditional culture, prevailing relations and path-dependent city structures. In contrast, Hiedanranta, Tampere could be presented as an ideal example of a change ecosystem. It has a positive cultural orientation towards change, creates new relations between actors and the city structures change completely.

Previous research has mentioned that new fields can be created by disruptive technologies and emerging new industries (Spigel 2013). This research implies the converse: disruptive fields create new technologies. In other words, a supportive environment towards change makes the emergence of

these technologies and industries possible. This process occurs in regions which do not suffer from path dependencies, and the setting can be interpreted as change in the ecosystem structure.

The results from Lahti showed that a limited number of new companies may limit the capabilities to create a shared location for the companies in the same way as in Tampere. When a region has a limited number of potential entrepreneurs, it is more convenient to rely on existing arrangements, leading to a sustaining ecosystem structure. When the local order is maintained by powerful players such as companies and universities (Spigel 2013), development occurs in and around prevailing institutions.

Lacking attributes have been discussed in previous entrepreneurial ecosystem research (Godley et al. 2021; Mack & Meyer 2016; Roundy 2017). However, previous research has had limited attention to the notion that a critical mass of entrepreneurs could be a lacking element in entrepreneurial ecosystem emergence and evolution, and there has been limited emphasis on the role of entrepreneurs as an input to the entrepreneurial ecosystem. Nevertheless, this issue has been addressed somewhat in the scientific discussions of learning regions (Florida 1995).

Regarding entrepreneurial ecosystem emergence, the results of this research challenge the standard evolutionary models of entrepreneurial ecosystems which start with weak social ties and a culture that has not yet become supportive towards entrepreneurship (Mack & Meyer 2016; Spigel & Harrison 2018; Thompson et al. 2018). Although the entrepreneurial ecosystem in Hiedanranta, Tampere was in emerging phase of its lifecycle, its culture of change and creation of new social relations implies that strong social ties can be formed, and the culture can be supportive towards entrepreneurship since the emergence of an entrepreneurial ecosystem. New collaborations within the emerging ecosystem included learning from each other, sharing resources, and sharing networks. Lahti ecosystem also contradicts ecosystem lifecycle models because the bioeconomy entrepreneurial ecosystem was emerging in the context of strong prevailing networks among local actors.

Although more evidence would be needed to support this claim, the findings may imply that ecosystems based around technological change could potentially start out as change ecosystems which may reduce the timespan for ecosystem development. If true, this would contradict the claims that ecosystem emergence is time-taking steady and gradual process (Mungila Hillemane 2017). Due to causation and lock-in in ecosystems (Brown & Mason 2017; Malecki 2018; Roundy et al. 2018; Spigel & Harrison 2018; Stam 2015), it can be expected that only specific environments can create change ecosystems and changing a sustaining ecosystem to a change ecosystem is not easy.



Furthermore, the results from Hieranranta, Tampere imply that new ecosystems could emerge from specific conditions. The ecosystem emergence in Tampere has similar characteristics to Spilling's (1996) case of an ecosystem emergence from a mega-event. In similar fashion, the need for new solutions was triggered by specific circumstances which created the conditions for new economic opportunities. These circumstances recruited actors to interact and collaborate, eventually leading to the creation of new infrastructures.

Previous research has claimed that transition to bioeconomy requires changes in infrastructures and city structures (Herrera-Gomez et al. 2017; Skar et al. 2020; Wesseler & von Braun 2017). The findings of this research imply that different areas have different capabilities for change; the change is easiest for those areas within cities that change completely. The development of a region takes time and is path-dependent; after buildings and infrastructure exist it is more difficult to make changes. Previous research has claimed that the lack of infrastructure may hinder entrepreneurship (Akpor-Obaro 2012; Neck et al. 2004). Based on this study, the opposite could be true for radical innovations: lack of infrastructure creates the potential for the change, and thus lack of certain infrastructure may be beneficial when an entrepreneur innovates something that does not fit into prevailing arrangements.

The ecosystem in Tampere resembles an optimal city structure mentioned by Desrochers and Sautet (2008) who asserted that diversified city consisting of many specialized clusters is optimal for entrepreneurship since it allows interindustry linkages, industrial symbiosis such as waste recovery linkages, and knowledge sharing between different industries. In dispersed city structures, distance between the actors and lacking social ties may hinder the potential for such collaboration.

A further question from an evolutionary perspective is whether entrepreneurial ecosystems act systematically and reproduce the same outcome continuously based on routines or should be viewed as continuously evolving organism (Becker 1998, 61–66). Especially in the case of sustaining ecosystems, an entrepreneurial ecosystem may not evolve constantly. When cities and their structures are considered, change could be very slow, i.e., the structure is path-dependent. This contrasts with prior research that has suggested entrepreneurial ecosystems should be investigated as changing processes, not as static arrangements (Spigel & Harrison 2018).

### **5.3 Legitimacy towards new entrepreneurs and new bioeconomy innovations**

Based on the results, new companies faced challenges related to the acceptance of new technologies, limited recognition in legislation, and access to public funding and subsidies, i.e., they had limited legitimacy. This is in line with previous research (Cohen 2006; Giurca & Späth 2017; Hannan & Freeman 1984; Hannan 2005; Kuratko et al. 2017; Lehtimäki et al. 2019; Liao & Welsch 2008; Neumeier & Santos 2018; Spigel 2013; Zucchella & Previtali 2019); according to prior research, legitimacy has relevance in the case of sustainable entrepreneurial ecosystems (Cohen 2006; Neumeier & Santos 2018; Volkmann et al. 2021).

The results of this research suggest that differences in cultural, social and material attributes have different implications for legitimacy. This is in line with previous research which has emphasized that certain cultures (Alvedalen & Boschma 2017; Aoyama 2009; Florida 2002; Mack & Meyer 2016; Saxenian 1994; Spigel 2017), and social contexts (Alvedalen & Boschma 2017; Brown & Mason 2017; Roundy 2017; Spigel 2016b; Spigel 2017; Spigel & Harrison 2018) are more open towards new ideas and innovations. The ecosystem in Tampere is a good illustration of this. Hiedanranta had a strong cultural emphasis on change and social orientation towards establishing new collaborations. Inclusive interaction helped actors to establish new ties and test innovations together; hence, the other companies and regional actors adopted the solutions of the companies. This adoption was related to developing the area and combining different innovations (e.g., a pipe to deliver excess CO<sub>2</sub> from one company to another). The city acted as an early adopter of these solutions. This adoption suggests increased acceptance of new solutions, i.e., social interaction created the conditions for legitimacy.

New companies had limited legitimacy in Lahti, and thus they had to spend more effort in convincing the other actors that their solution works. While the ecosystem in Tampere seemed to have more inclusive interactions, involving civil society, citizens and even the natural environment, Lahti had more limited interaction between new companies and some other actors. Based on prior research, lack of interaction hinders the emergence and evolution of shared expectations (Barrie et al. 2019; Berger & Luckmann 1966; Meyer et al. 2019; Thornton et al. 2012; Roundy et al. 2018), and creation and recognition of new opportunities (DiVito & Ingen-Housz 2021). In Lahti, the lack of interaction potentially hindered the adoption of new solutions in city planning. Both of the interviewed new companies had limited legitimacy and talked about the need to convince other actors. With limited interaction, shared expectations around the need for their solution may not emerge. Limited interaction may also not convince the other actors to adopt the new solutions.

Another factor in the Lahti ecosystem is the path-dependent city structure. In line with previous research (Geels 2002; Giurca & Späth 2017; Meyer 2017; Skar et al. 2020), the structures of cities and infrastructures create path dependencies which could obstruct change and adoption of alternative approaches. In this context, the results imply two different issues. Firstly, dispersed city structure may make it difficult for companies to locate close to each other, even when deemed necessary. Secondly, limited change in city structures maintains the infrastructure in its current form, although the adoption of radical bioeconomy innovations requires changes in infrastructures and city structures (Herrera-Gomez et al. 2017; Skar et al. 2020; Wesseler & von Braun 2017). Thus, in path-dependent infrastructures, legitimacy for new bioeconomy innovations is limited. By contrast, Hiedanranta, Tampere was a place with limited prevailing city structures. This area was planned to become a new sustainable urban area. Hiedanranta was more inclusive since the ecosystem interacted with the natural environment of the area. For example, the actors in the area talked about using natural resources such as snow and rainwater. The development was closely connected to solving the environmental challenges in the area, including zero fiber remnants and spoiled land areas. Due to the need to fix environmental problems in the area, new solutions were deemed necessary, thus creating the conditions for legitimacy of new solutions in the area.

In addition, the involvement of a strong prevailing institutional actor could be associated with increased legitimacy of new companies. In Tampere, strong involvement of the city provided increased visibility and increased legitimacy for new companies. From the perspective of previous literature, Hiedanranta could be characterized as a 'niche' space for experimentation which offers initial protection for emerging radical technologies (Barrie et al. 2019; Bosman & Rotmans 2016; Farla et al. 2012; Geels 2002; Kemp et al. 1998; Konietzko et al. 2020; Kruger & Steyn 2020; Leydesdorff 2000; Loorbach 2007; Quitzao et al. 2012; Schot & Geels 2008). Hiedanranta also acted as a showcase which had many visitors and visibility in the media; this visibility could also contribute to increased legitimacy of the activities in the area. In the case of Lahti, some of the strong institutional actors (e.g., the City of Lahti) had limited interactions with new companies, and this caused bureaucratic impairments which limited opportunities for deeper collaboration and creation of shared expectations. Thus, the new companies in Lahti had more limited institutional support.

Therefore, different regional contexts have different implications for legitimacy (Kuratko et al. 2017), and these differences are related to differences in the attributes of an ecosystem, i.e., change ecosystems provide more legitimacy to new companies and new innovations than sustaining

ecosystems. The results also suggest that it is easier to create a change ecosystem in a new-build city structure where the lack of existing infrastructure allows cities to test and implement more radical innovations than in sustaining ecosystems. Although change ecosystems create conditions for legitimacy towards new companies, limited legitimacy outside the given ecosystem may hinder the acceptance of new innovations.

Legitimacy is also crucial for the acceptance of new social arrangements (Cajaiba-Santana 2014; Colombelli et al. 2019; Harrisson & Laberge 2002), which are required to develop new technologies (Freeman 1995; van der Have & Rubalcaba 2016). Entrepreneurial ecosystems are an example of such an arrangement. The results showed that different regions had differences in the acceptance of this social arrangement. The ecosystem was more accepted in Tampere, while the acceptance remained limited in Lahti. In areas where an ecosystem has limited acceptance, the social arrangement may not be in line with the expectations and needs of the regional actors (Harrisson & Laberge 2002).

## **5.4 Implications**

### **5.4.1 Theoretical contribution**

The aim of this thesis was to create new scientific knowledge about the emergence of bioeconomy entrepreneurial ecosystems and the differences between regions. This research contributes by offering a comparative perspective in entrepreneurial ecosystem research (Alvedalen & Boschma 2017; Roundy 2017; Roundy & Bayer 2019; Theodoraki et al. 2018). According to research literature, sampling cases that are opposites to one another enables observations of contrasting patterns which helps to recognize central logic underlying the focal phenomenon (Eisenhardt & Graebner 2007). The comparative perspective taken in this research contributes to this literature in three different ways.

Firstly, the findings of this research challenge prior evolutionary models for entrepreneurial ecosystems. Based on the prior models, entrepreneurial ecosystems emerge with unsupportive cultures and limited ties between the actors (Mack & Meyer 2016; Spigel & Harrison 2018; Thompson et al. 2018). The prior models neglect alternative evolutionary paths for entrepreneurial ecosystems. The investigation of ecosystems showed that an entrepreneurial ecosystem in Tampere was emerging with new social ties and supportive culture, whereas Lahti ecosystem was emerging in the context of strong prevailing networks among local actors.

Secondly, this research proposes two contrasting development paths for entrepreneurial ecosystem emergence and evolution: sustaining ecosystems and change ecosystems. The two paths can be considered as ideal types, and hence ecosystems can be based on intermediate forms of these paths. Through the creation of this framework, this research provides new avenues for theorizing the emergence of entrepreneurial ecosystems, which have been lacking in literature (Alvedalen & Boschma 2017; Mack & Meyer 2016; Roundy 2017; Roundy et al. 2018; Spiegel 2017).

Change ecosystems can emerge with change-oriented cultures, new social relations and changing material attributes such as city structures. Such evolutionary path for entrepreneurial ecosystem emergence has not been suggested in prior research. The results imply that these ecosystems could emerge in completely new areas which do not suffer from path dependencies, thus highlighting the importance of material attributes for ecosystem emergence. This evolutionary path also seems to promote increased legitimacy towards new companies and their innovations.

Sustaining ecosystems emerge from path-dependent arrangements and strive for long-term development. This finding contributes to lacking entrepreneurial ecosystem research in small cities (Roundy 2017), and suggests that these cities may have to rely on prevailing cultural, social and material arrangements for ecosystem emergence due to small number of potential new entrepreneurs. However, the results suggest that city size as such may not determine whether the ecosystem develops as a sustaining ecosystem or a change ecosystem.

Thirdly, previous research has had limited emphasis on the implications of a strong institutional actor from the perspectives of ecosystem emergence and legitimacy. The literature has had different stances whether entrepreneurial ecosystems emerge naturally through bottom-up evolution similar to natural ecosystems or are created through a top-down process (Colombelli et al. 2019; Colombo et al. 2019; Du et al. 2018; Isenberg 2010; Isenberg 2016; Rampersad 2016; Spiegel 2016a; Stam 2015). Although some authors have criticized the top-down governance approach (Foray 2016), relying on bottom-up may lead to lack of institutional support (e.g., public sector's influence on land use and other physical resources, temporary flexibility of existing rules) which may have negative implications for bioeconomy entrepreneurial ecosystems. This contrasts with the belief that entrepreneurs are the best leaders of ecosystems (Spiegel & Harrison 2018; Stam 2015), and suggests that mere ecosystem facilitation may not be enough (Colombo et al. 2019; Isenberg 2016; Spiegel & Harrison 2018).

Previous research has called for more social science research on bioeconomy (Bryden et al. 2017; Bugge et al. 2016; Ingrao et al. 2018; Kleinschmit et al. 2014; Priefer et al. 2017; Sanz-Hernández et al. 2019; Toppinen et al. 2020). This study investigated regional differences (Sanz-Hernández et al. 2019), and showed that contextual attributes including culture, social relations and material structures have implications for the emergence and the development pathways of bioeconomy. Thus, bioeconomy was connected to its wider social dimensions (Bugge et al. 2016; Kleinschmit et al. 2014; Priefer et al. 2017; Sanz-Hernández et al. 2019; Urmetzer et al. 2018). Different attributes were also found to have different implications for the legitimacy (i.e., acceptance) of bioeconomy solutions. Breakthrough of innovations is thus context-dependent (Geels 2002), and social science was able to provide new ideas for the theory by comparing innovative entrepreneurship in different contexts (Swedberg 2000).

#### **5.4.2 Implications for practice**

The practical aim of this study was to provide practical recommendations to support the creation of bioeconomy entrepreneurial ecosystems and new bioeconomy companies in the regions. Governance and policy decisions are required to support regional development and bioeconomy (Acs et al. 2017; Aguilar et al. 2018b; Colombo et al. 2019; Kleinschmit et al. 2014; Kolehmainen et al. 2016), and policy approaches need to be tailored to local conditions and needs (Brown & Mason 2017). As Isenberg (2010) has noted, local conditions should be a starting point when an entrepreneurial ecosystem is being shaped, and this study contributes to knowledge regarding these local conditions.

Since some factors within entrepreneurial ecosystem cannot be replicated easily (Vedula & Kim 2019), it is important to recognize which ecosystem type is suitable for the region. This research proposed two contrasting ecosystem types: change ecosystems and sustaining ecosystems. Practical recommendations are provided in Table 17. Different types of ecosystem can be considered governance models that account for heterogeneity among entrepreneurial ecosystems (Acs et al. 2017). In certain regions, relying on prevailing arrangements may be more applicable whereas other regions could have more potential to rely on change. These recommendations can support the decisions for urban planning, governance, regional strategy and start-up services.

The recommendations should be evaluated critically and context-specifically since the entrepreneurial ecosystem in each region is a unique outcome of the region's historical and economic development (Spigel 2017). It is also worth to note that the investigated entrepreneurial ecosystems

were in the beginning of their lifecycle and had so far delivered limited success in bioeconomy entrepreneurship. Drawing conclusions of the degree of success of the ecosystem types and their success in later ecosystem lifecycle phases is not possible based on this research.

**Table 17. Practical recommendations based on the results and discussion**

<b>Suggestions for change ecosystems</b>	<ul style="list-style-type: none"> <li>• Applicable when an area changes completely, i.e., does not suffer from path-dependent arrangements</li> <li>• Recognize the implications of support from an institutional actor and lack thereof for ecosystem emergence and legitimacy</li> </ul>
<b>Suggestions for sustaining ecosystems</b>	<ul style="list-style-type: none"> <li>• Applicable when an area has a limited number of new entrepreneurs</li> <li>• Focus on long-term development and maintain prevailing arrangements</li> <li>• Connect new companies to prevailing networks and infrastructures</li> <li>• Find ways to increase experimentation and openness among actors</li> </ul>

The change ecosystem is based on the creation of completely new changing areas for bioeconomy companies. The advantage of a change ecosystem is the increased collaboration between new companies. This could support, for instance, attempts to build a shared international network, sharing material flows and learning from each other. This ecosystem type represents an inclusive and interactive innovation process which may help the ecosystem to progress towards deeper collaborative structure. This ecosystem type could potentially fulfill the need for inclusiveness in the development of bioeconomy (Autant-Bernard et al. 2013; Urmetzer et al. 2018; Van Lancker et al. 2016; Wreford et al. 2019). In this ecosystem type, the roles of local and regional public sector actors shift towards change agents which construct necessary spaces for change and guide other actors to new directions (Sotarauta & Suvinen 2019).

In the sustaining ecosystem type, new companies may lack certain social ties and interactions. To develop this ecosystem further, in line with recommendations in prior literature (Bosman & Rotmans 2016), new companies should be integrated into established networks and infrastructures. This ecosystem type implies more difficulties for new disruptive technologies, and thus actors should search for ways to increase experimentation and openness among the actors in the region. Although limited human capital in small cities has been noted in prior research, small cities can also act as nurturing environments (Roundy 2017). The nurturing nature of the entrepreneurial ecosystem (e.g., less intense competition, cheaper premises) could be communicated to potential entrepreneurs within and outside the region (Mack & Meyer 2016).

Moreover, this research highlights the importance of legitimacy in successful shift to bioeconomy. In order to help new companies gain more legitimacy and transform society towards sustainability, the

results imply that there may be a need for an involvement of a strong prevailing institutional actor in the regional ecosystem. These institutional actors could be organizations with a long-time presence in the specific regions. Although the risk averseness of cities was noted, consistently with previous research (Sarma & Sunny 2017), the city could have an important role in the emerging ecosystems of the bioeconomy. When the role of the city is limited, a good question is whether the city could have a more active role in facilitation and implementation of disruptive bioeconomy innovations, and how to organize potential conflicts between the city's core functions and the promotion of innovation. For example, one option could be giving the units broader mandates and possibly support from the state.

This thesis contributes by providing new insights for the creation of context-specific strategies and policies to enable ecosystems and platforms for startups in bioeconomy. Entrepreneurial ecosystems are dependent on human action and require normative planning. The real world and research are intertwined; knowledge shapes (and is shaped by) ecological and societal systems (Umpleby 1997; Urmetzer et al. 2018); the discussions of entrepreneurial ecosystem in research and real life have implications for our social reality: what kind of social organizations and identities there can and should be. As systemic concepts, 'entrepreneurial ecosystem' and 'bioeconomy' could potentially support the societal transformation from fossil-based economy to sustainable bioeconomy (Aguilar et al. 2018a; Urmetzer et al. 2018). The creation of the bioeconomy entrepreneurial ecosystems can enable new ways of collaboration (Chesbrough 2006; Chesbrough 2003), which are necessary for sustainable and healthy urban development (IACGB 2020).

## **5.5 Limitations**

Beliefs about the investigated phenomenon influence how research is done, how research questions are formulated, and how empirical data is collected and analyzed (Becker 1998, 18–22; Gartner 1990). This research was based on social constructionism which directed attention to social contexts of the case regions. Since the interest of this study was in social contexts, individual characteristics of entrepreneurs and other related actors and their influences on the results were excluded from the scope of this research (Hakala et al. 2020; Lindgren & Packendorff 2009).

This study had limited attention towards the heterogeneous nature of individual entrepreneurs (Brown & Mason 2014; Harrison & Leitch 2010; Schillo 2018; Ucbasaran et al. 2001). Startups are not always growth companies, many of them do not make significant contributions to regional employment and



economy, and therefore the importance of startups as an output of an entrepreneurial ecosystem could be questioned (Isenberg 2016).

The investigation of the social context in this study did not extend to an in-depth analysis of the actor roles and social relations. The study did not make clear distinctions between prominent roles of single actors (organizations or individuals) and collective action in larger networks (Farla et al. 2012). Complexity of social relations was not investigated in detail. Differences in interpersonal and interorganizational relationships were not examined, even though social collectives are not unitary actors (Phelps et al. 2012). Investigation of these matters could provide more in-depth knowledge of the roles of different actors and relations between the actors in emerging ecosystems. Network analysis could be applied to study networks more closely and more intersubjectively (Powell 1998).

Some authors have held critical stances towards bioeconomy (Birch 2006; Pfau et al. 2014; Vivien et al. 2019), and entrepreneurship (Lundmark & Westelius 2019). Although social science should not specifically argue for or against entrepreneurship (Swedberg 2000), this study paid limited attention to negative implications of the emergence of bioeconomy entrepreneurial ecosystems. For example, entrepreneurship may increase the cost of living in the area, drive other types of employment out from the area, or cause regional inequality (Spigel & Harrison 2018). Entrepreneurial economy could also cause societal pressure and widen the divide between the more competent entrepreneurs and the weak entrepreneurs (Devi & Thangamuthu 2006). The region's capability to access global value chains determines the living standards of the leading regions while the others are falling behind (Hill & Mudambi 2010). Successful regions form in the places where locational advantages exist, and it is difficult to create entirely new successful ones (Isenberg 2010).

The evaluation of positive and negative impacts of the bioeconomy remains scant in research (Sanz-Hernández et al. 2019). While scientific bioeconomy debate has focused considerably on sustainability, bioeconomy may not always be self-evidently sustainable (Pfau et al. 2014). At present, the developments in the bioeconomy remain in their infancy and their contribution to economic change is unclear (Wesseler & von Braun 2017). Besides, the bioeconomy is only one part of the transformation to sustainability (Urmetzer et al. 2018), and it may not be sufficient.

One limitation for this research was the lack of theory of the ecosystem and inconsistency of the entrepreneurial ecosystem literature. Integrative literature review was appropriate since the research topic was new (Snyder 2019), but inclusion and exclusion of literature was based on a subjective

judgement. The scope of the literature was mostly limited to ecosystem attributes (cultural, social and material). Other perspectives (e.g., availability of financial resources) were mostly excluded from the scope of the literature review. Integrative reviews have faced critique for their lack of rigor and potential for bias (Whittemore & Knafl 2005). Although only certain topics were selected for the literature review, empirical data supported the decisions to include these topics.

The market for concepts and their applications is characterized by path dependencies and trends in which different concepts have their own lifecycles (Audretsch et al. 2019). One could question whether the entrepreneurial ecosystem concept is at all necessary; the application of the metaphor of 'ecosystem' may be characterized by a trend which may burn up later, and the use of this metaphor could conceal some truths (ibid). Besides, there has been disagreement whether ecosystem concept can be used to describe business environment (e.g., Oh et al. 2016). Alternative concepts such as clusters, platforms, and knowledge networks could reveal different truths.

Primary data collection was complemented with secondary data collection which increased the validity and reliability of the research data. Bias in empirical data was limited by involving highly knowledgeable informants who represented different organizations and could view the phenomena from diverse perspectives (Eisenhardt & Graebner 2007). If only the companies had been interviewed, many insights related to regional development would have been left out. Although no one in Tampere and Lahti declined the invitation to an interview, some stakeholders were not asked to participate in interviews. These include outside observers, citizens, activists, customers and employees of the companies, and potential entrepreneurs who have not yet established a company. Additionally, the selection tended to focus on those in higher positions within organizations which leaves the perspectives of other members out from this study (Becker 1998, 127–129).

The interviews may suffer from an actor-observer bias. Prior research shows that entrepreneurs tend to rate their own abilities high and rate the facilitation low, while non-entrepreneurs are more prone to rate facilitation more positively within an entrepreneurial ecosystem (Manimala et al. 2019). Entrepreneurs could associate their entrepreneurial ego with the business, and as a result, they could externalize the causes of business problems when reporting to third parties (Gibb 2002). This may concern, for example, entrepreneurs' talk about limited legitimacy. It should also be noted that only two companies were interviewed from the Lahti region and they had a significant impact on the results.

The researcher influenced the discussions during the interviews. Interviews lasted for a limited time. In addition, the accuracy of remembering things, alertness and ability to respond affect the interviews. The results do not comment on what was not discussed in the interviews. Some topics may have been neglected. Anonymity of the informants, however, may have helped to include critical voices.

One specific limitation was the timing of the interviews. From the perspective of entrepreneurial ecosystem emergence, the timing may have been too early because the entrepreneurial ecosystems had delivered limited results at the time interviews were conducted. Despite this, the timing was suitable for investigating some features of ecosystem emergence.

Transcriptions were conducted for the whole interview data, carried out in appropriate detail, and each data item was given equal attention during coding (Braun & Clarke 2006). However, all words could not be transcribed due to background noise. The effect of this on the results can be expected to be insignificant. Most content was transcribed successfully, and themes reoccurred within and across interviews. The themes were based on a large number of data extracts, several examples of which were included in the results chapter to support the claims. Having multiple examples supported the analytic claims by providing sufficient evidence of an occurring pattern (ibid).

Boyatzis (1998, 12–15) recognizes challenges in thematic analysis. Projection occurs when the values and conceptualizations of a researcher are projected to the data and consequently the researcher sees what he or she wants to see and neglects other parts of the data. This was avoided by developing explicit codes, and carrying out the analyses in a consistent (i.e., reliable) and systematic way. Nevertheless, the richness of the information may be reduced when consistency is enforced. Even though one person encoded the whole data, the themes were developed while staying close to the raw data, and results were confirmed by several key informants after the analyses were done. Yet, thematic analysis cannot make up for the shortcomings of the interview data. (ibid.)

Based on suggestions by Gibbert et al. (2008) and Yin (2018), external validity was enhanced by formulating a clear research framework and matching patterns in research literature and empirical data, whereas construct validity was enhanced by continuous refining of the concepts during the research process. Iterative process of deduction and induction ensured the match between analytic claims and theory (Braun & Clarke 2006). Comparison with consistent literature sharpened the claims (Eisenhardt 1989). Reliability was improved by documenting the research procedures in detail and transparent manner (Gibbert et al. 2008; Yin 2018). During this study, the analysis shifted towards

providing a more detailed account of themes that relate to ecosystem attributes. For this reason, the analysis does not provide a rich thematic description of the entire data set (Braun & Clarke 2006). For example, more specific actor roles and various shared and conflicting goals of the actors were excluded from the scope of this study.

The results represent the interpretations of the researcher. Another researcher could make different interpretations. The researcher had a limited understanding of the phenomenon because he has not been involved with bioeconomy before this research. Thus, he does not have clear predetermined opinions about the topic. Data was analyzed as such, and the results do not comment on how well the research data represents reality. In constructionist thematic analysis, people's talk of experience is not a transparent window to their reality (ibid).

Lastly, it is unclear how well this study succeeded in applying social constructionism. Applying social constructionist ideas for research is not straightforward. Many researchers utilize qualitative methods and attach social constructionist label to define their work even when their research is concerned with subjective perceptions or experiences of their respondents, which neglect the ways in which meanings are shared and negotiated in social processes which construct reality. (Fletcher 2006.) Observation of interactions might have provided better access to the negotiation of meanings than interviews.

## **5.6 Ideas for future research**

Change ecosystems and sustaining ecosystems were based on two cases. They are preliminary categorizations that can be elaborated in further study and broader empirical data, i.e., the proposed framework in Figure 4 stimulates further research on the topic by providing a new perspective which highlights path dependence and change in entrepreneurial ecosystems. There existed no prior research on bioeconomy entrepreneurial ecosystems, and for this reason theory building addressed research questions better than theory testing. Cases were sampled for theoretical reasons, i.e., elaboration of the emerging theory (Eisenhardt & Graebner 2007). Developing theory requires more studies which develop and test the proposed framework further (Eisenhardt 1989). Validating the proposed preliminary categorizations in other contexts could provide evidence for their cross-cultural validity (Davison & Martinsons 2016).

Thereby, further studies could test the proposed theory of sustaining ecosystems and change ecosystems, and whether similar patterns exist in other places, or whether there could be completely

different patterns which do not follow the proposed dichotomy. Future research could investigate the topic further by adding more regions with different sizes and local conditions. These studies could be based on comparative case study design. In larger cities, high number of actors may lead to more complexity, fragmentation and plurality for entrepreneurial ecosystems (Brown & Mason 2017). Large cities might suffer from path dependencies, limiting possibilities to establish change ecosystems. During this study, interviews were also carried out in the Helsinki region, but they were excluded from the scope of this thesis. The data provides opportunities for future studies.

Future research could also investigate entrepreneurial universities from the perspective of path dependence and change in ecosystem attributes. Prior research implies that entrepreneurial universities act as drivers of entrepreneurship and innovation to meet regional societal and economic needs (Guerrero et al. 2016). Although universities can act as hubs in entrepreneurial ecosystems (Giurca & Metz 2018; Malecki 2018), and creation of entrepreneurial ecosystems in university contexts has been a central topic in entrepreneurial ecosystem research (Boh et al. 2016; Guerrero et al. 2016; Hallam et al. 2017; Miller & Acs 2017; Nicholls-Nixon et al. 2020; Sadek et al. 2015; Theodoraki et al. 2018), it is not known whether these locations are ideal places for change ecosystems due to path dependencies in material attributes.

Therefore, future research is needed to investigate larger cities and university entrepreneurial ecosystems and determine to which extend their ecosystem type is based on sustaining ecosystem and change ecosystem. Such research could explore these ecosystems in depth to find out whether these ecosystems can be categorized as a new ecosystem type with distinct advantages when compared with the two ecosystem types suggested in this study. A central question could be whether there exist other ideal types of bioeconomy entrepreneurial ecosystems than the found two. For instance, whether an ecosystem with prevailing social networks and change culture could be possible. Based on new findings, new typologies could be made. In addition, potential benefits of path dependence in entrepreneurial ecosystems could be investigated more. Lock-in has been considered a problem for entrepreneurial ecosystem development in prior research (Mack & Meyer 2016). Research could find out whether lock-in truly is a problem, and to what extent a sustaining ecosystem is capable of being successful as an entrepreneurial ecosystem type.

In addition to comparative case studies within a specific country, future studies are required to investigate bioeconomy entrepreneurial ecosystems in different countries which have different contextual and historical characteristics. Finland has specific characteristics as a research context.

These include tendency for business-as-usual (Bosman & Rotmans 2016), and less importance for regional level than the national dimension (Castonguay 2016).

Results of qualitative case studies of sustainable entrepreneurial ecosystems can also act as a foundation for quantitative research around the topic (Volkman et al. 2021). One option for theory testing could be statistical analysis which covers many different regions. In this study, weights were not given to different attributes. Deeper understanding of ecosystem attributes and their relevance requires future studies. In addition to bioeconomy, emerging theory could be tested in other emerging and prevailing technological sectors with different levels of material and resource intensity (e.g., ICT, health). More studies are needed to investigate other sectors and the possible impact of sector-specific attributes for entrepreneurial ecosystem emergence and legitimacy. Based on previous literature, different sectors may have different spatial organizations, i.e., they vary in their tendency to form clusters (Kenney & Patton 2005).

The results were only related to the emergence phase of bioeconomy entrepreneurial ecosystems in Lahti and Tampere regions. For this reason, the results provide only partial knowledge of entrepreneurial ecosystem evolution. When an entrepreneurial ecosystem evolves, the importance of cultural, social and material attributes changes (Mack & Meyer 2016; Neck et al. 2004). In the emerging phase of an ecosystem lifecycle, conventions are weakly organized (Thompson et al. 2018). This could imply that the attributes of the ecosystems had possibly evolved only to a limited extent, and the results obtained during the emergence phase may not show their true nature. Long-term research in Lahti and Tampere could validate the preliminary categorizations (i.e., change ecosystems and sustaining ecosystems) in later ecosystem lifecycle phases. Hence, future research is needed to examine these or other entrepreneurial ecosystems in different lifecycle phases or throughout the evolution of these ecosystems.

Moreover, the results showed that there could be substantially different evolutionary paths for entrepreneurial ecosystems. Future research could make typologies of these evolutionary paths and their determinants. The question of a critical mass of new entrepreneurs and its association with evolutionary paths in ecosystems could also be investigated in future research.

Much of entrepreneurial ecosystem research is static rather than longitudinal (Alvedalen & Boschma 2017; Spigel & Harrison 2018), while case-study snapshots are partial in unknown ways when compared with longitudinal studies (Malecki 2018). In the same way, this research only provided

snapshots of emerging bioeconomy entrepreneurial ecosystems. When timespan of data collection is limited in relation to the actual process that is being studied, researcher may not be capable to develop sufficient understanding of the whole process (Lindgren & Packendorff 2009). This is a matter of concern because entrepreneurial ecosystem emergence could be expected to take several years or even decades. Longitudinal studies could develop more precise and detailed evolutionary models.

In addition, future studies are necessary to investigate one specific region in more detail. Multiple case studies retain only features that are replicated across cases, and this reduces complexity when compared to richly observed single case studies (Eisenhardt & Graebner 2007). Another option is to focus on a single sector within bioeconomy (e.g., bioenergy), and its specific features in a more detailed manner. These in-depth studies could include diverse research data (e.g., ethnography, secondary data).

The issue of legitimacy provides several avenues for further research. There is more need to investigate the interrelation between change and legitimacy within entrepreneurial ecosystems. While this research recognized limited legitimacy outside a given ecosystem, the implications of this were not investigated in detail. More research is also needed to investigate the legitimacy of social arrangements within bioeconomy and entrepreneurial ecosystems, and how the legitimacy of these social arrangements can lead to emergence of shared goals (Autio et al. 2018). Such research could investigate how different narratives influence the actors within an entrepreneurial ecosystem (Roundy 2016; Roundy & Bayer 2019), and help actors to act accordingly and create a community with shared ambitions and goals (Loorbach 2007; O'Shea et al. 2019; Roundy et al. 2018; Thompson et al. 2018).

Different analysis methods also need to be considered. For example, thematic analysis is not a good method for analyzing variation and contradiction in research data, whereas narrative and other biographical approaches are capable to investigate continuity and contradiction within individual accounts, and these consistencies and contradictions could reveal new insights (Braun & Clarke 2006). The need for narrative accounts of entrepreneurial ecosystems has been suggested in previous research (Roundy 2016).

Investigating how different institutions influence the performance and structure of entrepreneurial ecosystems remains a challenge (Alvedalen & Boschma 2017). For example, in order to understand interdependence between regulation and innovation in bioeconomy (Wesseler & von Braun 2017),

future research is required to examine how regulation hinders new innovations in bioeconomy entrepreneurial ecosystems.

One option for future studies is to delve deeper into specific attributes within entrepreneurial ecosystems. Several questions can be formulated in this context. There remains more work to do in recognizing different cultures that are supportive towards entrepreneurship and their different implications. For example, there has been limited inquiry into family entrepreneurship culture within entrepreneurial ecosystems and its implications on evolution in these ecosystems.

More in-depth investigation of social relations and their complexity in entrepreneurial ecosystems is also necessary (Alvedalen & Boschma 2017). For example, inclusiveness of interaction could be researched by incorporating the Helix model with entrepreneurial ecosystem literature (Carayannis et al. 2017; Mungila Hillemane 2017). Research could also focus on non-local linkages (Ahn et al. 2010; Alvedalen & Boschma 2017; Autant-Bernard et al. 2013; De Besi & McCormick 2015), and network brokers (Barrie et al. 2019; Pittz et al. 2019; Urmetzer et al. 2018; Van Lancker et al. 2016), which were mostly neglected in this study despite their stated importance in bioeconomy.

Finally, further studies are needed to examine the role of material attributes in entrepreneurial ecosystems from the perspectives of change and path dependence. For example, many developing countries lack infrastructure, and this has been considered as a limitation for entrepreneurship in these areas (Akpor-Robaro 2012), although, from the perspective of capability for change, lack of infrastructure could be beneficial for certain forms of entrepreneurship.

As an alternative to focusing on contextual characteristics, role-based perspectives could be adopted in further entrepreneurial ecosystem research (Rampersad 2016). For example, research is needed to investigate the roles of strong institutional actors in ecosystem evolution and legitimacy, or the roles and ambitions of entrepreneurs in entrepreneurial ecosystems. The importance of these for regional development could be evaluated.

Additionally, future studies could also involve other actors who were not included in this research (e.g., potential entrepreneurs who have not established a company, customers, and activists). For instance, bioeconomy research should consider changes in consumer behavior to understand the acceptance of new technologies better (Priefer et al. 2017; Sanz-Hernández et al. 2019).



Further research could use other concepts and theories, such as clusters, platforms, and knowledge networks which can potentially reveal different truths. Alternatively, this topic could be approached through value chain and value network theory. From technology studies, actor-network-theory (ANT) could be used for this topic. Convergence of bioeconomy and other megatrends such as digitalization could also be evaluated (Aguilar et al. 2018b; Autio et al. 2018; Elia et al. 2020).

This research was based on a few assumptions that could be questioned. Further research is necessary to verify whether and how bioeconomy and entrepreneurial ecosystem can be connected as systemic concepts. Another issue for further inquiry is the presumption that interactive emergence of an entrepreneurial ecosystem would be associated with path dependencies and changes within a field.

Prior literature has questioned solving societal problems through innovating, increasing production or increasing wealth (Baudrillard 1998). A good question is in what direction do innovations take the world. Could innovations solve environmental problems related to overconsumption and contribute to sustainable consumption and local economy, or do they instead increase harmful consumption? Ethical questions surrounding bioeconomy and entrepreneurship should be discussed more. For instance, whether entrepreneurship in bioeconomy would benefit the whole society. Negative implications of bioeconomy, entrepreneurship, and entrepreneurial ecosystems could be explored.

In the end, social sciences could have a greater role in the current debates concerning entrepreneurial ecosystems around the world. As some authors have argued, the traditional business school model should not be the only vehicle for the teaching, research and development of entrepreneurship (Gibb 2002). New economic policies are needed to promote positive impacts and reduce negative impacts of entrepreneurial economy around the world (Akpór-Robaro 2012). Sociology could support integration of different levels of analysis and provide better explanations of how, where and why different policies are implemented and what societal impacts they have. Nevertheless, there is also more need for transdisciplinary research in bioeconomy, i.e., research which is based on integration between different disciplines (Pfau et al. 2014).

## 6 Conclusions

This research focused on bioeconomy entrepreneurial ecosystems in two Finnish regions: Lahti and Tampere. Developing these ecosystems is one way to address dramatic and unprecedented challenges the world is currently witnessing. These ecosystems could potentially make urban environments become circular bioeconomy hubs that allow experimentation and development of new solutions.

Most of the ecosystem literature has focused on successful entrepreneurial ecosystems in large urban areas. Knowledge to develop best practices and policies to develop bioeconomy entrepreneurial ecosystems in small cities has been lacking. Especially knowledge of entrepreneurial ecosystem emergence and legitimacy has been missing. This research developed new knowledge for this need and provides new social implications which have been neglected in bioeconomy.

The main argument of this research is the relevance of path dependence and change in bioeconomy entrepreneurial ecosystems. A framework of two contrasting ecosystem types was proposed: sustaining ecosystems and change ecosystems. Change ecosystems have positive cultural orientation towards change, create new relations and change material structures. In contrast, sustaining ecosystems rely on traditional cultures, prevailing networks and maintain material structures. Thus, this research implies that bioeconomy entrepreneurial ecosystems could emerge and evolve either from path-dependent arrangements (e.g., Lahti), or from change processes (e.g., Tampere).

The results challenge previous literature on entrepreneurial ecosystems. Evolutionary models have paid limited attention to alternative evolutionary paths for entrepreneurial ecosystem emergence and evolution. Bottom-up evolution may not be an ideal way to develop entrepreneurial ecosystems, especially when material attributes are hindering development. Entrepreneurs may not be able to develop radical innovations without the help of strong institutional actors.

To conclude, public sector and research institutions should take more prominent roles in the development of bioeconomy entrepreneurial ecosystems, no matter whether these are change ecosystems or sustaining ecosystems, and attempt to establish more inclusive collaborative process in regions around the world. Without such measures, bioeconomy may remain fragmented and might fail to transform our societies in the desired direction. Many questions remain unanswered, and more research is needed on the entrepreneurial ecosystems of the bioeconomy.

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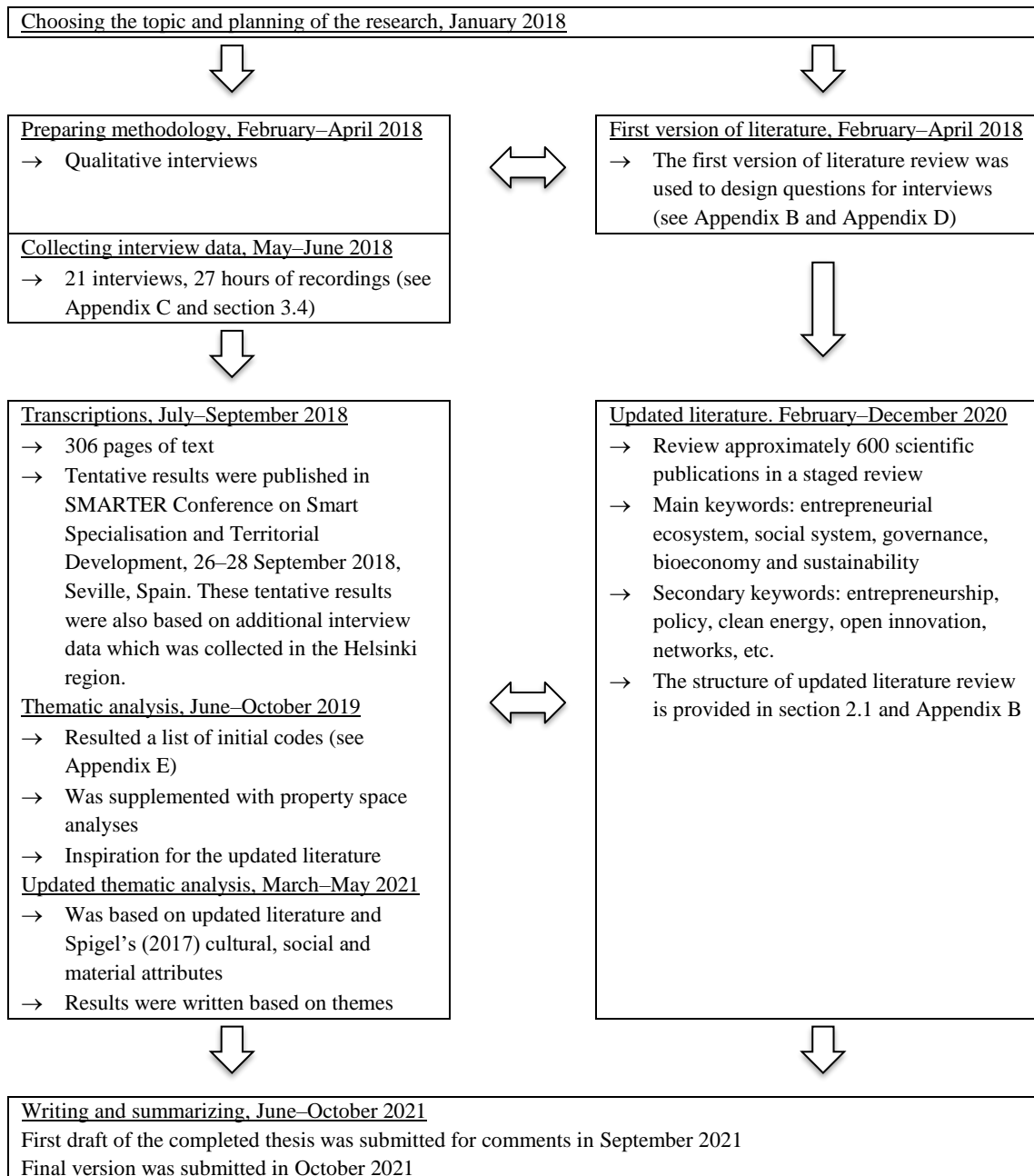
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## Appendix A: Research process

Research process and schedule are provided in Figure 5. This research was based on iterative process of theory elaboration which was achieved in inductive and deductive cycling between literature and interview data (see also Figure 2 in section 3.2).



**Figure 5. Phases of research process**

## Appendix B: Structure of first draft literature review

Before integrative literature review was written, there was a tentative version of literature review (see Table 18 and Table 19). Tentative literature review was mainly used for generating supplementary interview questions (Appendix D). Some thematic topics of the first draft of the literature review were included in the sections of the updated literature review. The updated literature review also contains much added content which was relevant based on the tentative analyses of interview data.

**Table 18. Structure of the first draft of the integrative literature review**

Section in first draft of literature review	Thematic topics
<b>Structure of entrepreneurial ecosystem</b>	Actors Material resources Institutions Conventions
<b>Action and dynamics in entrepreneurial ecosystem</b>	Goals Governance Interaction Learning and knowledge sharing New organization forms
<b>Context of entrepreneurial ecosystem</b>	Culture Digitalization Local context

**Table 19. Structure of the updated integrative literature review**

Section in updated literature review	Thematic topics from the first draft of literature
<b>Embeddedness of economic activity</b>	Institutions Conventions
<b>Regional ecosystem perspective</b>	Local context Governance
<b>Ecosystem attributes</b>	Culture Interaction Learning and knowledge sharing Material resources
<b>Ecosystem emergence and evolution</b>	New organization forms

## Appendix C: Details of interviews

Empirical data for this thesis consists of 21 interviews which were carried out in May–June 2018. During this study, interviews were also carried out in Helsinki region, but these were excluded from the scope of this research and are not included in Table 20.

**Table 20. Details of interviews**

	<b>Date</b>	<b>Interview</b>	<b>Location</b>	<b>Time</b>	<b>Duration</b>	<b>Partici pants</b>
R1	3.5.2018	University campus staff	Lahti region	10:00	1h 15min	1
C2	3.5.2018	Company, remediation of polluted soils	Lahti region	12:30	1h 20min	1
P3	7.5.2018	Regional council	Tampere region	10:00	1h 22min	1
P4	8.5.2018	Tampere city	Tampere region	12:30	56min	1
R5	8.5.2018	University, two professors	Tampere region	14:00	1h 12min	2
R6	8.5.2018	University, innovation services	Tampere region	16:00	29min	1
C7	11.5.2018	Company, bio-based fertilizers	Tampere region	8:00	56min	1
C8	11.5.2018	Company, food sector	Tampere region	9:00	1h 36min	1
C9	11.5.2018	Company, bioenergy	Tampere region	11:00	1h 23min	1
O10	11.5.2018	Regional environmental services organization	Tampere region	13:00	1h 41min	1
P11	14.5.2018	Regional development organization, startup team	Lahti region	11:00	1h 20min	1
P12	14.5.2018	Lahti city	Lahti region	14:00	1h 35min	2
P13	18.5.2018	Regional development organization, circular economy team	Lahti region	12:30	1h 16min	2
R14	18.5.2018	University campus professor	Lahti region	14:00	1h 26min	1
P15	23.5.2018	Regional development organization	Tampere region	9:00	1h 4min	2
P16	23.5.2018	Tampere city, water sector project	Tampere region	12:00	1h 12min	1
P17	1.6.2018	Waste management organization	Lahti region	10:00	1h 26min	1
P18	1.6.2018	Regional council	Lahti region	13:00	1h 26min	2
C19	1.6.2018	Company, energy from water	Lahti region	15:00	1h 33min	1
C20	4.6.2018	Company, water sector	Tampere region	10:00	1h 45min	1
P21	4.6.2018	Water supply organization	Tampere region	14:00	1h 11min	1
Total					27h 24min	26
C = company; P = public sector; R = research organization; O = other						

## Appendix D: Supplementary interview questions

Open interviews were supplemented by thematic interview questions (Table 21). The supplementary interview questions were based on a first draft version of the literature review (Appendix B), i.e., on deductive reasoning.

**Table 21. Supplementary interview questions**

topic	Finnish	English
	<b>HAASTATTELUKYSYMYKSET: YLLÄPITÄVÄT TAHOT</b>	<b>INTERVIEW QUESTIONS: FACILITATIVE ACTORS</b>
	Paljonko aikaa?	How much time?
	<b>TAUSTA</b>	<b>BACKGROUND</b>
	Voitteko kertoa organisaationne taustasta ja alueellisesta roolista/merkityksestä?	Could you talk about your organization's background and regional role/importance?
	Puhutteko yrittäjyyskosysteemeistä ja miten ymmärrätte käsitteen?	Do you talk about entrepreneurial ecosystems and how do you understand the concept?
Goals	Miten yrittäjyyttä tuetaan alueella? Miten tätä toimintaa organisoidaan? (Kuinka alueen yrittäjyyskosysteemi on syntynyt ja mitä tavoitteita alueella on)	How is entrepreneurship supported in the region? How is this activity organized? (How did the region's entrepreneurial ecosystem emerge and what are the goals of the region)
	<b>EKOSYSTEEMIN NYKYTILA</b>	<b>CURRENT STATE OF THE ECOSYSTEM</b>
Actors	Mitkä ovat tärkeimmät toimijat alueellisissa ekosysteemeissä?	What are the key actors in the regional ecosystem?
Resources	Mitä resursseja ekosysteemeissä on, mitä puuttuu, miten niillä tuetaan yritysten syntyä?	What resources are there in the ecosystem, what are missing, how do they support the creation of new companies?
Institutions, Conventions, Culture	Minkälaiset vakiintuneet toimintamallit/perinteet/kulttuuriset käytännöt ovat alueen vahvuus/heikkous, onko näissä ollut muutosta?	What established conventions/traditions/cultural practices are strengths/weaknesses in the region, have there been any changes in these?
	Miten ekosysteemi tuottaa uusia yrityksiä ja tukee alueelle syntyneitä yrityksiä? Esimerkkejä hiljattain perustetuista yrityksistä? Entä ekosysteemin ulkopuolella syntyneet?	How does the ecosystem create new companies and support businesses that have been created in the area? Examples of start-ups? What about those created outside the ecosystem?

Governance	Mikä on sidosryhmien rooli yritysten synnyssä? Miten ohjaavat toimintaa?	What is the role of stakeholders in the creation of companies? How do they govern activities?
Interaction	Miten yhteistyö eri toimijoiden välillä on toiminut?	How has cooperation between different actors worked?
Learning and knowledge sharing	Millaista oppimista ja tiedonjakoa tapahtuu?	What kind of learning and information sharing takes place?
New organizational forms	Millaisia organisaatiomuotoja tai alustoja yhteistyön kautta on syntynyt?	What kind of organizational forms or platforms have emerged through cooperation?
Digitalization	Miten hyödynnätte digitalisaatiota ja miten digitalisoituminen (trendi) vaikuttaa kokonaisuuteen?	How do you take advantage of digitalization and how does digitalization (trend) affect the whole?
	<b>KEHITTÄMISEN TARPEET</b>	<b>DEVELOPMENT NEEDS</b>
	Minkälaisia haasteita ja mahdollisuuksia ekosysteemin toimintaan liittyy?	What are the challenges and opportunities for functioning of the ecosystem?
	Millaisia odotuksia on tulevalle kehitykselle?	What are the expectations for future development?
<b>HAASTATTELUKYSYMYKSET: ALUEEN YRITYKSET</b>		<b>INTERVIEW QUESTIONS: REGIONAL COMPANIES</b>
	Paljonko aikaa?	How much time?
	<b>TAUSTA</b>	<b>BACKGROUND</b>
	Voitteko kertoa yrityksenne taustasta ja alueen merkityksestä yritykselle?	Could you talk about your company's background and the importance of the region to the company?
	Miten yrityksenne on syntynyt alueelle?	How was your company created in the area?
	Puhutteko yrittäjyyskosysteemeistä ja miten ymmärrätte käsitteen? Ajatteletteko kuuluvanne niihin?	Do you talk about entrepreneurial ecosystems and how do you understand the concept? Do you think you belong to them?
Goals	Miten yrittäjyyttä tuetaan alueella? Miten tätä toimintaa organisoidaan? (Kuinka alueen yrittäjyyskosysteemi on syntynyt ja mitä tavoitteita alueella on)	How is entrepreneurship supported in the region? How is this activity organized? (How did the region's entrepreneurial ecosystem emerge and what are the goals of the region)
	<b>EKOSYSTEEMIN NYKYTILA (yrityksenne kannalta)</b>	<b>CURRENT STATE OF THE ECOSYSTEM (from the perspective of your company)</b>
Actors	Minkä tahojen kanssa teitte yhteistyötä yritystä perustaessa? Minkälaiset	With which parties did you cooperate when founding the company? What kind of



	alueelliset tekijät vaikuttivat yrityksen perustamiseen?	regional factors influenced the establishment of the company?
	Millaista on yrityksenne nykyinen yhteistyö näiden tahojen kanssa?	What is your company's current cooperation with these parties like?
Resources	Mitä resursseja alueella on, mitä puuttuu, miten niillä on tuettu yrityksenne syntyä?	What resources are there in the area, what are missing, how have they supported the establishment of your company?
Conventions, Institutions, Culture	Minkälaiset vakiintuneet käytännöt ovat alueen vahvuus/heikkous teidän yrityksenne syntyä ajatellen, millaisia uusia käytäntöjä alueelle on muotoutunut?	What established practices of the region are strengths/weaknesses in view of the emergence of your company, what new practices have emerged in the region?
	Tiedätekö muita alueelle perustettuja yrityksiä? Miten yrityksiä syntyy alueelle?	Do you know any other companies established in the area? How are companies created in the area?
Governance	Mikä rooli sidosryhmillä oli yritysten synnyssä? Miten ohjaavat toimintaa?	What role do stakeholders play in the creation of companies? How do they govern activities?
Interaction	Miten yhteistyö eri tahojen välillä on toiminut?	How has cooperation between different actors worked?
Learning and knowledge sharing	Millaista oppimista ja tiedonjakoa tapahtuu? Mitä kukin toimija antaa yhteistyölle ja saa yhteistyöstä?	What kind of learning and information sharing takes place? What do actors give and receive from the cooperation?
New organizational forms	Millaisia organisaatiomuotoja, verkostoja tai alustoja yhteistyön kautta on syntynyt? Onko näistä ollut hyötyä teille?	What kind of organizations, networks or platforms have emerged through cooperation? Have these been helpful to you?
Digitalization	Miten hyödynnätte digitalisaatiota ja miten digitalisoituminen (trendi) vaikuttaa kokonaisuuteen?	How do you take advantage of digitalization and how does digitalization (trend) affect the whole?
	<b>KEHITTÄMISEN TARPEET</b>	<b>DEVELOPMENT NEEDS</b>
	Minkälaisia haasteita ja mahdollisuuksia yrittäjyydelle on alueella?	What are the challenges and opportunities for entrepreneurship in the region?
	Miten näiden tekijöiden voisi olettaa muuttuvan tulevaisuudessa? Toiveita/odotuksia?	How could these factors be expected to change in the future? Hopes/expectations?

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## Appendix E: Initial codes in thematic analysis

Based on initial ideas and initial codes, data extracts were copied from individual transcripts and categorized into separate files based on codes. In the third phase of analysis, tentative themes were searched for by combining these codes together into meaningful groups (Table 22).

**Table 22. Meaningful groups based on initial codes and ideas in thematic analysis**

Lahti (58 pages of data extracts)	Tampere (135 pages of data extracts)
<b>LIMITED HUMAN CAPITAL</b>	<b>ENOUGH HUMAN CAPITAL</b>
Not enough professionals/high-educated population in the area	Available workers from area
Attracting people to come to the area	Knowledge in the region
Can find workforce	<b>LEGISLATION</b>
<b>LIMITED ENTREPRENEURSHIP</b>	Legislation as a limiting factor
Small entrepreneur volumes	<b>EMERGING ECOSYSTEM</b>
Small material volumes	Ecosystem concept is unclear
Missing technologies	Lack of ecosystem conventions
Not enough interest in bioeconomy entrepreneurship	Not systematic
More new bioeconomy companies expected in future	Need to be more systematic
Enough funding if the idea is good enough	Lack of roadmaps of ecosystem
<b>LEGISLATION</b>	Unclear organization
Legislation as a limiting factor	Ecosystem sustains itself
<b>ECOSYSTEM</b>	Area in the beginning of development
Not systematic	<b>BIOECONOMY</b>
Does not prefer the word ecosystem	Unclear concept
<b>SUSTAINING THE OLD WAY</b>	<b>CHANGE</b>
Still doing the old way	Talk about change
More need for trying new things	<b>CITY PLANNING</b>
Family business tradition	Area in the beginning of development
Small circles	Area changes
Existing relations between actors	Path dependence of city structures
Concern for the environment since 1990	<b>NEW OPPORTUNITIES</b>
<b>CHANGE</b>	Material flows
Trying new things	Own needs
Need to change	Personal background
<b>GOALS</b>	Research
Common goal in regional strategies	Needs of area
Wellbeing in the region	Needs of water sector
Collaboration between companies and universities	<b>GOALS</b>
Concern for environment	Sustainability
Profiling the region	More companies
	<b>COLLABORATION</b>

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New employment  
 Regional development  
 Finding customers  
 Money

#### DISPERSED CITY STRUCTURE

Large companies with a long-time presence  
 Need to have contacts in other cities  
 Customers at a national/global level  
 Facilitators do not know new companies  
 Facilitators know new companies  
 Very small number of new companies  
 City planning  
 Niemi as an innovation center/platform

#### ACTOR ROLES

Innovation platform  
 Knowledge source  
 Network provider  
 Provider for funding  
 Provider of premises

#### DIGITALIZATION

Discussion forums  
 Events and workshops  
 Networking  
 Face-to-face  
 Limited time for interaction  
 Open atmosphere  
 Actors know each other  
 Prevailing relations  
 New relations  
 Learning from each other  
 Multidisciplinary collaboration

#### ACTOR ROLES

Knowledge source  
 Test platform  
 Network source  
 Funding provider  
 Visibility provider  
 Provider of premises  
 Provider of material resources

#### DIGITALIZATION

Electric communication  
 Webpages  
 Digitalization in products  
 Digitalization in material flows  
 Digitalization is important for developing solutions  
 Open data  
 Lack of standards  
 Limited digitalization

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## Appendix F: Data extracts in Finnish

The interviews were conducted mostly in Finnish and in one case in English. The data extracts were translated into English when the interview was conducted in Finnish. The original Finnish data extracts are provided in this appendix.

### Emergence of entrepreneurial ecosystems in bioeconomy

*“Yliopiston rahoitusrakenne tuottaa jatkossa ehkä enemmän spin-offeja ... Ajatusmaailma ei ehkä ole ihan valmis siihen. Ollaan menossa hyvään suuntaan.” (P13)*

*“Me ollaan ehkä siksi kriittisiä kun ei nähdä sitä kasvua tämän alan pk-sektorin kautta. Meillä on hienoja casejä ja kunta saattaa vetää kunniamerkin rintaansa. Jätteenkäsittelyprosentti on kova. Mut syntykö siihen bisnestä ja syntykö työpaikkoja, se on ihan eri taso.” (P18)*

*“Me halutaan rakentaa kestävästä kaupungistumisesta, kehittäjiä ja ratkasuitten ekosysteemiä ja justiin se että ne yritykset on siellä se ydin ... Kehitysohjelma on uus, perustettu tähän ja me koko ajan nyt kun me vasta saatiin tähän kehitysalustaan projektipäällikkö joka nyt polkee sitä, et tää saisi paljon formaloidumman muodon. Et me ollaan vasta niinkun alkuvaiheessa.” (P4)*

*“Tietysti tää voisi olla vielä enemmän ekosysteemiä siinä vaiheessa kun tänne saadaan enemmän yrityksiä, nythän meitä on aika harvalukuinen porukka täällä vielä.” (C9)*

*“Vielä kaikki [puuttuu], kun näit sen paikan ei siellä vielä mitään [ollut]. Yrityksiähän puuttuu vielä paljon, eikä niitä voi nyt ees nimetä vielä.” (O10)*

*“Alustalla pitäisi olla tarkoitus, mihin sitä tehdään. Termit, alusta vai ekosysteemi vai yritysrypäs, miten määritellään ... Haaste on saman tyyppiset tehtävät eri tyyppisillä organisaatioilla.” (P13)*

*“Haaste on tavallaan se organisaation epämääräisyys ... Se [paikallinen verkosto] nyt tällä hetkellä on tilassa joka ei oo selkee ... nyt kun se [Hiedanrannan kehityshanke] siirtyy pikkuhiljaa kaupungin toiminnaksi, siitä en tiedä kuka tekee mitään.” (C7)*

### Lahti

#### Family entrepreneurship culture

*“Veturirytykset tekee koko ajan tuotekehitystä, mutta [ne] on perheyrytyksiä jotka on jo vanhoja yrityksiä. Kehittävät tuotteita ympäristöystävällisemmäksi ... Yritysrakenne, on perheomisteisia yrityksiä, on poikkeuksellinen Suomessa. Silloin intensiteetti ja, toiminnan tekeminen on vähän erilaista, ollaan tunteella mukana.” (P13)*

*“Perheyrittämisen perinne on vahva ja sen nimeen on vannottu. Osin pitäyditty vanhoissa kaavoissa ... Jääny vähän vähemmälle uudet alat missä voitais menestyä.” (P18)*

*“Isommat yritykset joiden ympärillä tapahtuu asioita. Enemmänkin isojen kumppaneiden ja partnerien kanssa tekemistä ... Virrat on lähinnä isojen yritysten hallussa. Startup ei ehkä pääse väliin helpolla.” (P11)*

*“Alueella on isoja toimijoita, voisi toimia sellaisena jotka mahdollistaa aluskasvillisuutta ... Startupit voi olla tuulen puhahdus, lakkaa toimimasta. Veturien läsnäolo ruokkii kilpailua, muut joutuu uudistumaan ... Ei ne välttämät ne syntyvät yritykset oo tavallaan se, pääjuttu siinä, vaikka niitä olis tosi kiva saada ... sekin et olemassa olevat yritykset tosiaan kehittää sitä omaa, bisnestään niin se on se mitä myös toivotaan.” (P12)*

*“On pitkäjänteistä. Jätteen materiaalin hyödyntämisen kasvattaminen ... 90-luvun alkupuolelta lähtien on rakennettu kierrätykseen kannustavaa järjestelmää. Lahdessa oltiin Helsinkiä edellä. Asiat pitää tehdä 20 vuoden perspektiivillä. Kehittämisen vastuun on oltava todella kaukonäköinen.” (P12)*

### **Prevailing small circles**

*“Ihmiset tuntee alueella toisensa, heidät helppo koota yhteen. Aina samat ihmiset, syntyy sisäänpäin lämpiäviä piirejä. Uusia on tutustutettu ihmisiin, ei ole niin sulkeutunutta.” (R1)*

*“Kaikki tuntee kaikki, pienen paikkakunnan hyvä puoli. Ja osa yritysihmisistä on tuttuja osa poliitikoista on tuttuja. Suorat yhteydet.” (R14)*

*“On yrittäjyyshenkisyttä Lahdessa, mutta heikkous on yrittäjien välisessä luottamuksessa. On sisäänpäin lämpöävyttä. Kun on valmiita verkostoja, voi olla vaikea päästä verkostoihin ulkoapäin. Paljon yksin yrittämistä edelleen.” (P12)*

*“Älykkään erikoistumisen ryhmät pyrkii käyttämään olemassaolevia verkostoja, ei pidetä ylimääräisiä kokouksia, sinne tietoa missä on jo sovittu tapahtuma sinne tietoa. Tehostetaan olemassaolevaa rakennetta.” (P18)*

*“Peräänkuuluttaa tiettyä avoimuutta ... Voitaisiin tehdä vielä avoimempia alustoja. Siin varmaan meillä on tekemistä.” (P12)*

*“Pitäis ympäristöalan yritykset törmäyttää ja siellä pitäis olla yliopistot mukana ja ammattikorkeet että. Tärnäytettäis oikein kunnolla niitä. Pitäis olla Lahden kaupungin edustajat kuuntelemassa ja miettiä miten sen päätöksentekoon ja ohjaukseen ottavat. Jos puhutaan että ollaan cleantech-klusteri, sitten pitää olla tekoja siihen suuntaan.” (C19)*

### **Dispersed city structures**

*“Ei tämmösiä, monellekaan alalle mitään keskittymiä synny, missä olis tiettyjä toimialan juttuja samassa tilassa että, onhan meillä täällä yhteisöllisiä työtiloja ... mut se on sitte, pääpaino varmaan media-alan yrittäjyyden ja tämmösten juttujen ympärillä. Se ei oo sitte biotaloutta.” (P11)*

*“Ei ole sellaista teollisuusaluetta varattu missä nää yritykset vois sijoittua. Se näkyy jo hajaantumisenä, että näitä kierrätykseen liittyviä yrityksiä menee vanhojen teollisuusalueiden sisään, sieltä tulee haittoja kuten melua roskaantumista ja liikennehaittoja.” (P17)*

*“Heikkous on alustojen puute. Kujala alkaa olla aika täysi, ei pysty laajentaan aluetta. Kierrätyksen ja kiertotalouden ala kasvaa nopeaa vauhtia. Missä se on se tuleva alusta. Kun ei pysty laajentaan. Uutta aluetta on viisi vuotta pohdittu, jätekeskusalueen perustaminen on niin haastava, kukaan ei halua tätä naapurikseen. Nyt alkaa taas uusi YVA-prosessi.” (P17)*

*“Kiertotalouden keskittymälle alueen löytäminen tuntuu vaikealta tällä hetkellä, epäillään että se on joku jätealue. YVA ei sinänsä ole ongelma. Ne on valituksiin kaatunut ja on pitänyt sitten lähteä etsimään muuta aluetta.” (P18)*

*“On vähäkäyttöisiä teollisuustiloja vielä ympäri kaupunkia. Tiloista se ei ole kiinni. Kunhan vaan löytyy massaa ... Puuttuu massaa niinkun Helsingissä ja Tampereella jossa yliopistot on isoja ja ollu kauan ... Kyllä pitäis miettiä sen Tampereen tyyliin missä ne vois ne startupit kohdata. Tai et onko meillä semmoista väestöpohjaa, nyt tullaan maakuntien eroihin. Meillä on hirveen vähän koulutettu väestö. Voidaanko ajatella et ne pullauttelis biotalouden startuppeja tosta vaan ... Osaamisympäristö ei ole niin tukeva kuin muualla. On tyhjiä tiloja mutta sitä pöhinää ei ole.” (P18)*

## **Tampere**

### **Culture of change**

*‘tiettyä hulluutta’ (R5)*

*‘totuttu tekemään asioita’ (P15)*

*“Saat tehdä vähän jotain semmosta joka, semmonen konventionaali rakennusinsinööri tai prosessi-insinööri ois se projektinjohtaja niin ampus sut mennen tullen jos se kuulis mitä sä teet. Mutta siä pitää olla tiettyä hulluutta ja luovuutta ..., semmonen tietty vapaus, se kuuluu noihin kuvioihin.” (R5)*

*“Tääl on tavallaan sit vähän saman henkisiä ihmisiä, ne niinku hakee sitä muutosta ja, ei pelkää olla vähän erilaisia. Siinä mielessä tää on niinku, viehättävä alue ... Täähän on tämmönen niinku, koealue. Täällä se teema on kokeileminen ja uuden tekeminen ja se ettei tehdä niinku, välttämättä jos ei oo tarkoituksenmukasta niillä vanhoilla tavoilla vaan. Koitetaan muuttaa, löydetään niinku uusia tapoja tehdä asioita, parempia tapoja. Semmosia et ne tukee kiertotaloutta” (C9)*

*“Koska on rakenteilla tulevaisuuden kaupunginosa. niin, on tarkoituksena kehittää juuri sellaista nykyisiä toimintamalleja rikkovaa, tämmöstä, teknologiaa ja toimintatapoja ... Mä uskon siihen, että siä saadaan muutettua näiden julkisten toimijoiden toimintaakin, on se sit biotalous taikka muu se kiertotalous ... Se on sen ajattelutavan muutos. Niin se on se ensimmäinen joka voi sitten aiheuttaa sen toimintatapojen muutoksen. Ensin tarttee saada se mindset ikään kuin toiseen uskon.” (O10)*

*“Mun mielestä täällä on niinku sellanen avoimuus ja vuoropuhelu ja tämmönen niinku aktiivinen ote mahdollisuuksien ettimisessä ja selvittämisessä niin se on ainakin, positiivinen.” (C9)*

*“Hiedanrannassa on ehkä lähetty liikkeelle hyvin sillain, avoimesti, että, että kun kerran niinkun avattiin alue niin avattiin se tosi sillain ennakkoluulottomasti ... Se avoin lähestyminen on kieltämättä tehny Hiedanrannasta tosi houkuttelevan että, vuoden kahen ajan ajan nii on kyllä porukkaa lapannu.” (P16)*

## New relations and collaborations

“Me ollaan pystytty niinkun tarjoamaan sitten että nää meidän, yritykset tapaa toisiaan ... Mun mielestä siellä vallitsee aika semmonen avoin ilmapiiri ja nämä yritykset ne toimijat on, ruvennu keskusteleen toistensa kanssa.” (P4)

“Oon oppinu tuntemaan ison joukon tulevaisuuden toimijoita. Kyllä siis uskon näistä, yliopiston ihmisistä kehittyvän tän alan, mistä he kukakin työpaikkansa sitten saa mutta kumminkin. Heistä tulee niitä tulevaisuuden toimijoita.” (C7)

“On nyt keskusteltu tämän [yrityksen nimi] kanssa että, näitä ravinteita joita me nyt otetaan sieltä säkkiin niin niin tota ne vois hyödyntää. Mutta varmaan menee tää kesä ennen kun sitten päästään ihan. Toimiin ja. [yrityksen nimi]:n tuotetta, biohiiltä me varmaan tullaan käyttämään.” (C7)

“Kaikkien kanssa on jotain, jonkunlaista yhteistyötä, ehkä sen [yrityksen nimi]:n kanssa nyt eniten tähän hulevesiasiaan liittyen koska sitä biohiiltä olis tarkoitus kokeilla näissä hulevesiratkaisuissa. [yrityksen nimi] haluais referenssin siitä, että tehään joku tämmönen huleveden käsittelyratkaisu jossa käytetään biohiiltä ja, sitten me haluttas testata sitä biohiiltä.” (P16)

“Kyllä se niinku johtaa toisiin, [henkilön nimi]:lla on sitte esimerkiks taas kontakteja tonne Lähi-Itään päin ... Lähi-Idässä esimerkiks biohiillelle on paljon kysyntää siellä, saadaan lisäarvoa siitä paljon, kun siellä on esimerkiks vedestä huutava pula.” (C9)

## Test areas

”sitten että jos mä meen raportoimaan että nyt meni viissataatuhatta että kokeiltiin ja epäonnistuttiin, niin se että sanottais no hyvä juttu että, kyllä sanosin että siinä ollaan vielä pitkällä tiellä.” (P4)

“Tampereen kaupunki enemmän näkee Hiedanrannan sellasena kehitysalustana, että siellä voi pilotoida asioita ja testata asioita ... Saadaan oppia siitä miten kiertotalouteen pohjautuvaa, materiaali kiertoja sulkevaa asuinalueita voidaan rakentaa, se suuri oppi mitä voidaan saada ja soveltaa muuallakin.” (P3)

“Väitän että me osataan se kaupunki rakentaa ja suunnitella nykyisillä tekniikoilla mutta kun me halutaan tehdä se uudella kestäväällä tavalla, niin sen takia meil on tässä tällanen kehitysalusta ... jos me halutaan saada radikaaleja muutoksia meillä pitää olla valmiutta testata jotain jonka onnistumisesta me ei voida vielä tietää.” (P4)

“Hiedanranta, se on alue missä ei suurimmaksi osaksi ole mitään muuta kuin vettä, puoliks vettä. Se lähdetään rakentaa ihan tyhjästä, niin silloin tietysti tulee asioita mistä, missä on hirveen monta toimijaa mukana. Luvitukset, täytyy infra rakentaa, kiinteistöjä rakentaa, liikkumisen, energian ja kaiken muun suhteen.” (P3)

“Hiedanrannassa on tämmönen toimintaympäristö mikä on aika tyypillinen. Monista kaupungeista Suomesta löytyy jotain tällasia vanhoja teollisuuskiinteistöjä, mitkä on, vanha toiminta on lakannu sieltä ... mut sit täällä on niinku teollista perintöä, kaikenlaisia ongelmia mitä on saatu sieltä teollisuuden perintönä et on, eri tavalla pilaantuneita maa-alueita, on kaikenlaisia vuotoja mitä on

*tapahtunu tonne, sit on järvet täynnä nollakuitua tai isot kaatopaikat täynnä sitä samaa kamaa tossa ... rakentaminen alkaa parin vuoden päästä.” (C9)*

*“Sillon kun tehdään suunnittelua tollaselle alueelle, niin sillonhan löydään lukkoon jo paljon asioita joka tekee sen että jälkeenpäin ei ole mahdollista muuttaa niitä. Jos sä teet jotain linjauksia tai mitä rakenteita sinne tehdään kaasulinjoja tai jotain sähköhommia tai muuta niin ei sitä kovin helposti enää muuteta.” (R5)*

*“[Kaavoittamalla] sä voit sallia jotain asioita, sä voit kieltää jotain asioita ja sä voit antaa porkkanoita jollekin asioille. Niin se on ainakin tämmösellä uudella alueella se on tärkeä. Sit jos mennään olemassaolevaan infraan, sillonhan asiat on aika paljon vaikeempia saada mukaan.” (O10)*

### **Legitimacy within and outside ecosystems**

*’luotu aika ennakkoluulottomaksi’ (C7)*

*“olisi tarvetta kokeilla asioita rohkeammin. Alueella ei sallita rohkeutta, on epäilijöitä.” (R1)*

*“pitäisi miettiä miten osattaisiin ennakkoluulottomammin tehdä asioita. Sellaista roolia on kirjoitettu kaupunkistrategiaan.” (P12)*

*“On vastustusta asioista joista toimijoilla ei ole tietoa. Esimerkiksi uudenlainen menetelmä. Yrityksen tunnettavuus on tärkeää menetelmän hyväksynnän kannalta. Erimielisyyksiä ollut muun muassa Päijät-Hämeen jätehuollon näkemysten ja viranomaisten näkemysten välillä. Usein viranomaisyhteisö näkee uuden teknologian hyvänä, monesti innostutaan aluksi, mutta tämä jää usein puheen tasolle.” (C2)*

*“On huomattu että muualla menee helpomminkin asiat läpi kuin Lahdessa ... Lahdessa, okei. Se rakentamisen tai saneraamisen, kun ei vaadita energiatehokkuutta esimerkiksi. Ei edetä niin tehokkaasti kuin voitaisiin ... ympäristötehokkuuteen ja kiinteistöjen ympäristövaatimukseen. Sitä pitäisi vaatia. Helsinki vaatii jo uusilla asuinalueilla älykkäitä energiaratkaisuja. En ole kuullu Lahdesta tämmöstä.” (C19)*

*“Täällähän me löydettiin se koko juttu. Et sillä on iso merkitys. En usko että me oltas tässä tilanteessa ilman Hiedanrannan kehitysalustaa. Että tää mahdollisti tällaisen, mahdollistaa niinku myöskin epäonnistumisen et otetaan käyttöön joku ja testaillaan katotaan sitä et toimiiko ... Varmaan tarjoo [enemmän edellytyksiä] joo, koska tää on kuitenkin luotu aika ennakkoluulottomaksi ... Ei heti tuu päälle se et meidän lainsäädäntö sano niin tai näin, vaan tääl on saanu mennä vähän kokeilun nimissä ohi.” (C7)*