LAPPEENRANTA-LAHTI UNIVERSITY OF TECHNOLOGY LUT
School of Engineering Science
Degree Programme in Industrial Engineering and Management

Matias Nurmi

STARTUP ECOSYSTEM ORCHESTRATION PROBLEMS AND DIGITAL SOLUTIONS

Master's Thesis

Examiners: Professor Vesa Harmaakorpi.
D.Sc. Rinkinen Satu

ABSTRACT

Lappeenranta-Lahti University of Technology LUT
School of Engineering Science
Degree Programme in Industrial Engineering and Management

Matias Nurmi

Startup ecosystem orchestration problems and digital solutions

Master's thesis
2023
93 pages, 9 figures and 3 tables
Examiners: Professor Vesa Harmaakorpi and D.Sc. Satu Rinkinen

Keywords: startup, startup ecosystem, innovation, entrepreneurship, ecosystem orchestration, data driven orchestration, digital ecosystems, ecosystem framework

Objective of this thesis was to research how startup ecosystems are currently formed and orchestrated, what is the profile of current orchestrator, what kind of problems and tools the startup ecosystem orchestrators have. The study aimed to explore the potential impact of modern digital solutions on the orchestration process and examine the feasibility of a data-driven approach to ecosystem orchestration.

This thesis was conducted by a document analysis approach. The aim was to identify relevant sources related to startup ecosystem orchestration and its digitalisation. The author used a range of search terms and databases to maximise the number of relevant sources. A total of 87 publications were evaluated, and 60 were considered relevant and used in the study. The quality and relevance of each source was evaluated based on inclusion/exclusion criteria, with primary consideration given to academic sources published in peer-reviewed journals. The information from each source was compiled into a single database, and patterns and key insights were identified. The content analysis process was designed to comprehensively identify relevant sources and gather a broad range of academic and practical insights to address the research questions.

This thesis investigated the state of startup ecosystems and found that there is currently no natural ecosystem orchestrator overseeing the entire startup ecosystem holistic way, resulting in challenges and siloed ecosystem data. A digital ecosystem framework can overcome these challenges, but the establishment of a neutral ecosystem orchestrator is crucial for success in a long term orchestration involves coordinating various actors, resources, and knowledge within the ecosystem to create a favourable environment for startups to thrive. Digital solutions can help unlock ecosystem data and enable data-driven ecosystem orchestration. Defining the key elements of the startup ecosystem supported the establishing of the shared ecosystem framework and ecosystem orchestrator profile. Digitalisation has the potential to revolutionise the way startup ecosystems are orchestrated, enabling ecosystem stakeholders to work together more effectively and efficiently towards a shared vision.

TIIVISTELMÄ

Lappeenrannan–Lahden teknillinen yliopisto LUT
LUT Teknis-luonnontieteellinen
Tuotantotalous

Matias Nurmi

Startup ekosysteemin orkestroinnin ongelmat ja digitaaliset ratkaisut

Tuotantotalouden diplomityö
2023
93 sivua, 9 kuvaa ja 3 taulukkoa
Tarkastajat: Professori Vesa Harmaakorpi ja D.Sc. Satu Rinkinen

Avainsanat: startup, startup-ekosysteemi, innovaatio, yrittäjyys, ekosysteemin orkestrointi, datalähtöinen orkestrointi, digitaaliset ekosysteemit, ekosysteemi viitekehys

Tämän diplomityön tarkoituksena oli tutkia, miten startup-ekosysteemit muodostuvat ja miten niitä orkestroidaan. Tässä työssä on tarkasteltu nykyisten orkestroijien profiilia, käytössä olevia työkaluja ja kohtaamia ongelmia. Tutkimuksessa on keskitytty myös tutkimaan modernien digitaalisten ratkaisujen vaikutusta orkestrointiprosessiin ja selvittämään, olisiko dataohjaava lähestymistapa mahdollinen tapa orkestroida ekosysteemejä.

Tämä diplomityö toteutettiin dokumenttianalyysimenetelmää käyttäen. Tavoitteena oli löytää lähteitä, jotka liittyvät startup-ekosysteemien orkestrointiin ja sen digitalisointiin. Lähteiden kartoittamisessa käytettiin useita hakusanoja ja tietokantoja varmistaaksemme, että mahdollisimman monta soveltuvaa lähdettä saataisiin mukaan. lähteiden kartoituksessa arvioitiin yhteensä 87 julkaisua, joista 60 katsottiin sopiviksi ja otettiin mukaan tutkimukseen. Jokaisen lähteen laatu ja sopivuus arvioitiin sisällyttämis- ja poissulkukriteeriä käyttäen. Ensisijaisesti huomioitiin vertaisarvioidut tieteelliset julkaisut. Käytetyt lähteet koottiin yhteen tietokantaan, josta tunnistettiin kaavat ja keskeiset yhtymäkohdat.

Tässä diplomityössä tutkittiin startup-ekosysteemien nykytilaa ja havaittiin, että viitekehyksessä ei ole tällä hetkellä luonnollista ekosysteemin orkestroijaa, joka katsoisi koko ekosysteemiä kokonaisvaltaisesti. Tämä puute johtaa erilaisiin ekosysteemitason haasteisiin ja siiloutuneeseen ekosysteemidataan. Digitaalinen ekosysteemikehys voi ratkaista nämä haasteet, mutta neutraalin ekosysteemin orkestroijan perustaminen on ratkaisevan tärkeää pitkän aikavälin menestykselle. Orkestrointi tarkoittaa eri toimijoiden, resurssien ja tiedon koordinointia ekosysteemissä. Orkestroinnin avulla voidaan luoda suotuisa ympäristö startup-yritysten menestymiselle. Digitaaliset ratkaisut voivat mahdollistaa ekosysteemin datan avaamisen ja vapaan virtaamisen, joka mahdollistaa dataperusteisen ekosysteemiorkestroinnin. Startup-ekosysteemin avainelementtien määrittäminen on perustana yhteisen ekosysteemikehyksen ja orkestroijan profiilin luomiselle. Tämän työn perusteella digitalisaatiolla on potentiaalia mullistaa startup-ekosysteemien orkestrointitapa mahdollistaen ekosysteemien sidosryhmien tehokkaamman yhteistyön yhteisen vision saavuttamiseksi.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my family for their unwavering support and understanding throughout my journey. Their patience and encouragement have been my source of strength and motivation, especially during those long evenings and weekends when I had to work on my research. We completed this together.

I would also like to acknowledge my colleagues, Valto and Óscar, who shared the same passion as mine and founded a company with me around the research subject. You two are the crazy ones, and I am privileged and ever grateful to have had the opportunity to work with such passionate and talented people. I wouldn't want to do this with anyone else. Thank you for your hard work, dedication, and commitment to our vision. I would like to express my gratitude to my esteemed colleague, Ethan, for his constant support and encouragement throughout this journey. Ethan's valuable insights from the field have played a significant role in the successful completion of this project, and his willingness to engage meaningful discussions related the topic of this thesis has been greatly appreciated.

I extend my appreciation to Professor Vesa Harmaakorpi and D.Sc. Satu Rinkinen from Lappeenranta University of Technology for their invaluable guidance, expertise, and support to my research. Their patience, insights, and feedback have been a vital component in shaping this thesis to its final form.

I am grateful to all the people who have contributed to the success of my thesis. Thank you all for your guidance, support, and encouragement throughout this journey. Lastly, I would like to thank the University for providing me with a platform to pursue the opportunities I identified and all my fellow students for the classes and projects we shared. I wish nothing but the best for you all.

29.4.2023
Matias Nurmi

TABLE OF CONTENTS

1 INTRODUCTION

In today's competitive and rapidly changing world, entrepreneurship and innovation are seen as crucial drivers of competitiveness, social and economic development. This is particularly true in the context of digitalisation and the rapid growth of knowledge, which are creating new opportunities and challenges for entrepreneurs and innovators. As a result, many organisations, governments, and other stakeholders are focusing on supporting and promoting entrepreneurship and innovation, particularly through the growth and development of startups. By fostering a vibrant and dynamic startup ecosystem, these stakeholders can help to drive competitiveness, social and economic development, and create new opportunities for entrepreneurs and innovators.

The use of ecosystem word has increased radically in the business world since James Moore introduced it to the world in business context to describe the complexities of an interconnected world (Moore, 1993, pp. 75-86) (Gobble, 2014, p. 55). Even the usage of the ecosystem word outside of and ecological context has been criticised over the past years (Papaioannou, et al., 2009), the development of the ecosystem concept in business world shows that it cannot be replaced with other business collaboration concepts or implications, like business networks, clusters, triple helix, hubs etc. When Moore presented the ecosystem in business context, he specifically was referring to the business ecosystem concept, which crosses the variety of industries and where companies co-evolve capabilities around the innovation (1993, p. 76). After that ecosystem concept has been spreading inside the business world forming different ecosystem analogies, for example industrial ecosystems, digital business ecosystems, platform ecosystems, innovation ecosystems, social ecosystems, startup ecosystems, entrepreneurship ecosystems and the economy as an ecosystem, just to name a few.

When ecosystem has been getting new analogies, the ecosystem definition has also been evolving and finding its shape. The essential logic of the ecosystem thinking has been that ecosystem actors must proactively develop mutually beneficial relationships with other ecosystem entities and actors (Iansiti & Levien, 2004, pp. 68-69). Hence, the topic has become popular concept applied in many different domains that has various overlapping elements while maintaining their own specific features that define their essence.

This thesis is looking for the study problem in the framework of startup ecosystem, being explicit in its definition and comparing it to other similar ecosystems to showcase how and if the problem and presented solutions can be generalised to other ecosystem analogies as well. By startup ecosystem is referred to the ecosystem where the startups are born, and ecosystem value chain output is the number of new companies. When one think about the ecosystem concept, it should be collaborative networks making effort to mutually beneficial relationships, eventually always the same questions arise, who oversees the ecosystem, who owns it, can it be owned and who is responsible of the decisions that are made in the ecosystems? Answers to these questions varies depending on which ecosystem analogy are dealt with, but in generally the discussion is about the ecosystem orchestration.

Innovation systems has been going through transformation from closed innovation to open innovation. This transformation has led change in the innovation ecosystems as well. While traditional innovation ecosystems used to be simple and linear, open innovation has transformed innovation ecosystems to non-linear global ecosystems and so sifted towards startup ecosystems (Ketola, 2019, p. 11). Because there is lots of interconnectedness and overlapping in the innovation- and startup ecosystems, it's possible to reason that some systemic elements apply both ecosystems. Different ecosystem actors like startups, companies, public sector organisations, investors, and communities etc. forms startup ecosystem. All ecosystem actors are physical entities and individuals which are connected in different ways with each other. Ecosystem strength can be measured by how much there is connections in the ecosystem. That is due the better the information flows in the ecosystem between the ecosystem actors, more possibilities it creates for startups to become successful companies. In the age when digitalisation is disrupting everything, it's only natural to assume that logical way to orchestrate the data between ecosystem actors is digital. With that conclusion it is justified why three main thematic of this thesis are: innovation, entrepreneurship and digital. Visual presentation for the themes is presented in Figure 1 Themes of the thesis.

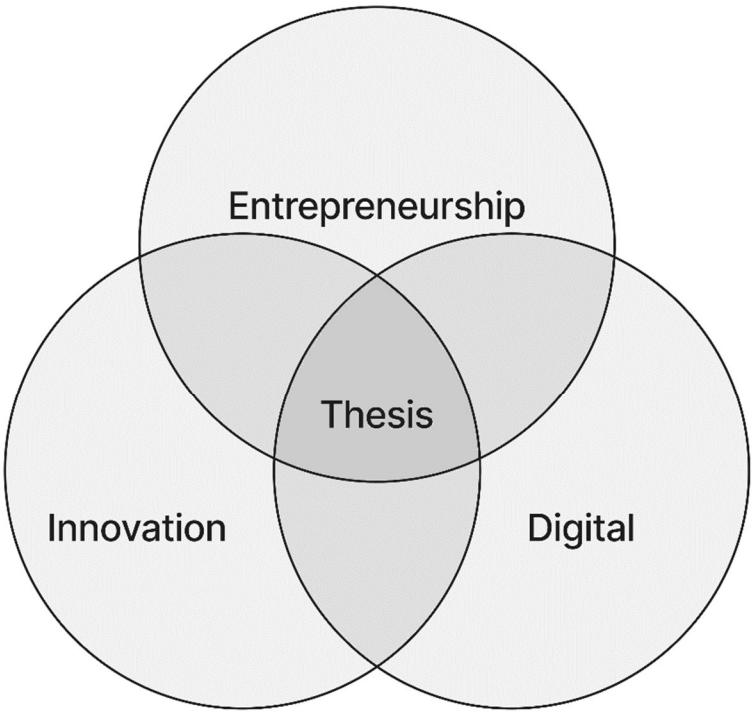

Figure 1 Themes of the thesis

1.1 Background

When compared to the innovation ecosystem and entrepreneurship ecosystem literature and academia, it's clear that startup ecosystem is not similar hot topic as those two mentioned. There's notable number of published research about the innovation ecosystems and entrepreneurship ecosystems, which cover startups as part of their research agenda. This is understandable since startups are vital part of both ecosystem analogies. On some occasions scholars don't make comparison between the startup ecosystem and entrepreneurship ecosystem, but study them as the same (Velt, 2020, pp. 16-17, van Rijnsoever, 2021). Open innovation model has increased startups profile in innovation ecosystem literature as well. Even the studies have mainly focused on large firms in the innovation ecosystems, it has become clear that startups are vital part of the innovation ecosystems (Yaghmaie & Vanhaverbeke, 2019, p. 4).

Startups and startup ecosystems have been in the in the secondary topic in many academic studies. There are multiple reasons for that, but one major reason is that there has been major gap between research and practice. Lean startup framework has been one of the most popular contributions in the practitioner-oriented entrepreneurship literature for last decade. Study shows that practitioners don't pay attention to academic research and researchers rarely become practitioners. Startups are also difficult to study because the very nature of the startups. It's difficult to identify individuals engaged in entrepreneurial behaviour before they have formed an organisation. The startup process is not simple or linear but is instead complex and dynamic. Startups also have high possibility to die or transform to be something else soon after they have been founded (Shepherd & Gruber, 2021, pp. 967-968).

Despite being outside of the academic spotlight, startups have always been vital for economic growth. Companies that are less than five years old are the primary source of job creation and they also are major contributors in economic dynamism via competition they create into market and spurring the innovation. Based on study from Kauffman Foundation, between 1988 and 2012, companies more than five years old destroyed more jobs than they created in all, but eight of those years in U.S. New businesses are accountable for almost all net job creation and almost 20% of gross job creation (Weins & Jackson, 2015). Based on the impact startups have on the economic growth, startups and especially startup ecosystems, should have more attention amongst the academia and research communities.

This thesis is delivered originally by the request of Startup Commons Global. Startup Commons was founded in 2008 as a non-profit association to develop open-source and creative commons-based assets and IP. Its brand and operations were later transitioned to Oy form in 2014. Since 2014 Startup Commons has been working on startup ecosystem development globally by operating over 30 ecosystems on the ground level. Products being digital ecosystem solutions and ecosystem development consulting & training. At the time of writing this thesis, Startup Commons has been transitioned from consulting to digital ecosystem solutions. Customers are cities, countries, states, and other key actors in startup ecosystems globally. With the comprehensive work on the modern global ecosystem development Startup Commons has been actively part on in recent years, it has been recognised globally as a source of information what

comes to the startup ecosystems and digital solutions. As part of the business model transitioning, Startup Commons reorganised its operations in the 2020 to the new company, Digiole Oy, to focus on digital solutions. The Startup Commons' ecosystem operations with new digital opportunities became part of Digiole. One of the fundamental aspects of the Startup Commons' strategy has been developing products and acquiring knowledge through profound market validation and using research materials when it's been possible. Via this strategy Startup Commons has been able to achieve its current position and trust in the markets. Although Startup Commons has been at the forefront of ecosystem development, driving progress globally, there are still significant research gaps in many focus areas. One of these gaps is the need for modern ways to orchestrate startup ecosystems, making the topic of this thesis both necessary and justified.

1.2 Key definitions

This chapter serves as a synopsis of the key concepts presented in this thesis. The outlined concepts provide an overview of the essence of the research framework. As presented in Table 1, these concepts will be further established and explored in greater detail throughout the research.

Table 1 Definitions of key concepts

Concept	Definition
API	Application programming interface (API) is a computing interface between software's. Developers build API connections to share and/or use data, or software features between applications.
Data	Facts and statistics collected together for reference or analysis.
Data model	An abstract model that organises elements of data and standardises how they relate to one another and to the properties of real-world entities.
Ecosystem	Ecosystems are complex and dynamic self-organising systems that involve various actors with different roles and interdependent relationships. These ecosystems are capable of generating greater

	output than any individual actor can deliver alone and can be changed through orchestration.
Innovation	Innovation is new or renewed method, process, business model, product etc. validated to create new value compared to previous solutions.
Open data	Open data is to data, public or private, that is published in a machine-readable format and can be used without restriction.
Open source	Denoting software for which the original source code is made freely available and may be redistributed and modified.
Startup	A Startup is an innovation in identifiable and investable form, that is in process to validate and capture the value of the innovation, with target of scalable growth for positive impact.
Startup ecosystem orchestrator	Dedicated neutral entity with mandate from all ecosystem key actors, proper resourcing, and long term thinking.
Use case	A specific situation in which a product or service could potentially be used.

1.3 Research questions

Main research question of this thesis will provide the backbone for the study by supporting the research agenda. In addition, there is two research questions introduced to support the main question for detailed inquiry. The guiding research question of this thesis is as follows:

What does orchestration mean in the context of startup ecosystem?

This research question is used to build the framework of this research to discover what startup ecosystem orchestration means and how the ecosystems are currently orchestrated. There is available several research about the ecosystem orchestration, but those studies mainly focus on the orchestrating different digital platform ecosystems, entrepreneurial ecosystems, or innovation ecosystems while startup ecosystem differs from them. Especially difference to platform ecosystems is noticeable, startup ecosystem being physical ecosystem infrastructure

while being organic by its nature. Innovation ecosystem and entrepreneurial ecosystems are closer to the startup ecosystem as a definition, but there are some fundamental differences what it comes to the orchestration of the ecosystems. At the time of writing this thesis there were no cohesive literature studies about orchestrating physical ecosystem infrastructures like startup- or innovation ecosystems and so studying it is still vital. Taking that into an account this thesis can be positioned at the cutting edge of the ecosystem orchestration field. The first supportive research question is as follows:

What are the main challenges or problems faced by ecosystem orchestrators in startup ecosystems?

This research question is focusing to understanding the practical implications of startup ecosystem orchestration. Ecosystem orchestrators face various challenges when attempting to manage and coordinate a complex and dynamic network of stakeholders within a startup ecosystem. Understanding these challenges is essential for developing effective strategies for ecosystem orchestration that address these challenges. By exploring the challenges faced by ecosystem orchestrators, this research can contribute to the development of digital solutions to address these challenges and improve the effectiveness of ecosystem orchestration. Moreover, identifying these challenges can also help policymakers and ecosystem actors to develop policies and initiatives that support ecosystem orchestrators and promote the growth and sustainability of startup ecosystems. Therefore, this research question is relevant as it can provide insights into the practical implications of ecosystem orchestration and inform decision-making in the context of startup ecosystem development.

What is digitalisation's role in the startup ecosystem orchestration now and what possibilities it can unlock?

Digitalisation is one of the megatrends that will have huge implications on industries, companies, society, people, and ecosystems (Ylijoki, 2019, p. 17). Exponential growth in data volumes and its benefits will also change how ecosystem orchestration is understood today. In this thesis, I want to explore current methods for startup ecosystem orchestration and to seek, if there's better, data driven ways, to orchestrate the ecosystems, what are the key factors in

data driven ecosystem orchestration and what kind of possibilities unlocking the real time ecosystem data opens to the ecosystem orchestrators.

1.4 Research design and methods

The chapter explains the research problem being investigated, which is the lack of understanding and cohesion in the existing literature on startup ecosystem orchestration and its digitalisation. The aim of the thesis is to investigate this concept and based on the document analysis, develop a digital solution to address the problem. The chapter also emphasises the importance of effective ecosystem orchestration for promoting innovation and economic growth, and the potential of digitalisation to enhance the efficiency and effectiveness of these efforts. The concept of startup ecosystem orchestration is new in the academic world, and there is a need to establish a common language and understanding of it among scholars and practitioners.

To address the research question of identifying the challenges and potential digital solutions for startup ecosystem orchestration, this study adopts a document analysis approach. The document analysis method involves a systematic and comprehensive examination of relevant documents, such as reports, articles, and other materials related to the topic of interest. This approach is chosen because it provides a structured and in-depth method for analysing existing knowledge and identifying potential solutions. By analysing and integrating the findings from a diverse range of documents, this research aims to provide a clear and comprehensive overview of the challenges faced by ecosystem orchestrators and the potential digital solutions that could address these challenges.

The process of document analysis involves several stages, with material selection being a first step (Bowen, 2009, p. 31). Once the material is obtained, it is carefully evaluated and combined to produce information that is relevant to the research questions (Bowen, 2009, p. 28).The analysis begins by scanning the material in general terms and then closely reading it to become familiar with the content. Once the material is familiar, it can be interpreted, and this iterative process combines elements of both content analysis and thematic analysis. Content analysis involves categorising information into groups based on the primary themes of the material,

while thematic analysis looks for patterns and relationships that form larger entities from the information (Bowen, 2009, p. 32). By applying both approaches, researchers can gain a comprehensive understanding of the material and identify important themes and patterns that can inform their research findings.

In the beginning, a range of search terms were used, including "startup ecosystem," "innovation ecosystem," "entrepreneurship ecosystem," "business ecosystem," "platform ecosystem," "orchestration," "data" and "digitalisation." These terms were combined in various ways to maximise the number of relevant sources identified. The search for relevant sources was primarily conducted using Primo search-engine for books and e-books, articles, databases provided by the Lappeenranta University of Technology. This search method was chosen due to its comprehensive coverage of academic literature across a wide range of fields. In addition, other online resources, namely websites and webinars, were also included. A total of 87 different publications were read and evaluated during the document analysis process on top of that several webinars were participated. After including/excluding criteria, presented in Table 2, 60 different sources were deemed relevant to the research topic and were ultimately used in the study. These sources included 5 books, 12 websites, 1 webinar, and 42 different research studies.

Table 2 Including/excluding criteria

Including criteria	Excluding criteria
Studies or reports that focus on the ecosystem orchestration.	Studies that focus solely on digitalisation in non-ecosystem contexts
Studies that examine the role of digitalisation in ecosystem context	Studies that do not provide any information or insights relevant to the research questions being investigated.
Research that explores the challenges faced by ecosystems.	Reports or articles that are outdated or not peer reviewed.
Research that analyses the effectiveness of different strategies for ecosystem orchestration	

Including criteria	Excluding criteria
Reports or studies that analyse the relationships between the ecosystems	
Studies about innovation and entrepreneurship ecosystem dynamics	
Inclusion of feedback from practitioners with experience in startup ecosystem orchestration and/or digitalisation	

After reading the documents a coding scheme was developed to categorise and analyse the data. The coding scheme included the topics as categories and type of sources (books, websites, research studies). Each source was coded according to the relevant categories based on the content, and the coded data was then analysed to identify patterns and insights related to the research questions. Original purpose of the material and its intended use, as well as possible differences, were taken into account while processing and analysing the material. As Bowen (2009, p. 33) points out, the fact that material is available brings its own challenge to document analysis. It requires researchers to deal with it as a whole, rather than extracting individual arguments or conclusions from it. In some cases, it was also possible to follow the development of existing material, which in turn enabled a better understanding of the phenomenon being studied. Furthermore, document analysis was used to verify information from other sources (Bowen, 2009, p. 30).

Coding process was conducted manually, which allowed for a more detailed and nuanced analysis of the data. Initial coding by the content is presented in Table 3. However, this also introduced a degree of subjectivity and potential for human error in the coding process. Overall, these findings provide valuable insights into the key terms and concepts related to ecosystem orchestration in startup ecosystems, which will be used to further analyse and answer the research question at hand. Once the coding process was completed, the data was analysed to identify the startup ecosystem phenomena and main challenges or problems faced by ecosystem orchestrators in startup ecosystems. This analysis was done through a process of synthesising the coded data and drawing conclusions. The analysis focused on the frequency of codes and

their distribution across different types of sources, such as research articles, books, and websites.

Table 3 Document analysis codes

	Total	Books	Research documents	Websites
Ecosystem	29	2	27	0
Startup Ecosystem	14	2	9	3
Orchestration	13	4	9	0
Innovation Ecosystem	12	1	11	0
Entrepreneurial Ecosystem	10	1	9	0
Startup	10	1	6	3
Digital	9	2	4	3
Ecosystem Policy	7	0	7	0
Business Ecosystem	3	0	3	0
Data	4	1	1	2
Platform Ecosystem	2	1	1	0

After the data analysis, the next step was to interpret the findings. The interpretation involved explaining the results of the analysis and relating them to the research questions. The findings from the coding process indicated that the most frequently coded term was "Ecosystem" with a total of 29 codes, appearing in 27 research documents and 2 books. The second most frequently coded term was "Startup Ecosystem" with 14 codes, mostly coming from research documents (9), followed by websites (3) and books (2). The term "Orchestration" was coded 13 times, with all but 4 of them coming from research documents, and "Innovation Ecosystem" was coded 12 times, mostly from research documents (11) and only one from a book. Other terms that were frequently coded included "Entrepreneurial Ecosystem" and "Startup" (10 times each), "Digital" (9 times), and "Policy" (7 times), all of which came mostly from research documents. Additionally, "Business Ecosystem" was coded 3 times, "Data" was coded 4 times, and "Platform Ecosystem" was coded 2 times.

The findings from the document analysis presented in chapters 2 and 3 provided the necessary insights into defining the startup ecosystem and the main challenges and problems faced by ecosystem orchestrators in startup ecosystems. Based on the insights gained from the document analysis, a digital solution for startup ecosystem orchestration was proposed in the form of a shared ecosystem framework concept, which is presented in chapter 4. This framework aimed

to address the identified challenges and problems and provide a holistic approach to ecosystem orchestration. The shared ecosystem framework concept specifically addressed cultural, process, and technology challenges that ecosystems face, and was developed based on the findings from the document analysis presented in chapters 2 and 3. By using the document analysis as a foundation for the shared ecosystem framework concept, this research aims to provide a practical and effective solution to address the challenges and problems faced by ecosystem orchestrators in startup ecosystems. Overall, the document analysis plays a critical role in informing the development of the shared ecosystem framework concept and providing insights into the challenges and problems faced by ecosystem orchestrators.

1.5 Research Structure

The purpose of this chapter is to provide an overview of the research structure that was used to investigate the phenomenon of startup ecosystem orchestration and its digitalisation. The chapter is organised in a logical sequence that begins with the introduction, followed by the analysis chapters, digital solution - a shared ecosystem framework, and concludes with future research directions.

The introduction chapter of the study on digital solutions for startup ecosystem orchestration outlines the structure of the study and provides context and motivation for the research. Key concepts and terminology used throughout the study are introduced, and the main research questions are outlined, relating them to the broader research topic. The methodology and design of the study, including the document analysis process and main research methods, are explained in the research design and methods section. The research structure section serves as a guide for the reader to navigate the study's structure and understand its logic, providing an overview of the different chapters and sections of the study and their interrelation.

The analysis of startup ecosystem and ecosystem orchestration chapter provides an understanding of the key concepts related to the study, particularly the startup ecosystem and ecosystem orchestration. It discusses the definition, formation, and key elements of a startup ecosystem and introduces the concept of ecosystem orchestration. By providing a theoretical foundation for the research, the chapter ensures that the study is grounded in established theory.

This chapter is part of the document analysis process and contributes to the understanding of the challenges faced by ecosystem orchestrators. The third chapter of the research analyses challenges of ecosystem orchestration. This chapter is part of the document analysis, and it aims to provide insights into how ecosystem orchestration can be improved by addressing these challenges. By examining and analysing challenges, this chapter provides a foundation and possible solutions for improving ecosystem orchestration.

Fourth chapter of the research paper outlines a digital solution for addressing the challenges of ecosystem orchestration. The chapter introduces a conceptual ecosystem framework that addresses the challenges presented in analysis and allows different stakeholders in the startup ecosystem to access and contribute to a common pool of data, resources, and tools. The chapter provides a guide for implementing and deploying the framework, which includes exploring the ways in which ecosystem data can be leveraged by different stakeholders and identifying the various data sources required to populate the framework. The chapter also discusses data collection and management methods, implementation and deployment of the shared ecosystem framework, and the importance of governance in ensuring its sustainability and evolution over time.

Final chapter summarises the study's findings, contributions, and recommendations. The study identified challenges in ecosystem orchestration and proposed a digital solution, the shared ecosystem framework. The study's contributions include insights into ecosystem orchestration, a practical solution to address challenges, and recommendations for future research on the framework's effectiveness, evolution, and ecosystem orchestrators' roles.

2 ANALYSIS OF STARTUP ECOSYSTEM AND ECOSYSTEM ORCHESTRATION

This chapter provides a detailed analysis of the concept of startup ecosystems, their formation, and key elements. It also explores the concept of ecosystem orchestration and its importance in the successful development of startup ecosystems. The chapter aims to provide a comprehensive understanding of the startup ecosystem phenomenon and ecosystem orchestration as a key element of it.

2.1 Startup ecosystem

To be able to startup ecosystem orchestration, clear and explicit definitions for startup ecosystem is required. Startup ecosystem forms around of two complex components ´startup´ and ´ecosystem´. Both components, but especially ´startup´ have been used in academic literature multiple times without clear definition. In this chapter, these topics are covered the extent which is required in the boundaries of this thesis. Both topics are complex, non-linear, and dynamic by their nature and they would deserve own separate research.

2.1.1 Startup definition

To understand the startups, it's necessary to define what they are, how they operate and why they exist. The problem with the word startup is, that it is not and officially defined term anywhere in the world. Main goal for this chapter is to define the key characteristics of the startup and keep it logically aligned with most commonly appearing definitions. Term startup became popular topic in entrepreneurial world after Ries (2011) and Blank (2012) wrote the books about it, which sold several million copies creating much discussion among entrepreneurs. Complexity for defining startup comes from its nonlinear and dynamic nature. Startups are not smaller versions of a large company and not every small business is a startup, not even a newly established small business. Steve Blank and Bob Dorf defined startup as a *temporary organisation in search of a scalable, repeatable, profitable business model* (2012, p. 9) while Ries defined startup as a *human institution designed to create a new product or*

service under conditions of extreme uncertainty (Ries, 2011). These definitions describe well what are the characteristics of startup and how it differs for example from small business.

There have been multiple additions to the startup definitions along the years. For example, using term *software startup* has increased its popularity among the research communities and academic literature. Software startups are described to be as organisations that the startup definition defined above but use dynamic product technologies or they are focused on the creation of high tech products. Main themes of software startups are described to be as lack of resources, low experience, small teams, rapid evolution, innovation, and single product. (Tripathi, et al., 2019, p. 78).

One of the terms that has been used in the literature is *born global startups*. Born global startup framework includes the new ventures that are focus on rapid growth and internalisation in very early stages, even they're relatively novice, young, small, and suffering from resource constrains. Additionally other terms that have been used to describe startups focused on scaling, such as 'high tech startups', 'instant internationals', 'high-tech startups', 'global startups', 'micromultinationals', 'entrepreneurial startups', 'born-international SMEs', 'early internationals' and 'high grow startups'. All these terms are used in literature to describe a young, entrepreneurial startup that initiate scaling via international business soon after it's founded. These companies are driven by distinctive entrepreneurial prowess and are typically led by founders or managers who view the world as their marketplace and thus exhibit a high degree of international entrepreneurial orientation even they are relatively small in scale and limited in tangible resources. These kinds of a startups that are willing to take risks, seeking high growth and scaling via internationalisation and global mindset often attract also better entrepreneurial talent. (Velt, 2020).

As can be seen, startups have multiple definitions in academic literature, but complexity increases when looked at the startups from the dynamic perspective. Startups are dynamic entities which goes through different phases during its life cycle. There are several frameworks referred in the literature for startup development and they're mostly focusing on the product development or mixing it with the organisational development. Most comprehensive open standard framework how startups develop idea to product and to growing business, and from

talent to team and to real organisation is presented by Startup Commons (see Figure 2 Startup Development phases) (Startup Commons, 2018).

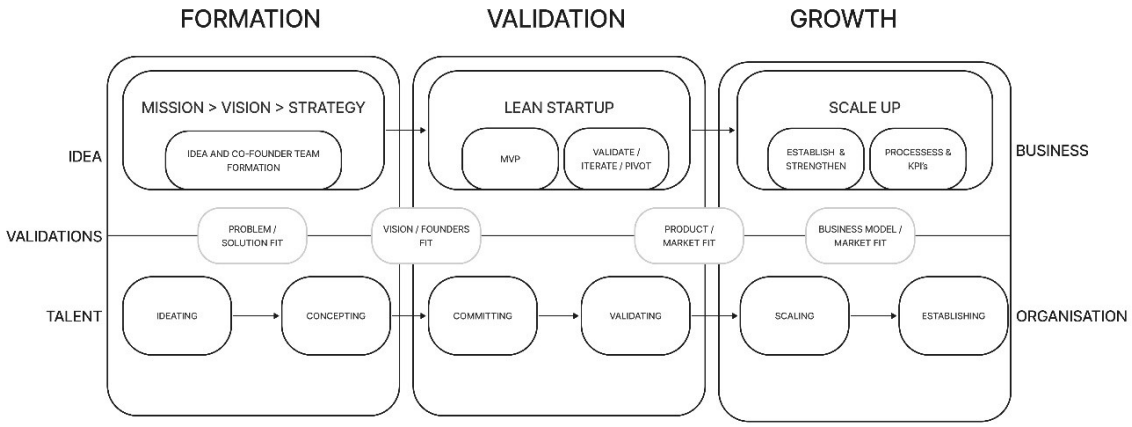

Figure 2 Startup Development phases by Startup Commons

Startup development phases presents clearly dynamic elements of the startups and how the startup development has multiple sides, and it needs to be developed in a balanced manner. Key process in a startup is to transform idea to a value generating product and market proven business model. But at the same time startup needs to build a strong committing founding team and develop both sides together into a real growing business and organisation. In the beginning of the formation-phase there is entrepreneurial talent with an idea. There's not yet commitment from the team, or there's no right balance of the skills structure, but there's entrepreneurial ambition and potential scalable product or service idea and how it would initially create a value. Mission, vision, strategy, and team formation are established when team moves from ideating to concepting. Roles and ownerships become clearer, and team validates the problem-solution fit. (Startup Commons, 2018).

When team is ready to commit to the startup, and they match the vision-founders fit, the startup will move to the validation-phase. Startup has skills balanced co-founding team with shared vision, values, and attitude. Co-founders shareholders agreement is signed with commitments. Startup operates with lean startup methodologies, creating minimum viable product, validating, and iterating it in the markets and potentially pivoting. In 2013 Blank defined the lean startup framework, which became the most dominant framework for the startups in the practitioner oriented entrepreneurship literature in the recent history (Shepherd & Gruber, 2021, p. 967).

Blank criticised the fact that many startups spend significant amount of time, financial resources, and effort on with a product idea and then perfecting it without knowing if they would be able to match the product market fit. Instead, Blank proposed that entrepreneurs should adopt different approach for introducing products to the markets, which required outward looking and learning mindset. Instead perfecting the product, they should come up with hypotheses about the key elements of their product idea and test it in real environment, and then adapt their learnings and initial concepts until they find a viable business model. Blank introduced agile engineering, customer development and minimum viable product (MVP) as tools to help entrepreneurs to gain the required learnings and validations about the product market fit (Blank, 2013). Lean startup framework has also developed since it was introduced. Its key elements are defined in literature as: finding and prioritising market opportunities in startups, designing business models, validated learning, building minimum viable products, and learning whether to persevere with or pivot from the current course of action (Shepherd & Gruber, 2021, p. 970). With market validation startup seeks for product-market fit. Big part of the market validations is the lean startup framework, iterating and testing assumptions for validated solutions to demonstrate the user growth and revenue. Validation can attract more additional resources via investments, loans for equity, interest, or revenue share from future revenues (Startup Commons, 2018).

When startups have validated that their product has a market, startups move to the growth-phase. In growth-phase startup aims to scale up and establish the operations in the markets. In scaling teams focus is on key performance indicators (KPI's) which are based on growth in users, customers, and revenues, but also in market share and traction in big, fast growing target market. Team can and want to grow fast and either consider or have attracted significant amount of funding or have option to do so. Startup hires more people, improve quality, and implement processes. In the growth-phase startup is trying to match the business model-market fit and after scaling establish its position in the markets. As part of the establishing itself, the growth is expected to continue. Startup attracts more easily resources and often tries culturally continuing like a startup. Founders and investors either make exits or continue with the company (Startup Commons, 2018).

So far there's presented multiple definitions for the startup and framework to visualise the startups dynamic nature. As can be seen through the dynamic framework, startups start from the idea, validate it in the markets, if it creates a new value in the markets, startups will scale up. When idea is validated, and it creates a new value, it becomes an innovation. Based on this framework, can be argued that one of the main characteristics of the startup is, that it's formed around the innovation and startups are driving the innovation and economic growth. This also aligned with Schumpeter's innovation and economic theories (Śledzik, 2013, pp. 90-93). Because the word startup, wasn't introduced at the time Schumpeter presented his theories, he used the word 'entrepreneur' instead 'startup' in his theories. Difference between the terms is, that entrepreneur is an individual and startups in an entrepreneurial team. Based on the presented startup development phase framework, we can also see that not all the new businesses are startups. It's possible to start a new company with market validated business model, with low ambitions to grow or with the non-scalable business model. More describing term for such venture is 'small business'.

There are multiple definitions for the startup in the beginning of this chapter. Both Dorf's and Blank's (2012) as well as Ries' (2011) original definitions fit well in the presented framework. Scalability in the business is one of the thematic that also defines what startups are. When we compare those definitions to the definition of '*software startup'*, it can be argued that definitions are very much the same, except software startups are described to build their innovation around the high technology products. When comparing closely these definitions, it can be argued that software is just a method to find scalable, repeatable, and profitable business model and therefore, there's no real difference between the definitions. Technologies are tools for the startups which enables the innovations and scaling. When comparing '*born global startup'* definition to the startup development phases framework, it can be clearly positioned in the scaling-phase. All startups have high ambition to grow in their core, but vast majority of the startups fail in the first two years for a variety of reasons. Based on research 75% of the startups end up failing mainly because they can't match the problem-solution fit and product-market fit (Tripathi, et al., 2019, pp. 77-78). Those startups that will get through the market validation, will seek to scale. Some of the startups will make through the framework faster and draw lots of attention, those are the earlier presented 'born global' startups. Reflecting the established framework and earlier definitions, startups are not 'startups' anymore, when their business

model is validated in the markets. More describing term for the startup, which is in post startup phase is '*scaleup*'. Born global-term still refers to the startup and mixes the terminology, while scaleup describes more accurately the direction and phase of the venture. While startups main challenge is to find repeatable, scalable, profitable business model, scaleup's main challenge is to grow with already identified business model while maintaining operational control (ScaleUp Nation, 2020, p. 4). Figure 3 Market validation and scalability shows a framework which separate these terms and clears the differences between established terminology.

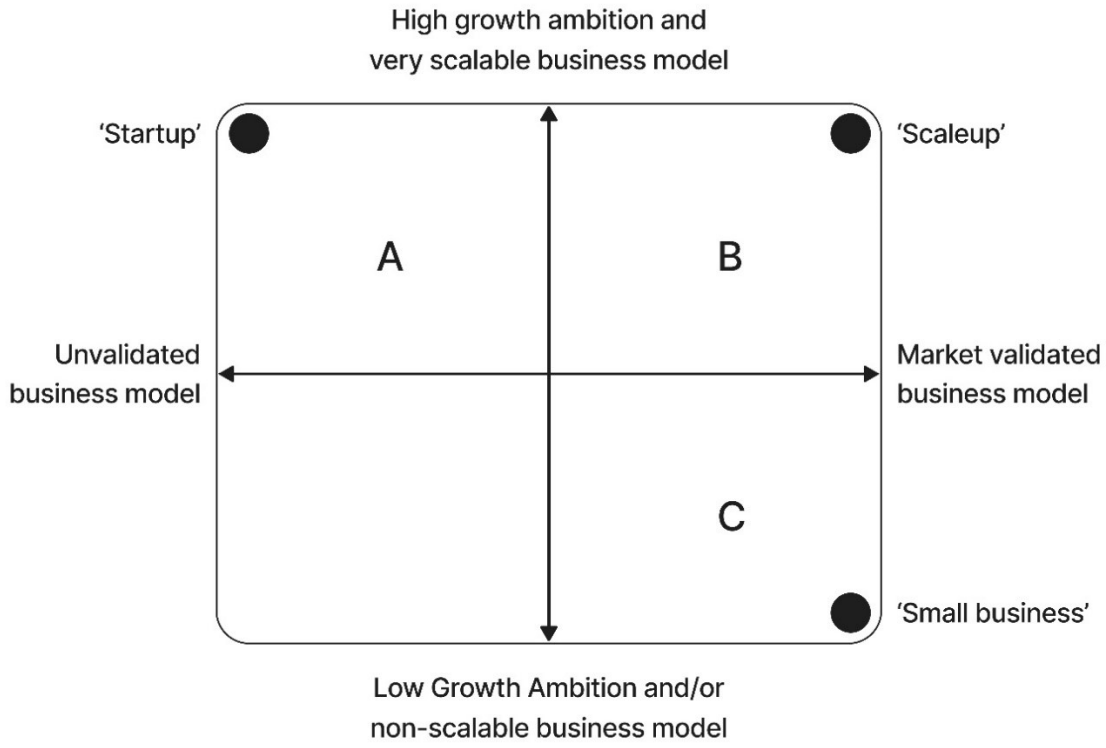

Figure 3 Market validation and scalability

As a summary of this analysis, it can be concluded that not all new ventures are startups, but startups are not smaller versions of bigger companies either. Startups cannot be defined by its size or a legal form. Startups can be anything from co-founding personnel and idea without even registered company status, to several years old company with even hundreds of people, regardless of making any profits or revenue yet, while focusing on building the value and scaling opportunity in other ways. Startups are a team of entrepreneurial talent which is focused on developing new innovations in the way that it's identifiable and investable. Startup is in progress to validate the value if the created innovation and capture that value in the scalable

business model, with ambition to grow fast with maximum impact. These are part of the reasons, why startups are such a difficult subject to research and to study in general. Like stated in the beginning of this chapter, startups as a data model and official definition are not globally yet established in research communities and among data collectors. That makes it very difficult to obtain data on startups with traditional methods. While startups are based on innovations, and innovations are born at the very limits of the traditional organisations, traditional Standard Industrial Classifications (TOL) do not often apply directly to the startups. Startups dynamic nature, with constant iterations and pivoting, makes it even more difficult to form a static picture of the startup companies (Ketola, 2019, p. 18).

2.1.2 Ecosystem as a concept

Ecosystem as a concept in business and management literature has increased its popularity since Moore introduced the business ecosystem phenomenon. Ecosystem concept origins comes from the biology, where natural systems co-exist, evolve, and succeed with the surrounding environment. Like in the biological systems, single entities don't have capabilities to succeed without interacting others in the same business and management system. Ecosystem term captures the evolutionary nature of interrelations between individuals, single entities, their activities, and environment. Moore didn't provide clear definition for ecosystem term, but he referred that in ecosystem companies work cooperatively and competitively across the industries to satisfy customer needs (Moore, 1993). Leaving the ecosystem definition originally somewhat vague, Moore enabled the elastic and flexible nature of the term and in three decades, ecosystem phenomenon has increased its popularity drastically among the practitioners as well as in researchers representing many fields. Ecosystem concept has currently been attached to business and strategic management, economic geography, innovation, marketing, entrepreneurship, startups, service, digital, platform (Velt, 2020, p. 15), technology, industrial, urban, civic, knowledge and open innovation concepts to describe them as well. Often different ecosystem analogies have been used with significant overlap as well (Autio & Thomas, 2021, p. 12). One of the reasons ecosystem concepts have increased its popularity in past years is disruptive changes in traditional value chain driven business logics, caused by the rise of digitalisation and internet economy. Changes in competition and operational environments has shifted the focus in competition between companies, to competition different value networks.

Therefore, companies should see themselves preferably as a part of an ecosystem than a part of an industry (Rinkinen & Harmaakorpi, 2019, p. 250).

There has been also critique should the ecosystem concept being used in the business literature. Based on theoretical analysis ecosystem as a biological concept, fails to capture the complexity of dynamic environment and social aspect of knowledge and innovation. Therefore, ecosystem provides more abstract and simplified explanation of social evolution and economics as a process of natural selection. Analogy should be kept more as a general metaphor of economics and social evolution, and it should be used critically and carefully in business literature (Papaioannou, et al., 2009, p. 336). The way ecosystem as a concept has been used in the academic literature so far reminds the usage of the 'startup' concept. Ecosystem concept's appearance has increased drastically, but it's been used often without proper definition, and it's been lacking the coherent definition as well among the researchers as practitioners (Rinkinen, 2016, p. 14). Despite presented shortcomings of the ecosystem concept in business literature, it's possible to define key characteristics of ecosystem phenomena. In management studies ecosystem concept provides a metaphor to describe collectives of heterogenous, complementary, organisational actors, who collectively produce ecosystem-level output. Ecosystems differs from most of the other organisational collectives, like supply chains, clusters, and networks, by the ecosystem output by the nature, heterogeneity among the participants and interdependence among ecosystem actors and their orchestration system. The presence of one of the activities doesn't yet distinguish the ecosystem, but combination of all four is unique to the ecosystems. (Autio & Thomas, 2021, p. 14).

System level outcome means that ecosystems are not defined by contractual relationships alone, and clear ecosystem roles and shared standards between the ecosystem actors, enables them to participate in fruitful interactions that generate ecosystem level output which is coherent, greater than any single actor can deliver alone and often targeted to defined audience (Thomas & Autio, 2020, p. 4). Each ecosystems have heterogenous group of stakeholders that are independent hierarchically but hold specific roles in ecosystem. Participant hierarchy doesn't distinguish ecosystems from other organisational collectives alone, but heterogeneity among the participants is often broader and can span multiple industries (Autio & Thomas, 2021, p. 14). Interdependence in ecosystem refers to the link which heterogenous ecosystem actors have

in between. It can be physical connection, spatial proximity, technological complementary, economic links, shared templates, technical interconnectedness, and mutual and indirect co-dependency on direct and indirect network effects. In technological interdependence ecosystem actors are cospecialised, often around unique resource shared platform or common modular architecture. In economic interdependence value that each actor receives from the ecosystem is dependent on availability of compatible offerings by others. In cognitive interdependence ecosystem actors has a set of mutually shared patterns, ways to operate, values and believes, which provides interactions that guide and constrain decision makers (Autio & Thomas, 2021, p. 15).

Ecosystems have different orchestration - sometimes referred as coordination, intermediation or brokering- mechanisms that rely on role definitions, complementary and technological, economic, and cognitive alignments that maintain the stability between change and stability. Instead, on to on supplier contracts, like in supply chains, ecosystems rely primarily on noncontractual mechanisms to maintain coherence in ecosystem efficiency and output. Ecosystem participants choose to join the ecosystem in specific roles, knowing that if they violate the role expectations, they have possibility to be shunned from ecosystem (Autio & Thomas, 2021, p. 15). Each ecosystem consists of a unique set of ecosystem actors, constituents, and interactions between those evolving in its own manner. Each ecosystem actor has their own role in the ecosystem, and they view the ecosystems from unique perspective. Overlapping ecosystems creates each ecosystem actor role even more complex, since one actor can be part of multiple ecosystems and have different roles in them. Figure 4 Illustration for overlapping ecosystems presents the illustration of overlapping ecosystems, geographical ecosystems are presented in different shades and business vertical ecosystems with dashed line. From the illustration can be seen that one actor can be simultaneously part of multiple regional ecosystems and cross cutting vertical ecosystems.

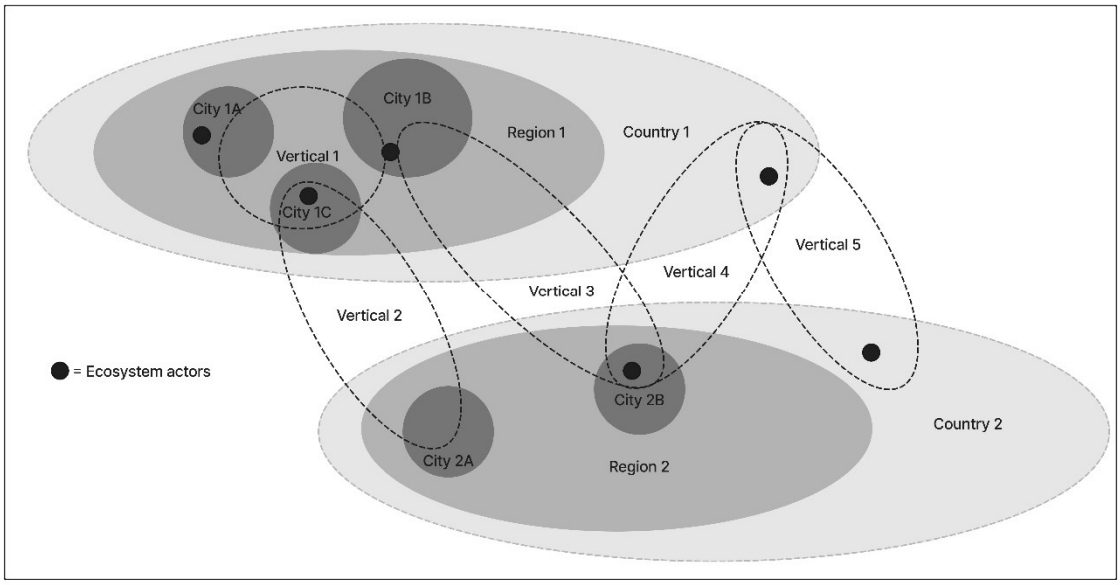

Figure 4 Illustration for overlapping ecosystems

It's been proposed that rather than focusing on ecosystems as platforms, ecosystems should be understood as structures and interactions between interacting actors. The decisions and outcomes of the related activities that are taken throughout the evolution of an ecosystem also influence ecosystem's present and the future state, as each decision delivers raw material for following decisions (Valkokari, 2015, p. 18). Because ecosystems are not linear, but by definition self-organising, complex, and dynamic by its nature, they are evolving and changing as well as they are changeable through ecosystem orchestration. Ecosystems are evolving with trial and experimentations, which requires strong experimentation culture (Rinkinen, 2016, p. 52).

Based on this analysis, we can summarise that ecosystem are complex and dynamic systems that are self-organising by its nature. Ecosystems are evolving and they change over the time and even they have evolutionary nature, it's possible to change them through orchestration. Ecosystems are overlapping each other, and they are formed by heterogenous group of ecosystem actors that hold different ecosystem roles and share interdependent relationships between other actors. All ecosystem actors participate in productive interactions that generate ecosystem level output, which is coherent, greater than any single actor can deliver alone and often targeted to defined audience.

2.1.3 Startup ecosystem phenomenon

Previous chapters have analysed what startups and ecosystems are. Based on findings that are presented so far, it's become clear that startups have been strongly linked to the entrepreneurship and innovation ecosystems. Studies show that there's strong relationship between entrepreneurship and innovation and the literature of those ecosystems evolve parallel in the academic literature. Yet there's little research from the intersection of the innovation and entrepreneurship and innovation ecosystems (Ianioglo, 2022, p. 2). It's also become clear that ecosystems are overlapping, and every ecosystem actor has a unique perspective to their own ecosystems. This chapter tries to differentiate startup ecosystem from other similar ecosystems and highlight its unique characteristics. To be able to do that it's important to study how startups are presented in the context of innovation and entrepreneurship ecosystems. Concepts of entrepreneurship and innovation ecosystems are often merged in the academic literature as well as in practice. Despite all of the similarities, both ecosystems are quite distinct. One of the major differences is that not all innovations are associated with entrepreneurship and at the same time not all entrepreneurs innovate. It's also been noticed among the researchers that innovation ecosystem literature traditionally ignores the entrepreneurship even the link between these topics has become clear. (Siegel, et al., 2019, p. 823).

Importance on being precise with terminology has been highlighted through this research and that applies to the ecosystem concepts as well. Being clear which concept of ecosystem researchers are using helps others to contribute to the subject and it enables the knowledge and creativity to cumulate. In entrepreneurship ecosystem literature, startups are many times narrowed down to the scale ups, claiming that it's the most important source of innovations, employment, and growth if productivity. This way to define the entrepreneurial ecosystem is very exclusive, it doesn't include startup development phases, innovative startups, and entrepreneurial employees. Academic literature also excludes other entrepreneurial activities like small businesses and self-employment when defining the entrepreneurship ecosystems, even they are clearly entrepreneurial activities. (Stam, 2015, p. 1761).

While there are several different definitions on entrepreneurial ecosystems in the literature and multiple researchers still don't differentiate entrepreneurship ecosystem from startup ecosystem (Harima, 2020, p. 40) even it's clear amongst part of the scholars that startups differentiate from traditional entrepreneurship, small and medium size enterprises, which follow rather linear growth paths with validated business models. Startups create innovative products and business models, which are new to the market, and they aim to scale business rapidly (Harima, 2020, p. 1). These two types of entrepreneurships are entirely different from each other for a numerous reasons like risks involved and economic outcome. They have different goals and face different challenges; therefore, they need different type of support from the ecosystem to thrive. While it's been recognised that there needs to be separation between these two distinctive types of entrepreneurships, some scholars refer them as entrepreneurial activities and entrepreneurial ecosystem (Harima, 2020, pp. 17-18). Separation presented above is commonly used in the entrepreneurial ecosystem literature, but it has several issues. It makes the entrepreneurial ecosystem and startup ecosystem redundant in literature and practice, which only creates confusion amongst the scholars and practitioners as well. It's been presented that because the traditional small and medium size companies needs differs from the startup needs, which leads to the situation where they need also different type of support. It means that actors, organisations, and services that are vital to the traditional small and medium size businesses are not necessarily important to the startups and other way around, even if they share the same geographical location (Harima, 2020, p. 18). Still both type of entrepreneurships needs different support mechanisms, services, and actors, that is ecosystem, to thrive. The level of ambiguity in ecosystem terminology is result the underdevelopment of theoretical ecosystem concepts. This thesis will focus specifically on the startup ecosystem, which is clearly overlapping with entrepreneurial ecosystem.

Like entrepreneurial ecosystems, innovation ecosystems have not defined univocally either. Some scholars research open innovation, others at the value creation and capturing process or the role of ecosystem orchestrators etc. Innovation ecosystems are also studied through the lens of some specific industries, different ecosystem actors and success factors etc. (Yaghmaie & Vanhaverbeke, 2019, p. 1). Traditionally innovation process used to happen inside the company boundaries and innovation ecosystem used to be linear and simple. While open innovation is becoming mainstream, it's challenging traditional innovation ecosystems to transform towards

startup ecosystems. That means open innovation have transformed the innovation process into non-linear global ecosystems, when traditionally innovations used to be closed and expensive. In contrast, startups use often free or affordable technologies, infrastructure, new digital platforms, and new channels for product or service launches. While innovation ecosystems used to be dependent on gate keepers and hosts, startup ecosystems have flexibility, swiftness, and cost-effectiveness with support from public and private sectors (Ketola, 2019, p. 11).

Startups are vital in amplifying innovation, satisfying customer demands, job creation, and other economic demands. It's well known fact amongst the scholars that important characteristic of startup entrepreneurs, is their capability to innovate. Startups are the ones who search innovative ways to capitalise idea to a new venture and develop the business. Innovation is acknowledged as an essential component in fostering growth and that's the reason why startups create considerable economic value in society. These factors have forced larger companies and enterprises out of isolation to the non-linear innovation ecosystem, where scarce resources are shared with entrepreneurial actors and startups. (Ianioglo, 2022, p. 1). Sharing the resources with the innovation ecosystem, leads companies to collaborate with startups one way or another. Companies are often searching problem solutions externally from their ecosystem. These can be for example startups, which can source for their internal innovation, and in the other hand, due their specific nature and scarce resources, startups are often searching for external technologies and ideas. For that need companies may spin out technologies that have already been commercialised. (Herzog, 2011, p. 21).

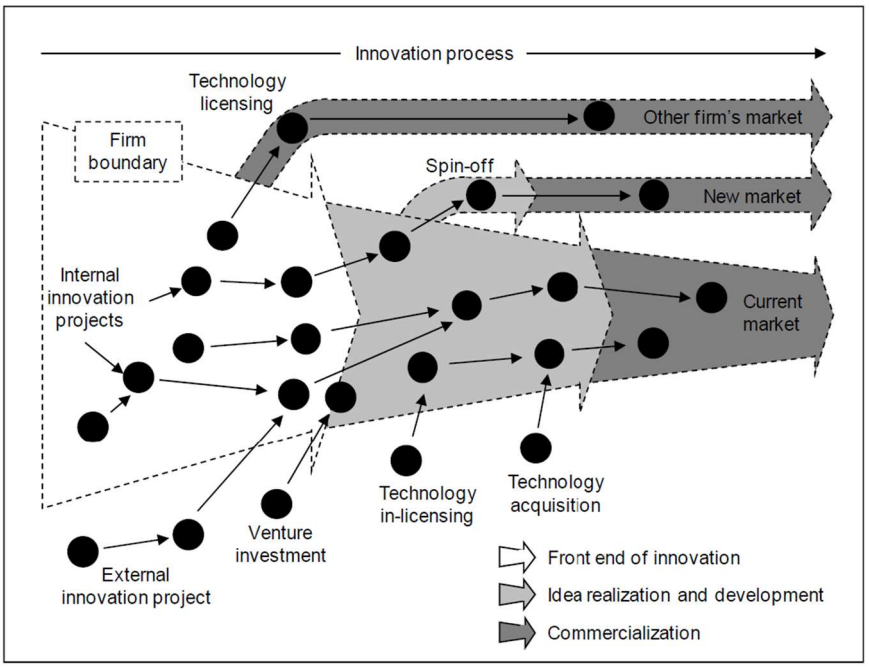

Figure 5 Open Innovation model **(Herzog, 2011, p. 23)**

Figure 5 presents the open innovation process from the perspective of the individual company. While open innovation is increasing its popularity, it challenges the traditional innovation ecosystems to transform them closer to the startup ecosystems (Ketola, 2019, p. 11). Scholars also argue that due the impact of the open innovation, innovation ecosystems should be explored through the lens of the open innovation. Vast majority of the open innovation studies have so far been primarily focused on the single company level of analysis. This kind of restrictions in the open innovation studies leads to the number of shortcomings. Like stated previously, every ecosystem actor has unique window to the ecosystem and focusing only the one ecosystem actor creates a very biased view from the ecosystem, which can ultimately lead to the failure of the open innovation model and specific ecosystem. Similar type of approach has been common on the innovation ecosystem studies. Majority of the studies have focused on single ecosystem actor, for example profit organisations or non-profit organisations like government agencies, universities, research centres or accelerators etc. Ecosystem thinking needs to be expanded much more broadly than a single ecosystem actor and it requires an in-depth understanding of the objectives and incentives of all ecosystem actors. Ecosystem approach collects the perspectives of all actors and provides an unbiased view of the actors involved in the ecosystem. Therefore, to achieve more comprehensive understanding of the

open innovation implications to the ecosystem as a whole, is necessary to have innovation ecosystem perspective. (Yaghmaie & Vanhaverbeke, 2019, pp. 2-3).

Ecosystem action logic varies in different ecosystem types. Innovation ecosystem theory and highlights fostering the growth creation, collaboration, and startups around so-called knowledge hubs, which Silicon Valley is prime example. That has led to the situation where innovation ecosystem studies have ignored that the ecosystems are global, and it's complicated to create geographical borders to them (Valkokari, 2015, p. 19). Present day development indicates that innovation ecosystems are focusing on internationalisation and growth oriented startups (Laasonen, et al., 2020, p. 12). Ecosystem actors can be part of multiple ecosystems, have different roles in them and ecosystems can be overlapping or connected with different ways. For example, highly mobile ecosystem actors, like platform also may be interconnecting factor between the ecosystems. Because of the platforms, and other interconnectivity actors ecosystems have possibility to interact with each other (Valkokari, 2015, pp. 19-20).

In this chapter it's presented so far how startups how startups are presented on the entrepreneurship and innovation ecosystem literature. It can be summarised that ecosystem literature lacs the cohesive definitions from both ecosystem types. However, it's clear that startup ecosystems are heavily overlapping the innovation and entrepreneurial ecosystems, yet they are still different. The entrepreneurship ecosystem represents a group of actors that cooperate within a geographically bound entrepreneurial environment and factors, which contribute to the development of productive entrepreneurship. Innovation ecosystems represent communities of cooperating actors that support innovation processes and produce innovations (Ianioglo, 2022, p. 12). Startup ecosystem represents people and startups in their various stages and various types of organisations, interacting as a system to create new startup companies. Innovation more likely occurs in entrepreneurial ecosystem, which have right actors, processes, and surrounding culture (Siegel, et al., 2019, p. 1). While startups are created around the innovations, startup ecosystem can be located in the intersection of entrepreneurial ecosystem and innovation ecosystem. Figure 6 presents illustration of overlapping's between innovation ecosystem and entrepreneurship ecosystem. Illustration shows that startups ecosystem is seeding in the intersection of innovation and entrepreneurship, being influenced by both ecosystems.

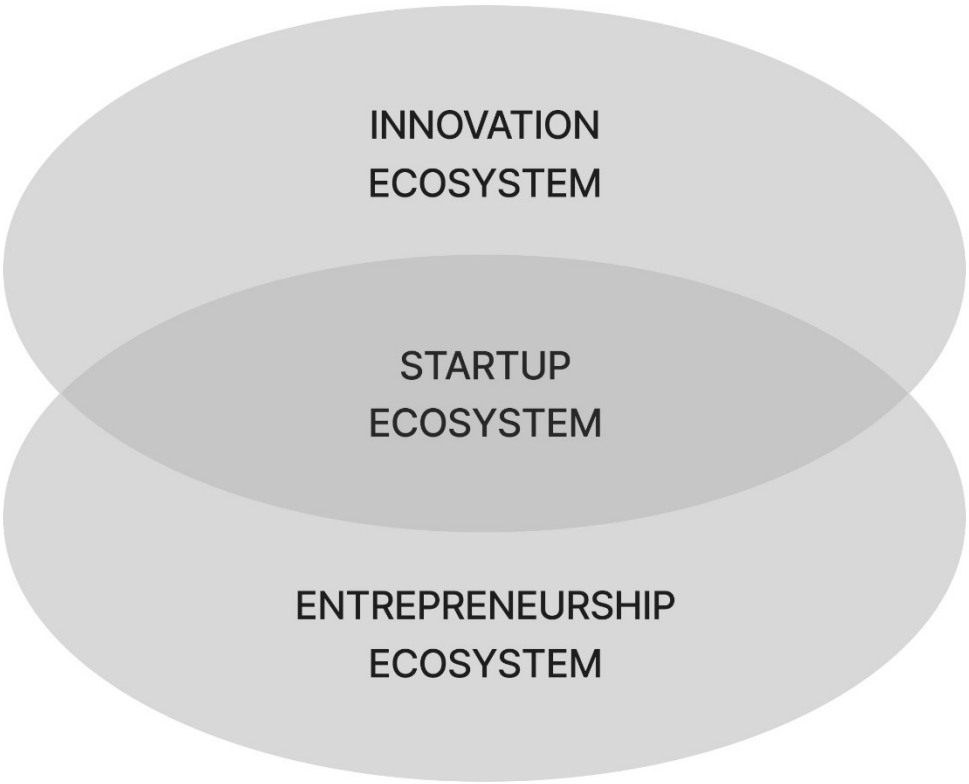

Figure 6 Overlapping ecosystems

Even the ecosystems have lot of common features, characteristics and even share same actors, there's major differences between them. In previous chapter one of the ecosystem characteristics were that there is a system level output from the ecosystem. In innovation ecosystem the system level output is value creation through the new innovations while in the entrepreneurship ecosystem aims to development of entrepreneurship itself (Ianioglo, 2022, p. 1). Startup ecosystems focuses on creating new startups and the system level output of startups ecosystem can be defined as number of new startups it produces.

2.1.4 Startup ecosystem formation

Due the special characteristics of startup companies, required services differ compared to traditional business services. Startups are strongly focused on growth, internationalisation, market drive and their sense of community (Ketola, 2019, p. 17). These factors, together with startups in different phases of the development framework creates a very specific needs to the surrounding ecosystem. Sustainable startups ecosystem is a result of long term ecosystem development, and it cannot be instantly implemented. Instead focusing on the dynamic nature of the ecosystems, many of the ecosystem studies are focused on static picture of the ecosystem. Ecosystems are dynamic by their nature and constantly evolving through the interactions between ecosystem actors. Ecosystem dynamics are evolving over time while being very complex and depend on multiple internal and external factors on different scales (Ianioglo, 2022, p. 5). It's notable that each ecosystem is different by their nature, and therefore the needs and deficiencies of the ecosystems are also different. For example, fostering a developing ecosystem requires different measures compared to a mature ecosystem. Networking of actors is especially important in the early stages of the ecosystem, while for a mature ecosystem it is essential to for example taking care of competences in the ecosystem. As ecosystems have evolutionary nature, dying ecosystems should not be artificially supported, but resources should be concentrated and directed to support their regeneration. Forming and developing of ecosystems requires cooperation from all ecosystem actors (companies, ministries, agencies, municipalities, regional actors, etc.). Each of these actors must find their own role as part of the ecosystem. Comprehensive development of the ecosystem environment and active ecosystem building requires close interaction and active cooperation and network building. In ecosystemic politics this practically means combining "top-down" and "bottom-up" approaches. (Kaihovaara, et al., 2016, p. 7).

Ecosystems have spatial a dimension. Generally, ecosystems are geographically bounded, but there's no limitation to the geographical scale. The ecosystem emerges as a result of successful interactions between the actors at different levels and they can be seen as local, regional, national, or global ecosystems. However, local, regional, or even national ecosystems cannot function alone, but must find their place as part of global ecosystems, since due rapidly increased social networks and digitalisation, entire globe can be seen as one big network of startup ecosystems (Kaihovaara, et al., 2016, p. 4, Ianioglo, 2022, p. 5). When ecosystem is formed, all the ecosystem actors in it needs to start adopting various roles in the ecosystem and

adapting their processes and operations accordingly. Ecosystem actors can have multiple roles in the ecosystem and as the ecosystem develops, these roles can change and grow to become part of geographically larger ecosystems (Ketola, 2019, p. 15). In the core of startup ecosystem are the startup companies. That's why it is crucial to understand and monitor the ecosystem in larger scale to be able to focus on the ecosystem development, services, policies, and measures in a way that they support the development of the startup companies (Ketola, 2019, p. 18).

2.1.5 Startup ecosystem key elements

Startup ecosystems are combination of different actors and activities, these actors and activities can be described as a key elements of the startup ecosystem. Despite the spatial element of the ecosystem, startups ecosystems have regional dimension too, which enables to define who are the stakeholders in the ecosystem. Startup ecosystem actors are startups in various stages, entrepreneurs, startup team members and other groups of actors who have self-interest in the ecosystem, for example investors, talents, mentors, advisors, and other entrepreneurial minded people. These people collaborate with various ecosystem organisations such as ecosystem support functions, service providers, finding agencies, government, and educational institutions. Dynamic startup ecosystems include activities various types of events and startup competitions, startup blogs, other business media, and other facilitators. Figure 7Figure 7 Startup ecosystem key elements shows the key elements of the startup ecosystems (Tripathi, et al., 2019, pp. 77-79, Startup Commons, 2022).

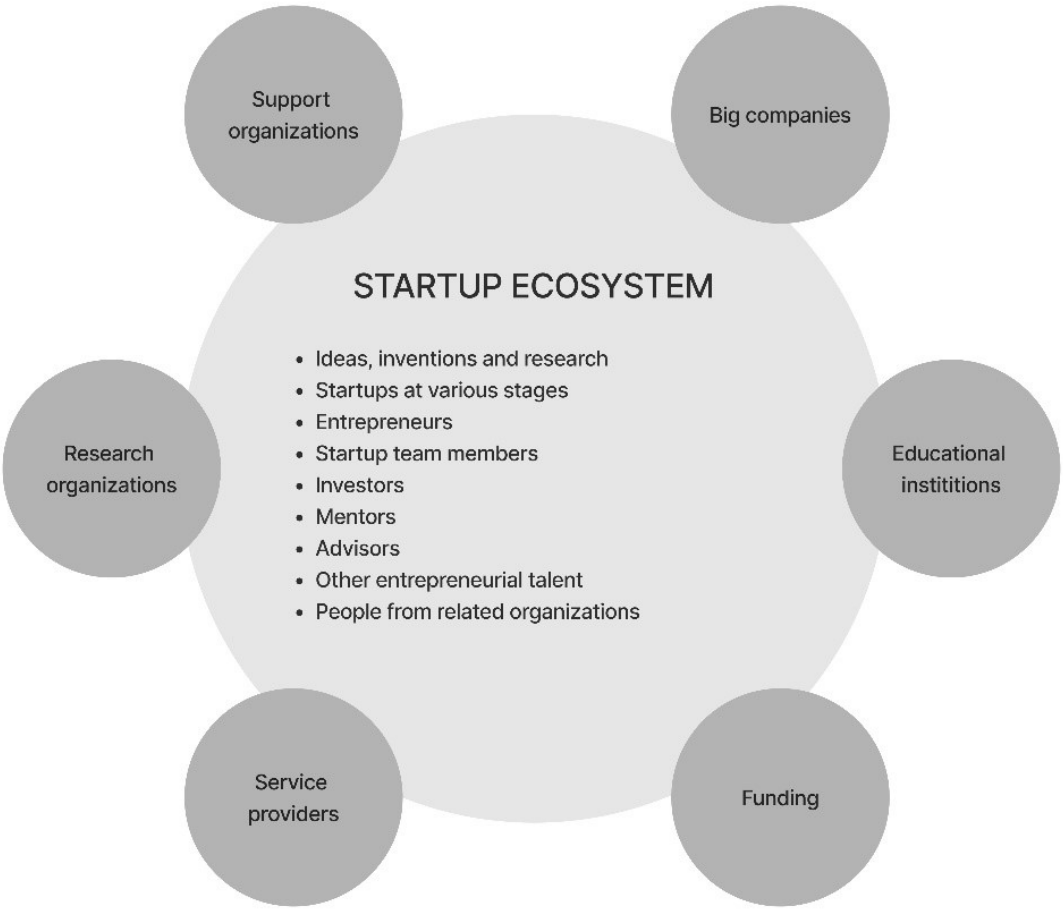

Figure 7 Startup ecosystem key elements **(Startup Commons, 2022)**

Dynamic startup ecosystem produces new startups companies which has positive economic impact, not only to the region, but as a country in a larger scale. By producing new jobs and attracting international talent ecosystems acts as a driver of growth and increases domestic product development (Ketola, 2019, p. 13). It's also important to recognise that ecosystems have always local component in them, and each ecosystem has unique structure, and it may vary in different geographic locations. Important is ecosystems ability to ensure system based support for startup creation, enabling access to markets, finance, human capital, and knowledge. (Ianioglo, 2022, p. 5). People are the fundamental component in the ecosystems. Innovations are results of interactions and work of people (Mulas, et al., 2015, p. 19). Creative people and entrepreneurs tend to seek living in areas where quality of life is high, atmosphere is diverse and permissive. They are looking for social activities and their peers. Competent people, on the

other hand, attracts other resources, like big companies and funding to the region. While entrepreneurs are seeking for startup support, cities are competing from the talents. The most attractive cities and regions are able to attract talent all over the world. Cities and regions are using different ecosystem elements to promote the area for the talents, thus improving and developing the startup ecosystem creates the positive cycle which pulls more talent to the area and feeds the organic growth of the ecosystem. (Mulas, et al., 2015, p. 10, Kaihovaara, et al., 2016, p. 4).

Startup ecosystems need various support organisations to thrive. Support organisations are public and private actors which cater support services directly to the startups and business creators. Typical support organisations are for example incubation and acceleration programs, but coworking spaces and event organisers etc. Oftentimes support is free, or it have some nominal fees, subsidised by larger organisation or public funding. Sustainable startup ecosystem has multiple different support organisations to cover the whole startup journey from idea to product and from talent to team. In the product side startups need support starting from ideation and product design, then expanding it to the product building, validation, business model design, testing, an eventually to the product scaling and business model validation. In the team side, in the beginning, support is needed for education, inspiration, and co-founder matching, then expanding it to team building, training, mentoring, seed investor and expert matching, and eventually to the venture capital investors, corporate and international partnerships. Most effective and valuable support is when organisations are providing it for a specific need at specific stage of the startup development (Startup Commons, 2022). As the support needs in the ecosystem are described above, it's clear that in the early stages of a startup, founders often lack practical experience, and they need different type of a support than the later phases of the startup development (Tripathi, et al., 2019, p. 87). When the startups are moving forward in the startups development phases, their needs also change, and ecosystem support should be catering services for that need.

Due the special nature of the startups, entrepreneurs are forced to use distinctive types of resources, networks, and learnings than other businesses do. Resources also include startup funding. While traditionally small businesses finance their operations on loans from banks, innovative and growth-oriented startups mostly seek equity funding from business angels or

venture capitalists (VC). This is simply because startups pursue the development of innovative products and services, which are new to the market, and their activities therefore involve high risks of failure (Harima, 2020, p. 18). Venture capital firms and investors can invest to the startups when there is minimum viable product with rich user experience and potential to scale. This might affect how startups want to design their product, so it will attract investors attention. Investors who invest in startups also can provide their perspective on how to improve the product to increase their return on investment. Optimum level of funding can act as a positive stress to the startup team to build the product efficiently and with allocated time (Tripathi, et al., 2019, p. 88). It's clear that the equity funding is more common in the later phase of the startup development. In the earlier phases, startups can use ecosystem support functions, like different accelerators, incubators, or crowdfunding portals for seed funding. Additionally, startups can apply local or regional startup development fundings, or grants provided by cities, municipalities, or non-governmental development organisations. Availability of such funding opportunities varies depending on the geographical and business vertical ecosystem which startup operates. One form of seed funding the startup is called bootstrapping, which means that startup team fund their own venture by themselves.

Big companies and corporations in startups ecosystems reflect the regional business ecosystem and they're connected to the startup ecosystems via open innovation model presented previously in this thesis. Big companies have generally more extensive resources to innovate, execute and act in the ecosystem than startups. Big companies also have often vision about the future and use their resource in the ecosystem to steer it to the direction they envision. Actions of big companies can also be measured (Ketola, 2019, p. 9). Research organisations and educational institutions, like universities are the one which keeps feeding the startup ecosystem with new talents, ideas, inventions, and researches. In functional startup ecosystem high educational institutions focus on university-industry collaboration, and required processes, mechanisms, and services to promote and improve the research commercialisation for supporting the startup ecosystem to increase the mobility of students and researchers into business life (Laasonen, et al., 2020, p. 12).

Startup ecosystem also contains various service providers which are part of business creation. These traditional services including for example consulting, accounting, and legal services etc.

The number of services available in the ecosystem depends on how sustainable and vibrant the ecosystem is. Public sector and local government have a service provider role in the ecosystem, but on the top of that, they have unique role also in managing the common ecosystem resources, how services should be carried out (Ketola, 2019, p. 9). Public sector is the one, who sets the rules for the ecosystem and competition through laws and regulations. From ecosystem perspective it's important that public actors and organisations are not business actors in the ecosystem, but act as facilitators, sponsors, regulators, and enablers. Public sector can provide the platform as a service to the ecosystem for cooperation and develop the ecosystem as well as startups (Rinkinen & Harmaakorpi, 2019, p. 257).

Based on this analysis, as a summary from the startup ecosystem key elements, can be said that the startup ecosystems are multidimensional combinations of economic, political, social and cultural elements within a specified regions that supports the development and growth of innovative startups and inspires entrepreneurs and other ecosystem actors to take risks of starting, funding, and assisting high risk ventures (Spigel, 2015, p. 2).

2.2 Ecosystem orchestration

In the literature one of the main characteristics of the ecosystems is its self-organised nature. Still especially in innovation- of platform ecosystem literature the role of ecosystem orchestrator is often highlighted. There are researches highlighting that even the self-organisation is one of the key components of the ecosystem, but at the same time, some scholars show that they are not entirely self-organised. Formal authority is invisible in the ecosystems, but they are organisational designs that are held together on the condition that ecosystem members are formally, or informally agreed about the purpose and operational model of the ecosystem. Ecosystem requires strategic decision making and orchestration mechanisms to thrive (Valkokari, 2015, p. 22). It has been pointed out by the scholars that orchestrator role in the ecosystem is key function that shapes the ecosystem, stimulate the cooperation amongst the partners, setting the research agenda, and adds value through its own capacities. Ecosystem orchestrator can positively influence the ecosystem success if it's able to create structure in the ecosystem that stimulates cooperation in the ecosystem (Leten, et al., 2013, pp. 51-52).

Ecosystem orchestrator have been referred with variety of names in literature. In innovation and business ecosystem literature most commonly used terms are hub firm or some other hub (Yaghmaie & Vanhaverbeke, 2019, Gupta, et al., 2020, Dhanaraj & Parkhe, 2006, Masucci, et al., 2019, Järvi, 2013) and keystone organisation or player (Rinkinen & Harmaakorpi, 2019, Iansiti & Levien, 2004). The most central actor in the ecosystem have been referred also as key actor, triggering entity, strategic centres, flagship firm, relationship-centred organisation, platform sponsor or a leader and ecosystem architect (Järvi, 2013, p. 19). In platform and digital ecosystem literature same central actor is most commonly referred as platform owner (Smelund, et al., 2018, Isckia, et al., 2020, Ivarsson, 2018).

In this thesis the most centric actor of the ecosystem is referred as ecosystem orchestrator. Orchestrator is neutral term describing the actions that the central actor of the ecosystem is performing. Orchestrator as ecosystem role is already established in the ecosystem literature as well as with the practitioners. Orchestrator term covers all of different type of ecosystems and it all the activities that currently ecosystem key organisations are performing. Ecosystem orchestration is described as deliberate, purposeful actions undertaken by a focal actor (orchestrator) to initiate and manage the construction and collaboration of the ecosystem. Based on this definition ecosystem orchestration is not about the management under hierarchical governance, but more influencing the actors (Hurmelinna-Laukkanen, et al., 2022, p. 175). Actual activities that ecosystem orchestrators do is a sum of multiple complex combinations. Ecosystems have diverse set of actors in different objectives which makes interactions and value creation and capturing challenging task. In premise the ecosystem orchestrator is the one and, in most cases, only actor that is looking after the whole ecosystem. Main responsibility of the orchestrator is design and management of the ecosystem. Orchestrator is the one actor who is removing the obstacles and resolving the challenges that are shared in the ecosystem. Collective ecosystem competitiveness depends on the ecosystem maturity, size, leadership, cohesion, and other aspects. (Yaghmaie & Vanhaverbeke, 2019, pp. 7-8).

Hurmelinna-Laukkanen et al. (2022, pp. 171-172) have studied how other studies have addressed the ecosystem orchestration and found that the management practices used by orchestrators in innovation networks can be influenced by the features of the ecosystem itself. For example, that the number of actors in an ecosystem or the diversity of those actors can be

a factor in determining the orchestration mode as well as the usefulness and necessity of an ecosystem conductor in high and low complexity settings. Different orchestrators may have different positions within an ecosystem, which can affect how they orchestrate it. It's also argued that the orchestration of ecosystems can vary depending on the value-creation logic of the innovation being pursued. Studies have also indicated that the orchestration practices used in innovation ecosystem can change over time as the ecosystem progresses from an embryonic stage to a more mature and phase. Orchestration can shift between different modes, and it's argued that multiple forms of orchestration can coexist, as a phenomenon referred to hybrid orchestration. Studies also pointed out the need for different capabilities at different phases of ecosystem evolution and addressed ecosystem governance in the formation and growth phases of an ecosystem compared to later stages. Overall, these studies suggest that the alignment of ecosystem properties and orchestration practices are important, and that changes in one can lead to changes in the other.

Ecosystem orchestration is essential for the success of ecosystems. Therefore, it is important to have clear orchestration strategy, a thorough understanding of how to coordinate and manage or influence the various organisations, individuals, and other components within an ecosystem. Previous studies have explored the different ways that orchestrators can manage and support the ecosystem to achieve a desired outcome. (Yaghmaie & Vanhaverbeke, 2019, p. 4) However, it is important to note that the role of orchestrators may vary depending on the specific goals and objectives of the ecosystem and can only be defined in relation to the roles and interactions of other actors within the ecosystem (Yaghmaie & Vanhaverbeke, 2019, p. 14). The orchestration and development of vibrant and dynamic ecosystems requires the creation of collaborative platforms that facilitate communication, information exchange, and collaboration among the various organisations, individuals, and other components within the ecosystem. These platforms can take many forms, including physical, digital, or social platforms for collaboration, and can provide a range of benefits to the ecosystem (Ketola, 2019, p. 7). Khairool Adzelan, manager of the ecosystem development and digital innovation from the Sarawak Digital Economy Corporation (SDEC) in Malaysia, explains the main purpose of the startup ecosystem orchestration as follows: Managing expectations and coordinating with different ecosystem actors are important tasks for any organisation. One way to achieve this is by creating a single source of truth, a comprehensive and accurate body of knowledge that

everyone can refer to and contribute to. This can be done manually, verbally, or ideally, systematically through recording and documentation. By having all actors focus on the benefits of the ecosystem and referring to this single source of truth, issues can be quickly resolved and presented statistically and quantitatively to policy makers for consideration in policy changes. This approach helps to ensure that the organisation is working towards the common goal of improving the ecosystem and staying a cohesive and effective (Startup Commons Global, 2022).

One of the key roles of these platforms is to orchestrate by supporting and promoting regional collaboration within the ecosystem. By facilitating interactions and connections between different organisations and individuals within the ecosystem, these platforms can help to enrich the ecosystem and support its growth and development. Public organisations can play a crucial role in facilitating regional collaboration within an ecosystem, by providing the necessary resources and support to enable collaboration and coordination among different stakeholders (Ketola, 2019, p. 7). Another way to think about these platforms is as the "synapses" of the ecosystem, forming a neural network that allows the ecosystem to function and thrive. These platforms can provide the necessary infrastructure and support to enable the ecosystem orchestration for the growth and development and can help to foster collaboration and coordination among the various organisations and individuals within the ecosystem. By supporting and promoting the development of these platforms, stakeholders can help to create a vibrant and dynamic ecosystem that is well-suited to supporting and promoting innovation, entrepreneurship, and the development of new startups (Ketola, 2019, p. 8). The literature on platforms has largely focused on the role of the platform owner in orchestrating the platform ecosystem, and on the ways in which platform orchestration can influence innovation, development, and transactions within the ecosystem. In physical ecosystems, orchestration is typically understood as facilitating the processes that lead to and promote relationships and activities among the participants in the ecosystem. In the case of service platforms, orchestration can impact how well actors in the ecosystem are able to innovate and develop new offerings, and to organise and execute transactions (Smelund, et al., 2018, p. 30). Platform literature emphasises that the platform owner is in a key position to orchestrate the platform ecosystem. The orchestrator is responsible for sharing standards, developing a platform vision, maintaining the integrity of the platform and its evolution, and determining to some extent who

can join the ecosystem as a participant. However, there is a lack of theories and empirical studies on platform ecosystem orchestration in the literature, and more research is needed in this area to better understand the role of the orchestrator and the impact of orchestration on the platform ecosystem (Smelund, et al., 2018, p. 32). Like presented above, in the literature and in practice, innovation ecosystems and platform ecosystems often form around key actors such as hub firms or platform owners, who serve as the orchestrators of the ecosystem. These orchestrators are responsible for coordinating and managing the various organisations, individuals, and other components within the ecosystem, and for supporting and promoting innovation and entrepreneurship within the ecosystem. However, in the startup ecosystem, it is not always clear who the central actor with a holistic view of the ecosystem is, and in many cases, there may not be a clear orchestrator within the ecosystem. This can create challenges for the ecosystem, as the lack of a dedicated orchestrator can make it difficult to coordinate and manage the various organisations, individuals, and other components within the ecosystem, and to support and promote innovation and entrepreneurship.

In many cases, the orchestrator of the startup ecosystem may not be a single entity or organisation, but instead may be a group of intermediaries or other organisations who possess a significant amount of data about the ecosystem. These organisations may include accelerators, incubators, venture capital firms, or other actors who have a strong presence within the ecosystem and who possess a wealth of knowledge and data about the ecosystem. While these intermediaries may be well-suited to perform many of the orchestration duties within the startup ecosystem, it is important to note that they are not necessarily the actor that is overseeing the entire ecosystem. Instead, they may be focused on specific stages of the startup life cycle, or on specific types of startups, and may not have a comprehensive view of the ecosystem as a whole. For example, startup accelerators are sometimes referred as a startup ecosystem orchestrator because they have important intermediary role in connecting entrepreneurial ventures with potential sources of funding, new customers, and peer-based mentors. Accelerators can potentially play a very powerful role in the startup process by alleviating information asymmetries facing small firms, such as difficulties obtaining finance from investors. Through their intermediary roles, accelerators can act as "middlemen" or "network intermediaries," connecting firms with access to sources of finance, contacts, and expertise. Furthermore, accelerators also appear to play an important intermediary or "brokerage mechanism" role,

providing startups with enhanced relational connections and networks. This brokerage or intermediation role enables accelerators to engage in crucial "ecosystem intermediation processes" that transcend national boundaries. Overall, the intermediary role played by accelerators is a key factor in the success of the startup ecosystem (Brown, et al., 2019, p. 4). While accelerators can play a crucial role in supporting and promoting the growth and success of startups within the startup ecosystem, they are not the only actor involved in the ecosystem, and they do not cover the entire startup development process. In particular, accelerators typically focus on the validation phase of the startup life cycle, and do not address the formation phase that occurs before startups enter the accelerator program, or the growth phase that occurs after startups graduate from the program. Additionally, accelerators may be industry-focused, meaning that they only support startups within a specific industry or sector. This can create challenges for the ecosystem, as different accelerators may not share data or collaborate with each other, which can make it difficult to get a comprehensive view of the ecosystem as a whole. As a result, despite their important role in the ecosystem, accelerators are not the one actor that is looking at the entire ecosystem.

Public sector is one actor that is presented as a startup ecosystem orchestrator, because it’s interested about the ecosystem output and can cover the whole startup development phase, but as some scholars show operating within a startup ecosystem requires that public organisations adopt new ways of working. The public sector cannot establish or manage the ecosystem, and it is up to the ecosystem itself to establish and develop itself through collaboration and participation. In this context, the public sector can play the role of an enabler, providing support and resources to help the ecosystem thrive. The role of the public sector within the ecosystem should be flexible and adaptable, as the ecosystem itself evolves and develops over time. To support the growth and development of the ecosystem, public organisations should strive to create local structures that allow them to work flexibly and collaboratively, without being limited by organisational silos. It is important to understand that the public sector cannot lead the emergence and development of startup ecosystems, but its systematic support can be essential to the success of regional and local startup ecosystems (Ketola, 2019, p. 4). Also, Kaihovaara et. al. (2016, pp. 1-6) points out that public sector cannot directly manage ecosystems, but it plays an important role in building and developing ecosystems. In practice, the ecosystem policy is directed from an appropriately well-functioning operating environment

(e.g., education, research funding, infrastructure), also towards the general direction of the efforts of actors in the innovation field, towards societal challenges. The public sector cannot lead ecosystems, but it can follow development in many ways. Especially the effective use based on radical innovations for long-term risk financing - where the public sector can also play a direct or indirect role through public procurement. However, the public administration must be wise and subtle enough to arrive at ecosystems and let the ecosystem lead in a self-directed manner.

The ecosystem approach to the policy involves a shift in thinking about how policy is developed and implemented. Rather than focusing on individual, isolated measures, this approach requires the coordination and alignment of various policies and measures to achieve a shared goal (Kaihovaara, et al., 2016, p. 6). It has been observed that innovation policy has undergone both a "widening" and a "deepening," with governments becoming more proactive in their involvement and intervention in order to achieve broader socio-economic objectives. This expansion of government involvement has resulted in a broadening of the scope and depth of innovation policy, as governments seek to address a wider range of issues and challenges related to innovation and economic development. This proactive approach to innovation policy reflects a recognition of the importance of fostering innovation and entrepreneurship as a means of driving economic growth and addressing societal challenges (Laasonen, et al., 2020, pp. 1-3).

However, the concept of innovation policy as being systemic and broad-based highlights the need for a long-term, holistic approach to policymaking that takes into account the interconnections and impacts of different policy fields and instruments. This can be a challenging task, as policy goals are often periodically revised and updated, disrupting the continuity and coherence of policy efforts. This can have negative consequences for the achievement of other policy goals, as the focus shifts from one policy area to another and can hinder the ability of the ecosystem orchestrator to implement and sustain long-term changes. It is therefore important for policymakers to consider the potential impacts of policy changes on the broader ecosystem, and to strive for a more integrated and consistent approach to policymaking that takes into account the diverse needs and goals of all stakeholders (Laasonen, et al., 2020, p. 3). Based on that, it is important for startup ecosystem orchestrators to be free from political agendas in order to effectively facilitate and coordinate the ecosystem. This

independence allows the orchestrator to focus on long-term goals and objectives, rather than being swayed by short-term political considerations. To be able to effectively carry out their role, ecosystem orchestrators also need steady and reliable funding. Maintaining and facilitating interaction within the innovation ecosystem requires the use of appropriate activities and processes, and these activities often require sustained funding over a longer period of time. Short-term project funding is insufficient to cover the costs of these activities and relying on such funding can lead to a lack of continuity and coherence in the ecosystem (Ketola, 2019, p. 7).

Examples of national innovation ecosystems have demonstrated the importance of a perseverant and reliable player in maintaining and facilitating interaction. Such a player is able to build trust and credibility within the ecosystem and is able to engage with a wide range of stakeholders to coordinate and support the development of new technologies and businesses (Ketola, 2019, p. 7). To ensure that the startup ecosystem is healthy and vibrant, it is important for stakeholders within the ecosystem to identify and support the development of a central actor who can serve as the orchestrator of the ecosystem. This orchestrator should have a comprehensive view of the ecosystem and should be dedicated to coordinating and managing the various organisations, individuals, and other components within the ecosystem in order to support and promote innovation and entrepreneurship. By doing this, stakeholders within the startup ecosystem can help to create a vibrant and dynamic ecosystem that is well-suited to supporting and promoting the growth and success of startups.

In a summary an ecosystem orchestrator should be a key player in the startup ecosystem, responsible for coordinating and facilitating the interactions and activities of different stakeholders within the ecosystem. To effectively carry out this role, an ecosystem orchestrator should possess a range of characteristics and capabilities. The ecosystem orchestrator should have a strong mandate from the ecosystem, indicating the support and trust of the community. This mandate should come directly from the ecosystem actors, such as government agencies, academic institutions, industry associations, support organisations and other ecosystem members. The ecosystem orchestrator should also have a holistic view of the ecosystem, taking into account the interconnections and impacts of different policy fields and instruments. This requires an understanding of the key players and their roles, the resources and infrastructure

required for startups to born and develop as well as the potential barriers and bottlenecks that may hinder the development of new technologies and businesses. In addition, the ecosystem orchestrator should be interested in ecosystem-level output, rather than focusing solely on the needs of individual stakeholders. This requires a long-term vision that takes into account the broader goals and objectives of the ecosystem, and the ability to act in the short-term to address immediate challenges and opportunities. Orchestrator should have the capabilities and capacity to carry out the necessary orchestration activities, including engaging with stakeholders, coordinating resources and efforts, and supporting the development of new technologies and businesses. To effectively do this, the ecosystem orchestrator should be independent from political agendas and have steady and reliable funding to support their efforts.

3 ANALYSIS OF CHALLENGES IN ECOSYSTEM ORCHESTRATION

The purpose of this chapter is to identify and analyse the challenges faced in orchestrating startup ecosystems based on the document analysis conducted in this study. The chapter focuses on the challenges in four main areas: ecosystem fragmentation, cultural challenges, process challenges, and technology challenges. The chapter begins by defining each of these challenges and then delves deeper into the specific issues within each category. By identifying and analysing these challenges, this chapter aims to contribute to a better understanding of the complexities involved in orchestrating successful startup ecosystems and laying the foundation for conceptual solution for the challenges.

3.1 Ecosystem fragmentation

Startup ecosystems are complex systems that are characterised by their focus on entrepreneurship, innovation, and venture development. They are shaped by their regional context and the specific needs of the startups within them and are designed to support the development and growth of startups, with the ultimate goal of creating new value for local and global communities. The resilience and sustainability of startup ecosystems depend on the ability of these stakeholders to work together and support the development of the ecosystem as a whole. One of the key features of startup ecosystems is the importance of interactions and interconnections among the various stakeholders within them. These interactions and interconnections can take many forms, including communication, collaboration, resource sharing, and partnerships. They are essential for the functioning and growth of the ecosystem and are facilitated by mechanisms and platforms that enable communication and collaboration among ecosystem members (Velt, 2020, p. 29). The pattern of connectivity within a startup ecosystem is a key factor in the value proposition offered by the ecosystem. In a startup ecosystem, actors rely on each other's contributions to a greater extent than in traditional value chains, where partners can be more easily replaced (Linde, et al., 2021, p. 2). If a startup ecosystem is disconnected, the various stakeholders within the ecosystem struggle to communicate and collaborate with each other, which hinders the development and growth of the ecosystem as a whole. Without interconnectivity in the ecosystem, it increases the difficulty for startups to access the resources and support they need to succeed, such as funding,

mentorship, or access to customers. In addition, a lack of interconnectivity within the ecosystem may lead to the emergence of silos, where different stakeholders operate independently and are unable to access or contribute to the knowledge and resources of the larger ecosystem. This can reduce the efficiency and effectiveness of the ecosystem, as it may be harder for ideas to flow freely and for ecosystem members to learn from each other.

Furthermore, disconnectivity can also make it more difficult for the ecosystem to attract and retain talent, as it may be less appealing to potential ecosystem members who are seeking opportunities for collaboration and learning. This can limit the growth and potential of the ecosystem and may make it more difficult for the ecosystem to achieve its goals and create value for the local and global communities it serves. A lack of interconnectivity within a startup ecosystem can lead to the fragmentation of the ecosystem. Ecosystem fragmentation occurs when the various stakeholders within the ecosystem are unable to communicate and collaborate effectively with each other, which can result in the ecosystem becoming disjointed and disconnected. Ecosystem fragmentation can have negative consequences for the development and growth of the ecosystem (Kitchin & Moore-Cherry, 2021, p. 1921). Ecosystem fragmentation refers to the separation of various components in an ecosystem and reducing their ability to communicate, collaborate, and coordinate with each other. This can occur due to a range of challenges, such as geographical or social distance, lack of communication, differences in goals or interests, lack of the proper technology or tools etc.

As established above, there is various challenges in ecosystem that can eventually lead to ecosystem fragmentation. These challenges can be broadly classified into three categories: cultural challenges, process challenges, and technology challenge. Figure 8 visualises the ecosystem challenges as they are presented in this thesis. Cultural challenges relate to the differences in values, norms, and expectations among ecosystem stakeholders, while process challenges pertain to the processes involved in ecosystem orchestration. Technology challenges, on the other hand, are related to the use of digital tools and platforms for ecosystem orchestration. In this chapter, we explore the specific ecosystem challenges in ecosystem orchestration and their impact on ecosystem fragmentation.

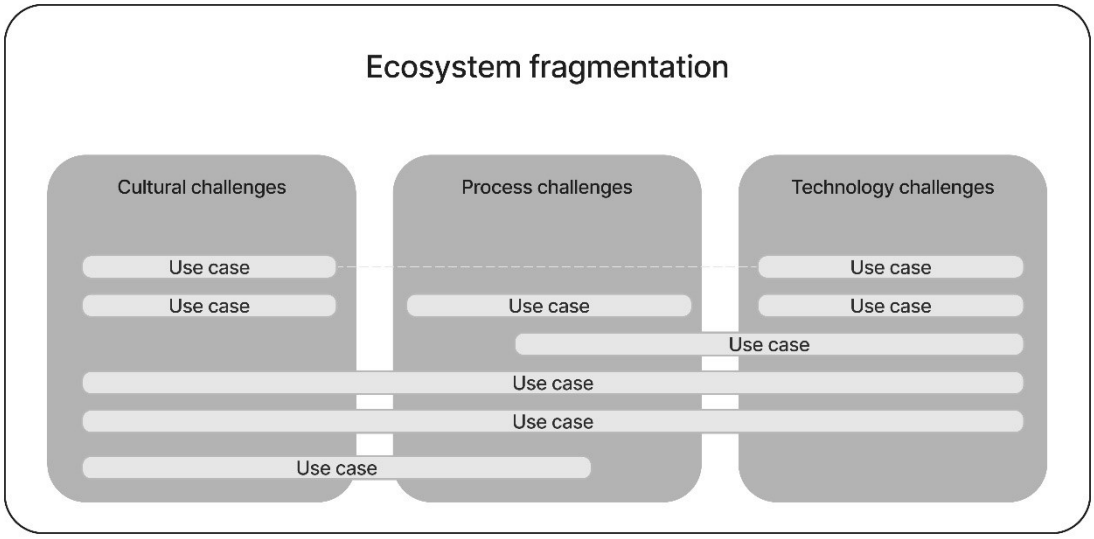

Figure 8 ecosystem challenges

In the next chapters each of these challenges are explained in more detail and their various use cases are explored by examples. By understanding these challenges and their corresponding use cases, we can develop a better understanding of how ecosystem orchestration can be improved, leading to more cohesive and integrated startup ecosystems.

3.2 Cultural challenges

One of the significant challenges that ecosystems pose is the cultural aspect of ecosystems. Cultural aspects include different dimensions, which are the local national or regional culture, local entrepreneurial culture, and the ecosystem culture. With the rapid changes in the ecosystem and the need to take new courses of action, the traditional heavy evaluation is mostly ineffective. More flexible and constant feedback mechanisms are required in order to be able to cut off failing trials and feed the successful ones in time. This also signifies the end of traditional and ineffective planning culture, project culture and roadmap culture (Rinkinen & Harmaakorpi, 2019, p. 258).

Ecosystems evolve through trials and experimentation, which requires a new kind of experimentation culture. The current state of the ecosystem necessitates an ecosystem

experimentation culture. Experimentation culture is defined by constant testing and iterative development, requiring a flexible approach that is open to change and adaptation. Ecosystems are an ideal environment for experimentation, and cultural challenges should be addressed to create a culture of experimentation (Rinkinen & Harmaakorpi, 2019, p. 258). The ecosystem culture should be supported by policies that offer platforms in which these trials can be carried out. These policies should be focused on providing an environment that encourages experimentation and provides feedback mechanisms for the ecosystem participants (Rinkinen & Harmaakorpi, 2019, pp. 258-259). The cultural challenges in ecosystem orchestration are closely tied to the different actors within the ecosystem and their unique priorities, bureaucracies, and cultures. In dynamic environments, institutional structures can both enable and constrain interactions across organisational boundaries. This variation in actors and their cultures can result in misaligned expectations and misunderstandings that hinder effective collaboration (Gupta, et al., 2020, p. 3).

Local culture can have a significant impact on the success or failure of an ecosystem. Different cultures may have different levels of support for entrepreneurship. For example, some cultures may value stability and security over taking risks and may be less likely to support new and unproven ideas. Other cultures may be more receptive to change and may have a greater tolerance for risk. This shows especially, when comparing ecosystems that have different national and entrepreneurship cultures (Harima, 2020, p. 191). Moreover, the nature of the entrepreneurial culture can also vary depending on whether it is government-led or private sector-led. In some countries, the government takes an active role in promoting entrepreneurship by providing funding, training, and other resources to aspiring entrepreneurs. In other countries, the private sector takes the lead, with investors and other stakeholders providing the necessary support and resources. The cultural attitudes towards collaboration and partnership also vary between regions. Some cultures may emphasise individual achievement and competition, while others may prioritise community and collaboration. These cultural differences can affect the way ecosystem actors interact with each other and work together towards common goals. Cultural attributes are a key element in creating a supportive ecosystem culture. They represent societal attitudes towards entrepreneurship, such as how risks are perceived and how success stories shape a positive outlook on entrepreneurial initiatives. The underlying values, norms, and beliefs of the society create social behaviours that support

entrepreneurial education and accessibility of resources for startups. In this way, cultural attributes aid the interplay of material and social attributes of the ecosystem (Harima, 2020, pp. 35-37).

Overall, understanding the local cultural context is critical for effective ecosystem orchestration. By taking into account the unique cultural norms, values, and attitudes towards entrepreneurship and innovation, ecosystem orchestrators can tailor their approach to best meet the needs of the ecosystem and support its growth and development. To successfully navigate cultural challenges in ecosystem orchestration, a shared vision and common understanding of ecosystem terminology is essential. Ecosystem policies can provide a foundation for establishing and communicating this shared vision, enabling actors to align their priorities and work towards common goals with trials and experimentation culture.

3.2.1 Ecosystem vision and terminology

Ecosystem vision and terminology can be considered part of the ecosystem culture. They reflect the shared values, beliefs, and attitudes of the ecosystem stakeholders regarding the purpose and direction of the ecosystem. Having a shared vision within a startup ecosystem is important for implementing effective governance structures and supporting collaboration and agreement among stakeholders. This shared vision allows for the design and operationalisation of strategies that facilitate cross-boundary data collaboration and access, enabling the ecosystem to effectively utilise data to drive innovation and value creation. A shared vision also helps to align the governance and institutional contexts with the narratives of change management and leadership, allowing the ecosystem to adapt and evolve over time (Gupta, et al., 2020, pp. 7-8). Shared vision is also critical for the success of a startup ecosystem because it helps to align the goals and objectives of all stakeholders within the ecosystem. When everyone is working towards a common vision, it creates a sense of unity and purpose that can drive innovation and growth. Additionally, having a shared vision helps to facilitate communication and collaboration within the ecosystem, as all stakeholders have a clear understanding of what is expected of them and how their actions contribute to the overall success of the ecosystem. It also promotes transparency and accountability, as all stakeholders are held to the same

standards and expectations. Overall, a shared vision is essential for the smooth operation and long-term sustainability of a startup ecosystem (Gupta, et al., 2020, p. 8).

The platform ecosystem literature emphasises that the ecosystem orchestrator develops the ecosystem vision (Smelund & Faghankhani, 2015, p. 5). Gupta, et al (2020, p. 7) points out that Shared vision is a mature element of ecosystem orchestration wherein a central and visible orchestrator formulates a set of agendas to be addressed based on the requirements across the ecosystem and operationalises it. Valkokari (2015, p. 22). argues that in order to effectively orchestrate an ecosystem, it is important to understand the coordination mechanisms at play and how they evolve over time. This understanding is crucial for strategic decision making and the overall orchestration of the ecosystem, as well as for developing roadmaps for its future evolution and establishing a clear vision for the ecosystem. By keeping track of these mechanisms and their evolution, the orchestrator can make informed decisions that help to drive the ecosystem towards its goals and vision. If there is no clear orchestrator in a startup ecosystem, it can lead to a lack of shared vision and direction for the ecosystem as a whole. Without a central actor to set standards and develop an ecosystem vision, it may be more difficult for the various stakeholders in the ecosystem to work towards a common goal and effectively collaborate. This can lead to disunity and potential conflicts within the ecosystem, as different stakeholders may have conflicting objectives and priorities. It can also hinder the overall development and growth of the ecosystem, as there is no clear leader to guide and support the various players within the ecosystem. In order to foster a strong and cohesive startup ecosystem, it is important for there to be a clear orchestrator who can provide direction and vision for the ecosystem as a whole.

This study has demonstrated multiple times the importance of shared terminology among ecosystem members in facilitating ecosystem orchestration. As stated in the chapter 0, the presence of ambiguous terminology within an ecosystem is often a result of the underdevelopment of theoretical concepts related to the ecosystem. Understanding and defining ecosystem terms in a clear and consistent manner is essential for effective coordination and decision-making within the ecosystem, as well as for the development of a cohesive vision for its future evolution.

3.2.2 Ecosystem policies

Ecosystem policies can be considered part of the ecosystem culture as they reflect the shared values, beliefs, and attitudes of the ecosystem stakeholders regarding the development and management of the ecosystem. Policies are designed to influence the behaviour of ecosystem actors and guide the actions of ecosystem stakeholders towards the desired outcomes of the ecosystem. Ecosystem policies can shape the culture of the ecosystem by creating a favourable environment for experimentation, innovation, and entrepreneurship, similarly, policies can also reflect the cultural values of the ecosystem.

Startup ecosystem policy is a complex and multifaceted area that can encompass a wide range of initiatives and programs. While ecosystems are self-organising and self-sustaining by nature and no government intervention is needed for them to survive and succeed. However, government participation can still play a valuable role in supporting and accelerating their growth. This can be achieved through providing platforms for co-development and co-creation, speeding up ecosystem development, investing in the development of infrastructure, resources and networks that support innovation and entrepreneurship and addressing systemic issues and market failures (Rinkinen & Harmaakorpi, 2019, p. 261). The ecosystem perspective emphasises the importance of flexible and constant feedback mechanisms in order to effectively identify and address failing trials while supporting successful ones. The evolution of ecosystems through trials and experimentation requires a culture of experimentation, which can be fostered through the provision of platforms for pilot projects, demonstrations, and rapid prototyping. Innovation policy can play a crucial role in this process by providing platforms and resources for co-development and ecosystem formation, as well as through the use of public procurement as a means of driving innovation. Overall, the goal of ecosystem-based innovation policy is to create an environment that promotes experimentation, learning and adaptation in order to foster innovation and growth within startup ecosystems (Rinkinen, 2016, p. 54).

Startup ecosystem policy is a vital aspect of promoting innovation and entrepreneurship. However, if not properly managed, a number of potential threats can arise that can impede the growth and development of the ecosystem. These include limited funding for policy initiatives and programs, lack of coordination and collaboration among different stakeholders, inadequate

understanding, and knowledge of the ecosystem among policymakers, limited participation of diverse stakeholders, an overreliance on government intervention and regulation, a focus on short-term goals over long-term sustainable growth, and limited feedback mechanisms and lack of evaluation of the policies. If these potential threats become reality, it can lead to a hindrance or stagnation of the ecosystem. This can result in a lack of progress and development in the ecosystem, preventing it from reaching its full potential and supporting innovation and entrepreneurship. Furthermore, it can also lead to fragmentation of the ecosystem. The lack of coordination and collaboration among different stakeholders can lead to a lack of alignment and inefficiency in the use of resources, causing different parts of the ecosystem to operate independently of one another, resulting in fragmentation. Additionally, a lack of diversity and inclusivity in the ecosystem can also result in fragmentation, as certain groups may not be well represented and may not have the same access to resources and opportunities as others. Similarly, a lack of feedback mechanisms and lack of evaluation of the policies can lead to a lack of learning and adaptability in the ecosystem, which can also lead to disconnectivity, preventing the ecosystem from adapting and evolving to changing market conditions. It is important for policymakers to be aware of these potential threats and take appropriate measures to mitigate them. This can be achieved through providing sufficient funding, fostering coordination and collaboration among different stakeholders, investing in the development of infrastructure, resources and networks that support innovation and entrepreneurship, and addressing systemic issues and market failures. Additionally, it is important to ensure diversity and inclusivity in the ecosystem and establish regular feedback mechanisms and evaluation of the policies to ensure the ecosystem's adaptability and growth.

It's also noticeable that the architecture of startup ecosystems is not static and is shaped by a variety of factors including legal and regulatory authority and the actions of industry participants. While the ecosystem architecture evolves as per the ecosystem dynamics, it's important for regulatory authorities to ensure that ecosystem architecture promotes fair competition, innovation, and growth. Industry participants may seek to establish and maintain dominant positions within the market and may use their influence to influence legal and regulatory authorities, to create barriers to entry for new competitors (Järvi, 2013, p. 18). Rinkinen and Harmaakorpi (2019, p. 260) propose a new approach to innovation policy that focuses on supporting the development of innovation ecosystems. They argue that this approach

is necessary in order to effectively promote innovation and entrepreneurship. However, it is important to note that this approach must be holistic in nature and encompass all policy fields, rather than focusing solely on traditional innovation policy.

3.3 Process challenges

The success of startup ecosystems depends on a variety of factors, including the orchestration processes, managerial strategies, resources, communication, and actors' roles within the ecosystem. To understand the dynamics of innovation ecosystems fully, it is essential to understand the ecosystem processes and how they work together to promote innovation and value creation (Yaghmaie & Vanhaverbeke, 2019, p. 14). Ecosystem processes refer to the routines, strategies, and actions that actors within an ecosystem use to collaborate and coordinate their efforts. These processes are critical for creating win-win situations for all partners and ensuring the efficient allocation of resources (Linde, et al., 2021, pp. 6-8). Understanding ecosystem processes is vital for policymakers, ecosystem orchestrators, and actors within the ecosystem. It helps them identify bottlenecks in the ecosystem and develop strategies to overcome them. Policymakers can use this knowledge to design policies that take a systemic perspective and address weaknesses in the ecosystem (Rinkinen, 2016, p. 24). Ecosystem orchestrators can use it to facilitate relationships and activities among ecosystem participants. Actors within the ecosystem can use it to innovate new offerings, develop them incrementally, and organise to execute transactions (Smelund, et al., 2018, p. 30).

The availability and flow of resources within a startup ecosystem is one critical process in the development and success of startups within the region. These resources can take the form of material resources, such as funding and physical infrastructure, as well as social and cultural resources, such as networks, expertise, and knowledge. The transfer of these resources between various actors within the ecosystem, including startups, investors, and support organisations, is essential for the growth and innovation of these businesses. Understanding the process of resource flow within an entrepreneurial ecosystem is important for both strategic decision-making and ecosystem orchestration. By identifying and addressing bottlenecks in resource flow, ecosystem orchestrators can help to facilitate the development and success of startups within the region (Harima, 2020, p. 5). Lacking resources can affect the ecosystem by hindering

the growth and development of startups within the ecosystem. Without access to sufficient resources, startups may struggle to bring their ideas to fruition and may not have the means to scale or develop their businesses. This can lead to too intense competition within the ecosystem as startups may compete for limited resources and funding. If competition becomes too intense, it can lead to the failure of some ecosystem actors, which can have negative consequences for the overall ecosystem. The shift towards competition between different value ecosystems means that the success of an ecosystem is no longer determined solely by the individual firms within it, but also by the ecosystem as a whole (Rinkinen & Harmaakorpi, 2019, p. 250). This shift in competition highlights the importance of ecosystem resources, as well as the need for effective orchestration in order to effectively manage and allocate those resources. Without understanding the resource processes and effective orchestration, an ecosystem may struggle to compete with other ecosystems, leading to its decline and potentially detrimental effects on the firms within it. Therefore, it is important for an ecosystem to not only have access to a range of resources, but also to have an orchestrator that understands the ecosystem processes and can effectively manage and allocate those resources in order to foster growth and competitiveness within the ecosystem.

Based on this analysis, it can be concluded, understanding ecosystem processes is crucial for promoting startups and value creation within startup ecosystems. It helps ecosystem actors collaborate more efficiently, allocate resources effectively, and identify and overcome bottlenecks in the startup process. Policymakers, ecosystem orchestrators, and actors within the ecosystem can all benefit from this knowledge to promote the success of startup ecosystems.

3.4 Technology challenges

The orchestration of ecosystems is important for value creation and capturing among actors (Yaghmaie & Vanhaverbeke, 2019, p. 15). However, with rapid technological advancements and digitalisation, industry convergence and transformation are on the rise, making ecosystem orchestration more dynamic Ecosystem leaders require capabilities to leverage these dynamic conditions and orchestrate the ecosystems effectively (Linde, et al., 2021, pp. 1-2). In the context of ecosystem formation, the creation of effective and transparent processes for the orchestration is important (Linde, et al., 2021, p. 8)

Digital disruption has a significant impact on the ecosystem orchestration (Curley & Salmelin, 2018, p. 15). With digitalisation, traditional analogical tools for orchestration become outdated, and digital technology becomes the solution for ecosystem challenges that. Digital technologies improve access to ecosystem actors, reduces the cost of distribution of services, products, and solutions, and extends access to collaborators and adopters of innovation (Curley & Salmelin, 2018, pp. 17-19). However, lack of digital technology can pose challenges to ecosystem orchestration, impeding effective communication, collaboration, and information sharing among ecosystem partners. Digital technology has an exponential nature, and something that starts as insignificant can become very big very fast (Curley & Salmelin, 2018, p. 19). Digital connectivity dramatically lowers collaborative friction and allows for the creation of orchestration applications and platforms, which can facilitate ecosystem orchestration (Curley & Salmelin, 2018, p. 15). That transforms the ecosystem orchestration closer to platform ecosystems, which emphasise technological dependencies and focus on a shared connectivity (Autio & Thomas, 2021, p. 8).

In summary, digital technology is a potent ingredient for ecosystem orchestration, and lack of it can pose challenges to the ecosystem's success. The exponential nature of digital technology makes it critical for ecosystem leaders to leverage these technological advancements to facilitate effective communication, collaboration, and information sharing among ecosystem partners. Platform ecosystems, with their emphasis on technological dependencies, provide an avenue for ecosystem orchestration.

3.4.1 Orchestration tools

Ecosystems have become increasingly complex due to the involvement of numerous actors, transactions, and relationships. As a result, the orchestration of ecosystems has become more challenging, and platform owners cannot manage them in a goal-oriented fashion (Smelund & Faghankhani, 2015, p. 1). To effectively manage the ecosystem, the use of digital tools for ecosystem orchestration has become necessary. These tools not only involve technological infrastructure but also include soft infrastructure such as value networks and governance aspects (Gupta, et al., 2020, p. 2).

The deployment of urban data platforms has been investigated to manage and coordinate ecosystem data (Gupta, et al., 2020, p. 1). Such data ecosystems embody new interactions between all entities involved with data from all of the ecosystem members. Standardisation of the technological interface between the ecosystem orchestrator and ecosystem members could increase data mobility in the ecosystem and between the ecosystem members and the orchestrator. The standardised technological interface may either offer a common set of technologies, tools, and other assets that ecosystem members can use ensuring consistent data quality and enhancing the of ecosystem integration or establish a common repository for ecosystem members to share their proprietary tools, technologies, and other assets with one another (Järvi, 2013, p. 42). Ecosystem data has transformative impacts on ecosystem entities, and new roles emerge that they have to fulfil, such as data collection, data storage, data usage, data visualisation, and data access. These roles highlight the importance of the transformative impact of ecosystem data as data-infrastructures embody value judgments about the ecosystem and thus are not neutral tools but mechanisms for orchestrating the ecosystem (Gupta, et al., 2020, p. 2). To realise the benefits of ecosystem data, new capabilities must be developed (Ylijoki, 2019, p. 61).

Furthermore, the analysis based on system dynamics suggests that standardisation of the technological interface between the orchestrator and the ecosystem has a positive effect on the ease of ecosystem application development, increasing the ecosystem data flow and further enhancing the attractiveness of the application development from an application developer's perspective (Järvi, 2013, p. 43). However, ecosystem data as such is hardly valuable, and it needs to be extracted and augmented with other fragments of data before it can be useful for value creation. Therefore, certain tools are required to extract and augment data to make it useful for ecosystem entities (Ylijoki, 2019, p. 104). In light of the limitations of current ecosystem digital tools, there is a clear need for more advanced solutions that can effectively address the challenges of ecosystem orchestration. Ecosystem portals, for example, provide a good overview of ecosystem data, but they rely on manual data entries, making the data unreliable and easily outdated. Current tools lack intelligence, making it difficult to answer important ecosystem questions such as what is happening, why did it happen, what is happening now, what might happen, and what is likely to happen in the ecosystem. To overcome these

limitations, new ecosystem digital tools need to be developed that can automatically collect and analyse data from different sources to provide real-time insights into ecosystem dynamics. These tools should also take into account data ownership issues and ensure that all ecosystem members have access to the data they need to make informed decisions. In addition to the aforementioned limitations of current ecosystem portals, it is important to note that many of these tools are proprietary and subject to vendor locks. This can create significant challenges for ecosystem participants, as they may be unable to access or modify the code for these tools. To address these challenges, it is important that ecosystem tools be developed as open-source projects, with no vendor locks or proprietary code. This approach would allow ecosystem participants to customise the tools to better meet their needs and would help to promote collaboration and innovation within the ecosystem. Additionally, an open-source approach would help to ensure that the tools remain accessible to all ecosystem participants, regardless of their financial resources or technical expertise. Open-source approach to ecosystem tool development would help to promote a more equitable and collaborative ecosystem, while also helping to ensure the long-term sustainability of the ecosystem. One potential solution is to use machine learning and artificial intelligence algorithms to analyse ecosystem data and provide real-time insights. These technologies can help to identify patterns and trends in the data that may not be immediately apparent to ecosystem members, enabling them to make more informed decisions and take proactive measures to address emerging issues. Another important consideration is the need for interoperability between different ecosystem digital tools. Ecosystems are complex systems with many different actors and stakeholders, and effective orchestration requires a high degree of coordination and collaboration. By ensuring that different ecosystem tools can work together seamlessly, it will be possible to create a more integrated ecosystem environment that can support innovation and growth (Ali & Alexopoulos, 2023, p. 76).

In conclusion, the lack of technology and tools is a challenge for effective orchestration of ecosystems. Digital tools for ecosystem orchestration are necessary to manage and coordinate ecosystem data effectively. The standardisation of the technological interface between the orchestrator and the ecosystem could increase data mobility in the ecosystem and between the ecosystem members and the orchestrator. Additionally, the transformative impact of ecosystem

data highlights the importance of developing new capabilities for the effective use of ecosystem data.

3.4.2 Geographic and social distances

Social and geographical distance can be seen as part of the cultural and technological challenges in ecosystem development. Cultural challenges may arise when partners from different geographical regions have different cultural norms, values, and business practices. These differences can result in terminology, communication difficulties, misunderstandings, and mistrust, which can hinder the establishment of collaborative relationships and resource-sharing agreements. Overcoming cultural differences requires a process of building trust and respect among ecosystem partners, which can be facilitated through effective communication.

Ecosystems can be thought of as communities or combinations of communities, where the social dimension is crucial. The scope of ecosystems is the community, rather than a specific geographic location. While the geographic dimension can be useful for developing social connections, it is not sufficient on its own to build and sustain these connections. Therefore, it is important for ecosystems to focus on building networking assets that facilitate community building, such as meetups and collaboration spaces, as well as providing platforms for these connections to form. Ignoring the social aspect of ecosystems and solely focusing on the geographic dimension can lead to less impact and a lack of sustainability (Mulas, et al., 2015, pp. 8-9). Technological challenges can also arise due to social and geographical distance. For instance, ecosystem partners may face difficulties in sharing and accessing information due to differences in technological infrastructure and communication networks. In such cases, there is a need for innovative technological solutions that enable partners to share information and collaborate effectively despite the physical distance.

Like we have stated previously, startup ecosystem is shaped by its geographical context and location. The geographical dimension of an ecosystem can have significant impacts on the resources, opportunities, and challenges that are available to startups within the ecosystem. For example, startups located in a region with a strong and well-established ecosystem may have access to a larger pool of resources, such as funding, mentorship, and talent, compared to

startups in a region with a weaker ecosystem. Additionally, the geographical location of an ecosystem can also influence the types of industries and sectors that are present within the ecosystem, as well as the level of competition. Understanding the geographical dimension of an ecosystem is important for startups, investors, and policymakers who are looking to support and enhance the development of startup ecosystems. If the members of an ecosystem are geographically dispersed, it can be more difficult for them to physically meet and collaborate, leading to a lack of connectivity within the ecosystem. This can also make it more difficult for the orchestrator to effectively manage and facilitate interactions within the ecosystem.

Too large social or geographical distance within an ecosystem can lead to fragmentation and disconnectivity. The actors within the ecosystem may not have the necessary social connections or networks to facilitate the exchange of resources, ideas, and information. This lack of communication and collaboration can result in a lack of trust and understanding among the actors, which can ultimately lead to a breakdown in the ecosystem. Technological solutions can play a vital role in reducing social and geographical distance within an ecosystem. By providing digital tools that enable easy communication and collaboration among ecosystem actors, these solutions can help to facilitate the exchange of resources, ideas, and information. This can help to build trust and understanding among actors, ultimately leading to a stronger and more connected ecosystem. Open-source tools with no vendor locks can further enhance this connectivity by promoting transparency, collaboration, and innovation across the ecosystem. As such, technological solutions can be instrumental in bridging social and geographical distances and creating a more cohesive and effective ecosystem.

4 DIGITAL SOLUTION – A SHARED ECOSYSTEM FRAMEWORK

To provide a solution to the challenges faced by startup ecosystems, a shared ecosystem framework concept was developed, which is discussed in this chapter. The framework is designed to address the cultural, process, and technological challenges identified in the document analysis. Data-driven orchestration is identified as a powerful tool to tackle ecosystem fragmentation and facilitate better coordination and collaboration among stakeholders. The benefits of data-driven orchestration include more efficient allocation of resources, improved access to information and expertise, and enhanced ability to identify promising startups and investment opportunities. The shared ecosystem framework concept aims to provide a centralised platform for information sharing and communication, which can help stakeholders make better decisions and ultimately lead to a more efficient and effective ecosystem.

4.1 Value in the ecosystem data

The emergence of big data and data-driven innovation presents significant opportunities for individuals, organisations, and ecosystems. As former European Research Commissioner Maire Geogeghan Quinn aptly put it, "Knowledge is the crude oil of the 21st century." In the context of startup ecosystems, this means that the collection and analysis of data can create opportunities for collaboration, and growth (Curley & Salmelin, 2018, p. 2). Data has always been a valuable resource, but with the emergence of big data and the development of more powerful machines, data mining, machine learning algorithms and rapid development of the artificial intelligence, the value of data has increased dramatically. For startup ecosystems, this means that the collection and analysis of data can be a valuable tool for ecosystem actors (Curley & Salmelin, 2018, p. 2). In the context of startup ecosystems, data plays a critical role in informing decision-making, facilitating collaboration, and driving growth. While in this thesis ecosystem orchestrators and decision-makers are the beneficiaries of ecosystem data, it is important to note that other ecosystem stakeholders benefit from the collection and analysis of ecosystem data (Basole, et al., 2015, p. 5). Generally, ecosystem members don’t want data for the sake of having data, people want answers and data is the tool to provide accurate answers. This chapter will explore in a high level the ways in which ecosystem data can be

leveraged by different stakeholders, including business creators, support providers, financiers, big companies, and ecosystem developers.

For business creators, access to relevant information, content, and knowledge is crucial for success. By collecting and analysing ecosystem data, ecosystem developers can provide startups with easier access to this information, as well as facilitate effective matchmaking for co-founders, services, knowledge, funding, events, and other relevant connections at the right time. By leveraging ecosystem data, business creators can make more informed decisions about product development, fundraising, and growth strategies. Avoiding duplication of data collection is an important benefit of ecosystem data collection. By collecting data in a standardised manner, support providers can reduce inefficiencies and strengthen collaborations across the ecosystem. Furthermore, the overall accuracy of ecosystem data is improved, which can contribute to the global reputation of the ecosystem.

For financiers, access to more and better data about the companies being funded, such as SME loans, investors, and grants, can lead to more informed investment decisions and better returns on investment. By leveraging ecosystem data, financiers can gain insights into the performance of individual companies, as well as the broader trends and patterns within the ecosystem. Big companies can leverage ecosystem data to gain a more comprehensive understanding of the innovation landscape, including IP and tech transfer opportunities from research and universities. By using ecosystem data to identify relevant startups and available talent and expertise, big companies can more easily identify new innovations and potential partnerships. Ecosystem developers can leverage ecosystem data to measure and benchmark support functions and policy impacts. This data-driven approach can inform more effective policy design and ecosystem management. Additionally, ecosystem data can be used to develop new services based on data, analytics, and digital tools such as artificial intelligence.

Data openness plays a major role in the success of startup ecosystems. By opening up selected data to the world, ecosystem stakeholders can attract investments, help startups to be discovered, and scale innovation. For example, making data on the performance of local startups available to potential investors can help to attract more investment and foster growth within the ecosystem. Benefits of data openness extend beyond the local ecosystem. By

accessing open data from other markets, ecosystem stakeholders can compare their city's performance, access innovation from other markets to solve local problems, and gain valuable insights into best practices and emerging trends. For example, comparing the performance of local startups with those in other ecosystems can help identify areas where the local ecosystem is underperforming and opportunities for improvement. At the same time, data openness also presents challenges that must be addressed. One of the biggest challenges is ensuring that open data is accurate and reliable. To address this, ecosystem stakeholders must establish clear standards for data collection and management, as well as implement effective quality control measures to ensure the accuracy of the data (Basole, et al., 2015, p. 5).

4.2 Shared ecosystem framework

The importance of a shared framework in the startup ecosystem and the challenges faced by startups in this regard are introduced in the chapter 3. This chapter aims to further explore the need for a centralised platform for ecosystem data management in addressing these challenges. The purpose of having a shared framework in the startup ecosystem will be discussed in detail, highlighting the benefits and potential solutions it presents. The chapter will examine the current fragmented state of data management in the startup ecosystem and the difficulties faced by startups in accessing and utilising the data they need to succeed. The benefits of having a centralised platform for data management will be analysed, with a focus on how it can help startups overcome these challenges and succeed in their endeavours. The chapter will conclude with a discussion on the potential solutions for implementing a shared framework in the startup ecosystem and the steps that can be taken to achieve this goal.

The current state of industries is characterised by an increasing number of initiatives led by ecosystem leaders who aim to incorporate digital technologies into physical products to offer digital services. However, the orchestration in these ecosystems faces challenges such as aligning incentives among diverse actors with varying backgrounds and motivations. In the context of the startup ecosystem, these challenges are particularly pronounced and require a robust solution for effective data management. This highlights the importance of a shared framework that can effectively address these challenges and support the growth of startups (Linde, et al., 2021, pp. 1-2). The fragmentation of data in the startup ecosystem can lead to a

lack of a unified view of the ecosystem and its components. This results difficulty in making informed decisions and can hamper the growth and development of startups within the ecosystem. The lack of consistent data quality can also lead to misunderstandings and misinterpretations of the ecosystem and its components, leading to further challenges. In the context of the startup ecosystem, it is recognised that the extraction of data from silos is a crucial step in value creation. However, the trustworthiness or quality of the data, referred to as veracity, also plays a significant role. As demonstrated in publications, the value of data is dependent on context. The importance of understanding the quality of data is emphasised, as a single error in one record may have severe consequences, while several errors may be insignificant in records collected for statistical analysis (Ylijoki, 2019, p. 105). Additionally, the difficulty in accessing relevant data can also be a hindrance to the growth and development of startups. This can result in a lack of visibility into the current state of the ecosystem and its components, leading to missed opportunities and an inability to make informed decisions.

The challenges faced by startups in the current state of the ecosystem can be addressed through the implementation of digital solutions. The comparison between digital and non-digital approaches highlights the differences, which plays a crucial role in the success of an ecosystem. Digital orchestration needs to be integrated with ecosystem design to a greater extent while non-digital orchestration is considered separate process from ecosystem design. (Ivarsson, 2018, p. 41). One key difference between digital and non-digital orchestration processes is the extent to which they are scalable. Digital orchestration processes are more scalable, allowing for coordination and optimisation on a larger scale. For instance, digital systems enable the orchestration without geographical limitations. This is made possible through the use of digital tools, which are more powerful and efficient than the capabilities of individual human agents. In comparison, non-digital orchestration processes are limited by the number of employees, as well as geographical and technological restrictions. This can lead to friction and inefficiencies in the flow of information, hindering the success of the ecosystem (Ivarsson, 2018, p. 41).

Although ecosystem data should be considered an asset, it does not convert automatically into economic value. Data typically resides locked in silos such as operative system databases, document repositories, or external systems. To unlock the economic value of ecosystem data, it is important to break down these silos and integrate the data into a centralised system. This

requires careful consideration of data governance, privacy, and security concerns. Once the data is integrated and accessible, it can be analysed and used to develop insights that can drive economic value creation (Ylijoki, 2019, p. 104). To address these challenges and enabling the implementation for the digital solutions, it is necessary to establish a shared framework for data management in the startup ecosystem. This would allow for the collection, storage, and analysis of data in a centralised manner, resulting in a more comprehensive and accurate view of the ecosystem. The implementation of such a framework would also lead to increased efficiency and improved decision-making, ultimately leading to the growth and development of startups within the ecosystem (Ylijoki, 2019, pp. 104-105). Having a shared framework in place enables better decision making by providing access to accurate and up-to-date information. This in turn leads to improved collaboration among stakeholders as they are able to rely on the same set of data and information. With a shared framework in place, stakeholders are able to work together more efficiently and effectively, leading to improved outcomes for all parties involved.

The benefits of a shared framework are not limited to just improved data quality and accessibility. It also has the potential to drive innovation, enhance transparency, and increase the overall competitiveness of the startup ecosystem. By fostering a culture of collaboration and trust, a shared framework enables startups to focus on their core competencies, leading to increased productivity and growth. The evolutionary nature of ecosystems is a crucial aspect to consider when developing a framework for the startup ecosystem. The complexity, regional embeddedness, and various interactions among stakeholders contribute to the idiosyncratic and dynamic nature of startup ecosystems, making it difficult to fully understand their evolution. A lack of understanding of the evolutionary nature of ecosystems can lead to a static framework that does not take into account how they evolve over time. This highlights the importance of considering the evolution of the startup ecosystem in the development of a shared framework. A framework that takes into account the evolving nature of the startup ecosystem can help to ensure its relevance and effectiveness in improving data quality and accessibility, increasing efficiency, and promoting better decision-making and collaboration among stakeholders (Harima, 2020, p. 5).

In the context of the startup ecosystem, data standardisation is main component of a shared framework. One way to achieve data standardisation is by implementing a shared open standard

ecosystem data model as part of the framework. Data model is a common nominator in all types of ways of handling and sharing data. In more detail it is a conceptual representation that defines the structure of data by organising its elements and establishing their relationships with each other and real-world entities. For instance, a data model may specify that a startup's data element is composed of other elements representing the industry, development phase, owner, and other relevant information. The term is used in two closely related ways: first, as an abstract formalisation of objects and relationships specific to an application (such as customers, products, and services), and second, as a set of concepts (such as entities, attributes, relations, or tables) used to define these formalisations. A shared ecosystem data model ensures that data is consistent and unambiguous, making it easier for stakeholders to understand and use. Having a shared ecosystem data model also makes it easier for stakeholders to share data and collaborate on projects. When all stakeholders use the same data model, there is no confusion about what data means or how it should be used. This leads to improved data quality and greater efficiency in the ecosystem (Basole, et al., 2015, p. 3). In addition, a shared ecosystem data model can help to address the challenges of data privacy. Data privacy is an important concern in the startup ecosystem, as stakeholders may have sensitive information that they do not want to share with others. By implementing a shared ecosystem data model, stakeholders can control the data they share and limit access to sensitive information. Data standardisation through a shared ecosystem data model is a key feature of a shared framework in the startup ecosystem. It helps to improve data volume, quality and velocity thus increasing efficiency, and enhance collaboration among stakeholders (Dibbern, et al., 2022, pp. 45-46).

The importance of openness in the technological dimension cannot be overstated when it comes to building a shared ecosystem framework. Open source technologies and standards play a vital role in the ecosystem data narrative, particularly in the quick and cost-effective implementation of initiatives. This is evident from primary and observation data, which show that ecosystems are focusing on technological openness to pursue the following objectives: open source systems to accelerate ecosystem data initiatives by replication, open standards for local governments to ensure they have access to their data stored in procured IT systems, and open standards for data sharing initiatives across the ecosystem data (Gupta, et al., 2020, p. 5).

The adoption of open source technologies in the ecosystem is increasingly widespread, as evidenced by the use of open source codes, platforms, and licenses. Open source codes, for instance, make it easier to replicate, standardise, and validate data products such as predictive analytics data models. Additionally, they provide an opportunity to upskill local government staff on data science and analytics (Gupta, et al., 2020, p. 5). However, despite the benefits of open source technologies, the current state of ecosystem data presents scenarios where local authorities face challenges to access their data, which is often locked in silos such as operative system databases, document repositories, or external systems, and stored in systems procured from large IT vendors. In some cases, local authorities may have to pay to access data, leading to vendor lock-in and hindering access to data and interoperability As a result, local authorities are increasingly coming together to create an open supplier community that prevents vendor lock-in and ensures access to data and interoperability (Gupta, et al., 2020, p. 5).

In conclusion, building a shared ecosystem framework requires a focus on openness in the technological dimension. This means adopting open source technologies and standards that allow for easy replication, standardisation, and validation of data products, upskilling ecosystem orchestrator on data science and analytics, and ensuring access to data and interoperability through open supplier communities. Such an approach will facilitate the integration of ecosystem data and create economic value for all stakeholders involved.

4.3 Identifying ecosystem data sources

Identifying and utilising data sources is essential to establishing a comprehensive shared framework that supports the growth and success of startups in the ecosystem. Such data sources include locations such as venues and spaces, people with different roles, supporting organisations, services, companies, startups, ideas including intellectual property, products, and concepts, projects, assets such as calls, shared resources, and stats, ecosystem organisations, events, activities, and interactions. Data from various stakeholders, including startups, investors, accelerators, government agencies, and other ecosystem actors, provides valuable insights that can inform decision making and help address key challenges. With the right data sources in place, startups can make informed decisions about product development, fundraising, and growth strategies, while investors can identify promising opportunities and make informed

investment decisions. Government agencies and other ecosystem actors can also benefit from the insights provided by data sources, enabling them to allocate resources effectively and better support the growth of the ecosystem.

4.3.1 Startups

Startups are a key component of the startup ecosystem, and as such, they represent an important source of data that can provide valuable insights into the overall health and growth of the ecosystem. In order to effectively analyse and understand the startup ecosystem, it is important to have access to a wide range of data from various sources, including startups themselves.

Financial data is one of the most important data sources for startups, as it provides a detailed view of their financial health and growth over time. This includes information on revenue, expenses, profits, and losses, as well as funding rounds and other financial transactions. By analysing this data, stakeholders in the startup ecosystem can gain a better understanding of the financial performance of individual startups and the ecosystem as a whole (Shepherd & Gruber, 2021, pp. 968-969). Customer data is another important source of data for startups, as it provides insight into the needs and preferences of customers, as well as how they interact with products and services. This includes information on customer demographics, buying habits, user behaviour, and feedback. By analysing this data, startups can gain a better understanding of their target market, identify areas for improvement, and develop new products and services to meet customer needs (Shepherd & Gruber, 2021, p. 969). Product data is another valuable source of data for startups, as it provides detailed information on the features and functionality of products and services. This includes data on product usage, product performance, and customer feedback. By analysing this data, startups can gain insights into the strengths and weaknesses of their products and services and identify areas for improvement and innovation (Shepherd & Gruber, 2021, p. 978). Operational data is another important source of data for startups, as it provides information on the day-to-day operations of the startup. This includes data on business models, productivity, project management, and supply chain management. By analysing this data, startups can identify areas for optimisation, improve efficiency, and reduce costs (Shepherd & Gruber, 2021, pp. 971-975)..

Overall, from ecosystem orchestrators perspective, startups are a critical source of data for understanding the overall health and growth of the startup ecosystem. By analysing financial, customer, product, and operational data, stakeholders in the ecosystem can gain valuable insights that can inform decision-making and help address key challenges. Data generated by the startups can be used to inform decision-making, such as identifying areas for improvement, validating assumptions, and identifying new opportunities for growth. Similarly, investors generate data on their investment portfolio, including performance metrics, financial data, and due diligence reports, which can help them identify trends and opportunities in the market.

4.3.2 Accelerators

Accelerators have emerged as a critical element in the startup ecosystem, providing mentorship, funding, and other resources to support the growth of new businesses. As such, accelerators are a key source of data that can be used to understand the state of the startup ecosystem and identify areas for improvement.

One important data source from accelerators is application data. This includes information on the number of applications received, the industries and sectors of the applying startups, and the stage of development of these companies. By analysing this data, stakeholders can gain insights into the trends and patterns in startup activity in the ecosystem (Brown, et al., 2019, p. 2). program data is another important source of information that can be obtained from accelerators. This data includes information on the startups that are accepted into the program, the services and resources provided to these companies, and the success rates of the program. Program data can help stakeholders understand the effectiveness of different accelerator programs and identify best practices that can be replicated or scaled across the ecosystem (Brown, et al., 2019, p. 2). Finally, alumni data is a valuable data source that can be used to measure the long-term impact of accelerator programs on the startups that participated. This includes information on the growth and performance of these companies over time, such as their revenue, number of employees, and fundraising activities. By analysing alumni data, stakeholders can identify the most successful startups that have gone through the accelerator programs and assess the impact of these programs on the overall health and growth of the ecosystem (Harima, 2020, pp. 235-236).

In summary, accelerators are a key source of data in the startup ecosystem, providing important insights into startup activity, program effectiveness, and long-term impact on the ecosystem. By leveraging the data from accelerators, orchestrators and other ecosystem stakeholders can make more informed decisions and take actions to support the growth and sustainability of the ecosystem.

4.3.3 Investors

Investors are an important source of data for understanding the overall health and growth of the startup ecosystem. Investors can provide valuable insights into trends and patterns in startup investment, which can inform decision-making and help address key challenges in the ecosystem.

Investment data, such as the amount and type of investment made by investors in startups, can be analysed to understand which types of startups are receiving the most funding, and which industries or regions are seeing the most investment. Portfolio data, which includes information about the startups that investors have invested in, can provide insights into the success rates of different types of startups, as well as the investors' strategies for investing in specific industries or technologies (van Rijnsoever, 2021, p. 8). In addition to investment and portfolio data, investors can also provide industry trend data, which can be useful for understanding emerging markets and technological trends. This data can help startups and other stakeholders in the ecosystem to identify potential areas for growth and innovation, as well as to anticipate changes in the market that may impact their operations.

Investors play a critical role in shaping the startup ecosystem, as they provide the financial resources that startups need to grow and innovate. By analysing the data provided by investors, stakeholders in the ecosystem can gain insights into the investment landscape, identify trends and opportunities, and make informed decisions about resource allocation and strategy. Furthermore, the data provided by investors can be used to evaluate the overall health and growth of the startup ecosystem, and to identify areas where further support or intervention may be necessary to foster innovation and growth (Burstöm, et al., 2023, pp. 1-3).

4.3.4 Government agencies

Government agencies also play a important role in the startup ecosystem, providing funding, infrastructure, and other resources to support the growth of the ecosystem. Data from government agencies, such as economic development agencies and regulatory bodies, can provide insights into the needs of the ecosystem and identify areas where resources should be allocated.

One of the most important types of data that government agencies can provide is regulatory data. This includes information on laws and regulations that affect startups, such as intellectual property laws, tax regulations, and data privacy laws. By providing this information, government agencies can help startups navigate complex legal requirements and avoid costly mistakes (Rinkinen & Harmaakorpi, 2019, p. 258). Economic data is another important source of information that government agencies can provide. This includes data on employment rates, GDP, inflation, and other economic indicators. By analysing this data, stakeholders can gain insights into the overall health of the economy and the impact that startups are having on job creation and economic growth. Demographic data is also a valuable source of information for understanding the startup ecosystem. This includes data on the demographics of entrepreneurs, such as age, gender, and ethnicity, as well as data on the location and size of startups. By analysing this data, stakeholders can gain insights into the diversity and distribution of startups and identify areas where additional support and resources may be needed (Ylijoki, 2019, p. 47).

In addition to these types of data, government agencies may also provide data on funding opportunities, research and development initiatives, and other programs designed to support the startup ecosystem. By working closely with government agencies and leveraging their data resources, stakeholders can gain a deeper understanding of the challenges and opportunities facing the startup ecosystem and develop more effective strategies for promoting growth and innovation.

4.3.5 Other ecosystem stakeholders

In addition to startups, accelerators, government agencies and investors, there are a variety of other stakeholders in the startup ecosystem that can provide valuable data to better understand the health and growth of the ecosystem. These stakeholders include industry associations, universities, ecosystem hubs, incubators, service providers, research organisations and other active members of the startup ecosystem.

Industry associations can provide important data on trends and challenges specific to a particular industry, as well as insights into how startups in that industry are faring. Universities can offer data on research and development activities, as well as insights into the talent pool available to the ecosystem. Ecosystem hubs, such as co-working spaces and innovation centers, can provide data on the physical infrastructure available to support startups, as well as data on the types of services that are in demand (Tripathi, et al., 2019, p. 88). Incubators can offer data on the types of startups that are being created and the level of support they require to succeed. Service providers, such as marketing agencies and legal firms, can provide data on the needs of startups in terms of business services. Research organisations can offer data on trends in entrepreneurship and innovation, as well as insights into best practices for supporting startup growth (Tripathi, et al., 2019, p. 88).

Each of these stakeholders can provide unique data sources that can be used to gain valuable insights into the overall health and growth of the startup ecosystem. By analysing the data provided by these stakeholders, policymakers and ecosystem builders can make more informed decisions about how to support startups and foster innovation.

4.3.6 Summary for data sources

The availability of data from various stakeholders in the startup ecosystem can provide valuable insights and knowledge to an ecosystem orchestrator, enabling them to make more informed decisions and take effective action. By analysing the data from startups, accelerators, investors, government agencies, and other stakeholders, the ecosystem orchestrator can gain a comprehensive understanding of the ecosystem's overall health and growth, identify trends and

opportunities, and address challenges in a timely and effective manner. For instance, an ecosystem orchestrator could use data from startups to identify gaps in the ecosystem and help allocate resources and support to areas that need it the most. By analysing data from accelerators, they can gain insights into the most effective accelerator programs and identify best practices to replicate in other regions. Investors' data could help the ecosystem orchestrator identify promising startups, track the flow of investment, and develop strategies to attract more investment to the ecosystem. The data from government agencies could provide valuable insights into regulatory frameworks and policies, demographic trends, and economic indicators, which can inform the ecosystem orchestrator's decision-making. Other stakeholders such as industry associations, universities, ecosystem hubs, incubators, service providers, and research organisations can also provide valuable data sources. The data from these stakeholders can help the ecosystem orchestrator identify emerging trends and opportunities, understand the needs of different groups of stakeholders, and foster collaboration among different players in the ecosystem.

The startup ecosystem generates vast amounts of data, and extracting value from this data is becoming increasingly important. Improved decision-making is a primary objective of many big data projects, and incorporating analytics and insights into processes and decision-making routines is essential. However, organisations may face resistance to adopting a data-driven culture due to old habits and skill shortages, which are often related to new technologies (Ylijoki, 2019, p. 45). One significant factor influencing the value of data is usage. As the cost of using data is usually very low, the value-cost ratio of data increases when more people use it. Data is also perishable, and its value typically depreciates over time. Real-time usage of data is becoming increasingly important, and the value of data depends on the use case. (Ylijoki, 2019, pp. 46-47). The accuracy of information also plays a vital role in determining the value of data. Accurate information is more valuable, and organisations should strive to maintain data accuracy to maximise its value. Additionally, combining data from various sources can provide valuable insights from the ecosystem. For example, combining startup founder demographics with accelerator program data can provide valuable insights (Ylijoki, 2019, pp. 46-47).

In summary, the identification of various data sources in the startup ecosystem is essential for the shared ecosystem frameworks, which enables orchestrator to make informed decisions,

identify key trends and challenges, and take action to support the overall health and growth of the ecosystem. By analysing the data from startups, accelerators, investors, government agencies, and other stakeholders, the ecosystem orchestrator can gain a comprehensive understanding of the ecosystem and take appropriate measures to ensure its continued success.

4.4 Data collection and management

Data collection and management are critical aspects of any data-driven initiative, and this is especially true for the startup ecosystem. In order to leverage the vast amount of data available in the ecosystem, it is essential to establish a reliable and trustworthy data infrastructure that can support decision-making and ecosystem orchestration. This chapter will explore the key considerations for data collection and management, including data quality, privacy, ownership, and security.

Data quality is a fundamental consideration for any data initiative. It is crucial to ensure that data is accurate, complete, and consistent to support reliable decision-making. In the startup ecosystem, there are multiple sources of data, and each source may have different data quality standards. Therefore, it is essential to establish a data quality framework to ensure that data is standardised and consistent across all sources (Ylijoki, 2019, p. 105). Another critical consideration is data privacy. The startup ecosystem comprises a vast network of stakeholders, each with different data privacy concerns. It is necessary to respect the privacy and ownership of the data and establish a framework that ensures that the data is collected and managed in a way that protects the rights of each stakeholder (Ylijoki, 2019, p. 44). The shared ecosystem framework, built on top of my data movement principles, can provide an excellent foundation for data privacy by ensuring that the rightful owners of the data retain ownership. Data ownership is also a vital consideration for data collection and management. In the startup ecosystem, data is often owned by different stakeholders, including startups, investors, accelerators, and government agencies. It is essential to establish clear ownership rules and regulations to ensure that each stakeholder's rights are protected. With my data principles, shared ecosystem framework can provide the base for data ownership by allowing each stakeholder to retain ownership of their data while enabling data sharing and analysis (My Data movement, 2017, Margoni, et al., 2023, pp. 9-11). Finally, data security is a critical

consideration for data collection and management. The startup ecosystem is susceptible to various security risks, including cyber-attacks, data breaches, and insider threats. It is necessary to establish robust data security measures to protect against these risks. The shared ecosystem framework can provide a foundation for data security by enabling the adoption of best practices and standardising security measures across the ecosystem.

Based on these findings data collection and management are critical aspects of the shared ecosystem framework. The key considerations for data collection and management include data quality, privacy, ownership, and security. Establishing a reliable and trustworthy data infrastructure that considers these aspects will enable the ecosystem orchestrator to leverage the vast amount of data available in the ecosystem, providing valuable insights that can inform decision-making and foster innovation.

4.4.1 Ecosystem data collection methods

In the context of the startup ecosystem, data collection is a critical process that enables decision-makers to gain insights and understand trends that inform strategic decisions. Traditionally, data collection has been done using a range of methods, including surveys, interviews, secondary data sources, and automated data collection tools. Each of these methods has its advantages and limitations that need to be considered when selecting a method to use.

Surveys are a commonly used method of data collection in the startup ecosystem. They provide a way to collect large amounts of data from a broad range of respondents. However, surveys can be time-consuming to design and administer, and response rates can be low, which can affect the quality of the data collected. In addition, survey data is usually self-reported, which can lead to bias. Interviews are another popular method of data collection in the startup ecosystem. They provide an opportunity to collect in-depth data from a small number of respondents. Interviews can be time-consuming and expensive to conduct, and the data collected may not be generalisable to the broader population. Secondary data sources, such as public databases and research reports, are a useful way of collecting data that has already been collected by others. This method is cost-effective and can provide access to data that may not be available through other methods. However, the quality of the data may not be as high as data

collected through primary methods, and the data may not be up to date. Automated data collection tools, such as web scraping and social media analytics, are increasingly being used for data collection in general. These tools can provide real-time data, which is essential for decision-making in developing environment. However, they may not capture all relevant data, and there may be concerns about data privacy and security.

The shared ecosystem data model, which is a part of the shared ecosystem framework, provides a standardised way of collecting and sharing data in the startup ecosystem. It enables real-time data collection and harmonisation of data from the ecosystem. This approach reduces the time and cost involved in data collection while ensuring data quality, privacy, and security. Moreover, it provides a comprehensive and up-to-date view of the startup ecosystem, which is essential for decision-making and efficient ecosystem orchestration. While traditional data collection methods have their advantages, the shared ecosystem data model provides a standardised, real-time, and comprehensive way of collecting and sharing data in the startup ecosystem. This approach reduces the time and cost involved in data collection while ensuring data quality, privacy, and security (Digiole, 2022, Dhauwers, et al., 2022, pp. 6-8). The shared ecosystem framework can help to establish common data standards and best practices. It helps to ensure that the data collected is consistent, complete, and accurate. This is particularly important in the startup ecosystem, where data is often fragmented, and quality can be a significant challenge. The shared ecosystem data model, can help to address these challenges by providing a standardised way to collect, store, and analyse data.

One of the main challenges of data quality in the startup ecosystem is missing data. Startups are typically focused on growth and develop their business and may not prioritise data that they produce to the ecosystem. This can lead to significant gaps in data, making it difficult to draw meaningful insights. To address this challenge, data cleaning and validation can be used to identify missing data and fill in the gaps. The shared ecosystem data model can help to facilitate this process by establishing a standardised data collection process that ensures data is collected consistently across the ecosystem (Digiole, 2022). Another challenge of data quality is inconsistent data. This can be caused by differences in data collection methods or data entry errors. To address this challenge, data integration can be used to consolidate data from different sources and eliminate inconsistencies. The shared ecosystem data model can help to support

this process by establishing common data standards that make it easier to integrate data from different sources (Basole, et al., 2015, pp. 5-6).

The shared ecosystem framework and data model can help to improve data quality in the startup ecosystem by establishing common data standards and best practices. It can help to ensure that the data collected is complete, consistent, and accurate. This can help to support decision-making and ecosystem orchestration (Ding, et al., 2011, pp. 332-333).

4.4.2 Ecosystem data governance

Effective data governance is an essential component of any successful organisation, particularly those operating within complex ecosystems. Data governance is the process of managing the availability, usability, integrity, and security of data used within an organisation. It involves developing policies, procedures, and controls to ensure that data is accurate, consistent, and trustworthy. Well-designed data governance framework ensures that data is managed and used appropriately across the organisation. This facilitates compliance with regulations and standards, reduces the risk of errors, fraud, and misuse of data, and helps to maintain data quality and consistency. In turn, these outcomes enable better decision-making and more effective business operations (Lis & Otto, 2020, p. 8, Janssen & Estevez, 2012, p. 6). The components of data governance include data quality management, data security and privacy, data stewardship and ownership, metadata management, data lifecycle management, data classification and categorisation, and data access and authorisation. Each of these components plays a critical role in ensuring that data is managed effectively. To implement effective data governance, it is important to adopt best practices such as establishing clear policies and guidelines for data management, appointing a data governance team responsible for overseeing data management activities, implementing data quality control processes and procedures, regularly auditing data management processes to ensure compliance and identify areas for improvement, providing regular training to employees on data governance policies and procedures, and continuously monitoring and adapting data governance practices to changing business needs and regulatory requirements (Lis & Otto, 2020, pp. 8-9).

In conclusion, data governance is a critical component of any organisation that values the accuracy, consistency, and security of its data. By implementing effective data governance practices, organisations can ensure that their data is managed appropriately, enabling better decision-making and more effective operations within complex ecosystems.

4.4.3 Ecosystem data visualisations

Ecosystem data visualisation is a crucial aspect of developing a data-driven culture within the ecosystem. The ability to visually represent and explore the various patterns and connections within the ecosystem data can greatly enhance the knowledge and understanding of the ecosystem. By bypassing hierarchies and building a data culture within the ecosystem, it is possible to develop capabilities such as data visualisation and data integration that enable a more holistic view of the ecosystem (Gupta, et al., 2020, p. 9). Visualising ecosystem data can allow ecosystem stakeholders to quickly identify patterns and trends that may be difficult to discern from raw data. For example, visualising data related to startup growth rates or investment trends can help ecosystem managers identify areas of strength and weakness within the ecosystem. Additionally, visualisations can be used to communicate insights to stakeholders in a clear and concise manner, improving decision-making and driving action (Okano, et al., 2018, p. 3). The use of data visualisation also has the potential to enhance data integration and collaboration within the ecosystem. By presenting data in a visually appealing and accessible way, it becomes easier for stakeholders from different organisations to share data and collaborate on initiatives. This can help break down silos within the ecosystem and promote greater connectivity and knowledge sharing. Importance of the use case approach to building and implementing an ecosystem framework will be established in the chapter 4.5 Framework implementation. This approach involves building tools that match specific use cases to enable the real-time data movement within the ecosystem. These tools will serve as the data visualisation tools for ecosystem orchestrators and other stakeholders.

Various data visualisation tools and techniques can be utilised to help ecosystem stakeholders identify trends and insights. Examples of these tools include charts, graphs, and dashboards. The use of charts and graphs can help to identify patterns in data that may not be immediately apparent. Meanwhile, dashboards can provide a high-level overview of data, making it easier

to identify key insights and trends. When designing visualisation tools for the startup ecosystem, it is essential to keep in mind that every ecosystem is unique, but they still face similar problems. Therefore, the tools developed should match specific ecosystem use cases, so cater solutions that ecosystems need. With the use of shared ecosystem framework, solutions are not tailormade for specific ecosystems, but they can be implemented in multiple ecosystems, which enables ecosystems to share data and benchmark themselves in a standardised way. By doing so, ecosystem stakeholders can make the most of the data available to them and gain valuable insights that enables orchestration and support ecosystem development.

In conclusion, data visualisation is a crucial component of the data collection and management process in the startup ecosystem. With the use of visualisation tools, ecosystem stakeholders can gain a better understanding of the data available to them and make more informed decisions. By implementing a use case approach to building and implementing ecosystem frameworks, stakeholders can develop visualisation tools tailored to specific use cases, making it easier to identify key insights and trends.

4.5 Framework implementation

As the previous chapters conclude, the shared ecosystem framework is a collaborative effort to standardise data and provide real-time information in the startup ecosystem. It aims to establish a unified ecosystem by enabling stakeholders to access and share critical information on a single source. The framework seeks to address the challenges of siloed data and fragmented systems by creating a shared data repository that can be accessed by all ecosystem participants. By deploying the shared ecosystem framework, stakeholders can benefit from a more efficient and effective ecosystem that is better equipped to support decision-making and ecosystem orchestration. It provides a platform for data sharing that enables stakeholders to access relevant data in real-time, which can lead to more accurate and timely decision-making. The standardisation of data can also help to improve data quality and consistency, which in turn can lead to more reliable insights and trends. The shared ecosystem framework also provides a more secure and reliable data infrastructure for the startup ecosystem. Data privacy and security are critical considerations for all stakeholders, and the framework can provide a secure environment for data management and sharing. This can help to build trust and confidence among ecosystem

participants, which can lead to more open and collaborative working relationships. This chapter will explore the ways to implement and deploy the shared ecosystem framework. Overall, it is essential for the startup ecosystem to function at its full potential. It provides a unified and standardised data infrastructure that can support decision-making and innovation, while also improving data quality and security.

4.5.1 Ecosystem use cases

A use case is a scenario that describes a specific situation or problem that a product or service can be used to solve. It outlines the steps or actions that a user would take when using the product or service to address a particular need or achieve a specific goal. A use case can help developers, designers, and stakeholders understand how a product or service will be used in the real world and what features or functionality it needs to include to address user needs effectively. By defining use cases, product teams can prioritise development efforts and ensure that the product meets the needs of its target users (Marinelli, et al., 2023, pp. 18-19). One of the most important aspects of deploying the framework is the development of ecosystem-specific use cases. These use cases are designed to prioritise the deployment of the framework and ensure that it meets the unique needs of the ecosystem stakeholders. By focusing on the most pressing issues facing each ecosystem, use cases can help to drive the adoption of the framework and increase the likelihood of success. Ecosystem use cases are numerous and multiple examples can be found in every ecosystem, entrepreneurs are looking for a mentor or funding, economic developers are looking for a startups, just to name a few. This chapter explains several universal ecosystem use case in more detail.

One of the most well-known ecosystem use cases is ecosystem mapping. Ecosystem mapping is the process of creating a comprehensive view of the actors, resources, and relationships within a given ecosystem. This can be used to identify the gaps that ecosystems have and areas of strength and weakness, as well as opportunities for growth and development (Andrews, et al., 2022, pp. 1-3). By using the shared ecosystem framework to collect and manage data related to ecosystem mapping, ecosystem stakeholders can gain a more complete understanding of the ecosystem and make more informed decisions about how to allocate resources and pursue opportunities (Ramirez, 2022). Another important use case is the development of an ecosystem

dashboard for economic development. This use case involves the creation of a data dashboard that provides real-time visual information about the economic health of the ecosystem. The dashboard can be used to track key economic indicators, such as job growth, business formation rates, and investment levels. By providing this information in a visual and accessible format, ecosystem stakeholders can make more informed decisions about how to support economic development and ensure the long-term health of the ecosystem (Digiole, 2022). The deployment of the shared ecosystem framework should begin by identifying the ecosystem-specific needs. While the use case approach prioritises the deployment based on the needs of the ecosystem stakeholders, it is important to note that some ecosystem use cases are universal and core activities that provide immediate value. For instance, ecosystem mapping and data visualisation are core functionalities that should be implemented at the beginning as they can be developed using publicly available data sources and require minimal orchestration structure to get started. Starting with these core functionalities can help refine and test the framework on a smaller scale before scaling up to the next use case and allow for a more focused and targeted implementation of the framework.

One of the example use cases comes from the problem where many startup founders face challenges in navigating the complex ecosystem of support services available to them. The process of managing interactions with these services can be time-consuming and confusing, requiring founders to collect and manage a large amount of information, such as entity information, pitch decks, business plans, and financial data. The lack of a centralised tool to manage this information can lead to inefficiencies and missed opportunities for startups. In addition, stakeholders responsible for ecosystem development may lack the necessary insights and data to make informed decisions about policy and budgeting. The ecosystem use case can be developed to address these challenges by providing startups with a centralised tool to manage their information and ecosystem interactions, and by providing stakeholders with real-time insights to improve ecosystem growth and development (Digiole, 2022). Just like the startups, support organisations are lacking a centralised means to gather important details about clients, log, and document interactions, and identify areas for ecosystem improvement. The ecosystem use case provides a solution by streamlining these processes, allowing support organisations to efficiently manage and track interactions, schedule meetings, document feedback and outcomes, and identify additional support needs (Digiole, 2022). Use case can be built to

manage ecosystem services usage and identify needs for additional services. By utilising this data, support organisations can tailor their services to better meet the needs of their clients and improve overall ecosystem performance. The use case also provides insights into ecosystem trends, patterns, and performance metrics, helping support organisations to identify areas for service development and make data-driven decisions to optimise overall ecosystem performance.

APIs (Application Programming Interfaces) have revolutionised the way software applications communicate with each other over the internet. They allow for data to flow seamlessly between different applications without the need for human intervention. In the context of an ecosystem framework, APIs can be leveraged by different parties to build ecosystem-specific applications for various use cases. Once the core functionalities of the ecosystem framework are in place and there is an orchestration structure in place, API integration becomes much easier for other parties. Different parties can leverage the existing framework to build their own applications and use cases that leverage the data and functionality of the ecosystem framework (Trček, 2019, pp. 1-5).

4.5.2 Technical aspects of the ecosystem framework

One of the key features of the shared ecosystem framework is the shared ecosystem data model, which standardises the ecosystem data and provides real-time data to support decision-making and innovation. The use of a shared ecosystem data model enables the development of data access protocols and data management tools that can be used across different ecosystems. The data models need to be designed to be modular, so that they can be adapted to different use cases and data sources (Digiole, 2022). Data integration is one technical part of the shared ecosystem framework, as it allows for the consolidation of data from different sources. This enables ecosystem stakeholders to gain a holistic view of the ecosystem and make data-driven decisions. The shared ecosystem data model is designed to be interoperable with other systems, which means that it can be integrated with existing systems and applications (Ali & Alexopoulos, 2023, p. 76).

Scalability, flexibility, and modularity are also important aspects of the shared ecosystem framework. The framework needs to be designed to be scalable, so that it can handle large volumes of data and support the growth of the ecosystem as it develops. The flexibility of the framework means that it can be easily adapted to the unique requirements of each ecosystem. The modularity of the framework enables the development of ecosystem-specific use cases that can be easily integrated into the framework. Open data is one of the key functionalities of the ecosystem development framework. With both technical and legal considerations are necessary for successful implementation. Essentially, open data refers to data in a "machine-readable" format that can be used without restriction, whether it is public or private. The technical aspect of open data involves making sure that data is structured in a way that computer applications can retrieve it efficiently, while the legal perspective ensures that the data is licensed in a way that allows for commercial and non-commercial use without restriction (Barns, 2016, p. 557).

While open data can come from any source, there is a particular focus on public data, which has been created and gathered through public investment. It is important to note that while "open data" and "open government data" are often used interchangeably, there are distinctions between them. The Organisation for Economic Cooperation and Development (OECD) defines open government data as a philosophy and set of policies that promote transparency, accountability, and value creation by making government data accessible to all (Barns, 2016, p. 557). The benefits of open data in ecosystem are numerous, including promoting innovation and economic growth, fostering transparency and accountability, and enabling better decision-making in various sectors. The availability of open data enables individuals, organisations, and governments to analyse data trends and create solutions for various use cases to improve efficiency and effectiveness in ecosystems.

4.5.3 Evolution of the framework

As the implementation of the shared ecosystem framework is not a one-time event, this chapter will address the importance of implementation and evolution of the framework to ensure its sustainability and effectiveness. The maintenance and evolution of the shared ecosystem framework require a governance structure, regular updates based on ecosystem specific use

cases, and user feedback mechanisms to keep it relevant, up-to-date, and meet the needs of the ecosystem stakeholders (Smelund & Faghankhani, 2015, pp. 36-38).

In the beginning, there needs to be a common understanding within the ecosystem that the framework is needed. This can be achieved through activities such as ecosystem forums or workshops where stakeholders can discuss and agree on the need for a common ecosystem framework. It is important to ensure that all stakeholders have a shared vision and understanding of the purpose and objectives of the framework and commit to the framework with manifesto. Once there is agreement on the need for a framework, the next step is to establish a common terminology within the ecosystem for the first use cases. The success of any ecosystem framework depends on the use of ubiquitous terminology that is understood and adopted by all stakeholders. This step involves harmonising terminology and creating a common language that can be used across the ecosystem. Whit a strong manifesto from the ecosystem and shared terminology the use case implementations can begin. The use cases represent different scenarios that the framework can support, and the data model provides the underlying structure for the data that is collected and analysed. As new use cases are identified, the data model may need to be expanded or modified to support these new scenarios so new use cases can be built on the top of the framework.

Based on all the findings in this thesis, Figure 9 represents conceptual evolutionary path for the ecosystem orchestration framework after the ecosystem has committed to it. Because of the evolutionary nature of the ecosystems, the evolution of the ecosystem framework is a mandatory aspect of its long-term success. in this concept, there are three initial distinct phases in which an ecosystem can evolve its framework to meet its changing needs and goals.

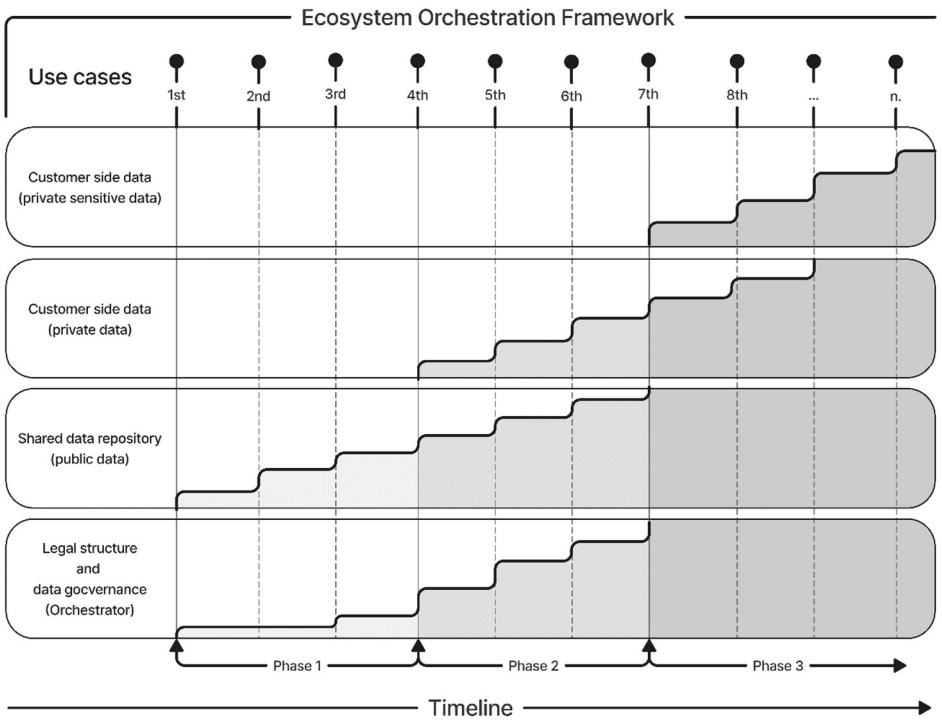

Figure 9 Ecosystem framework evolution

When prioritising use cases in the ecosystem, it's recommend following certain guidelines, such as starting with projects that do not involve personal data or focusing on projects that have access to data of relatively sufficient quality. This approach, which is more focused and bounded, can help to establish initial legitimacy for unfamiliar practices (Gupta, et al., 2020, p. 7).

Phase 1 is the starting point for any ecosystem looking to manage its data effectively. In this phase, the focus is on core functionalities and common use cases, such as ecosystem mapping, data visualisation with dashboard creation, and AI-enhanced advisory applications. This phase for ecosystems just getting started with data management and utilises only public open data. Applications can be operated with SaaS by outside organisations if needed, and no heavy governance structure is needed to get started. A shared global repository can be used for data storage and retrieval.

Phase 2 is the next step for ecosystems that want to increase the ecosystem understanding and analysis. This phase includes dedicated data repositories with global connections, which

supports data model can customisation. Private and customised applications can be created for relevant use cases via APIs, relevant common use cases are for example applications for support organisations and entrepreneurs to matching each other. Data models in this phase include private data that is not sensitive. Private data means any information relating to an identifiable person who can be directly or indirectly identified. However, as the framework now has private data, the legal structure and data governance need to be built step by step when the framework develops with new use cases and applications connected to the data model.

Phase 3 is the final phase of the ecosystem framework and is designed for mature ecosystems with the highest flexibility and control over their data. The key difference between this phase and the previous two is that it can hold the use cases with custom, private, and sensitive data models via APIs. In this phase, data models and ecosystem applications should not have sensitive data until the legal structure and data governance are fully in place. The ecosystem should have a clear orchestrator with required resources and funding, which can operate the framework by itself without relying on SaaS models.

The key to successful framework evolution is the gradual shift from utilising only open public data to incorporating private data use cases while building the legal structure and data governance framework simultaneously. This phased approach ensures that the ecosystem can grow organically while maintaining a solid foundation of data management practices. With each new phase, the ecosystem gains more control and flexibility over its data, enabling it to achieve its goals more effectively.

The evolution of an ecosystem framework is closely tied to the quality and quantity of the data that it manages. In the first phase of ecosystem orchestration, the focus is on core functionalities and common use cases, with data management limited to public open data. While this provides a starting point for data management, the quality and quantity of the data is limited, and it restrains the intelligence of the ecosystem. As the ecosystem framework evolves, the quantity and quality of the data increase, resulting in a more intelligent and effective ecosystem. The ability to manage and analyse data becomes more sophisticated, providing greater insights and opportunities for collaboration and innovation. However, this evolution must be accompanied

by the development of proper legal and governance structures to ensure the responsible management and protection of private and sensitive data.

Overall, the ongoing evolution of the shared ecosystem framework provides numerous possibilities for improving the functionality and value of the framework for ecosystem stakeholders. By identifying new use cases, expanding the data model, and increasing connectivity with other ecosystems, the framework can become more effective in providing real-time data and supporting innovation and decision-making in the startup ecosystem.

4.5.4 Governance structure

Establishing a governance structure is important for the maintenance and evolution of the shared ecosystem framework. The governance structure defines the roles and responsibilities of different stakeholders in the ecosystem, outlines decision-making processes, and ensures compliance with data privacy and security policies. It also provides a mechanism for resolving conflicts and ensuring accountability (Gupta, et al., 2020, p. 9). The orchestrator, as the central actor, has a leading role in the governance structure. The orchestrator is responsible for managing the shared ecosystem framework, overseeing the deployment of use cases, ensuring data quality, and making decisions that benefit the entire ecosystem. The orchestrator also ensures that the governance structure is aligned with the values and goals of the ecosystem and is responsive to the needs of ecosystem stakeholders (Gupta, et al., 2020, pp. 2-3). To establish effective governance, it is important to define decision-making processes that are transparent, participatory, and accountable. Decision-making processes should be informed by input from all relevant stakeholders and guided by clear criteria and performance metrics. In addition, governance should promote a culture of innovation and experimentation while ensuring the protection of sensitive data (Gupta, et al., 2020, p. 8). Data privacy and security policies are also critical elements of the governance structure. To ensure data privacy and security, the governance structure should establish clear guidelines for data collection, storage, sharing, and use. This includes implementing appropriate data access control mechanisms (Dhauwers, et al., 2022, p. 7).

One key part of the ecosystem governance are conflict resolution mechanisms. They are essential for maintaining a stable and harmonious ecosystem. Conflicts can arise between ecosystem stakeholders, including data owners and users (Yaghmaie & Vanhaverbeke, 2019, p. 14). To address these conflicts, the governance structure should establish clear procedures for dispute resolution, such as mediation or arbitration, and ensure that all stakeholders have access to these procedures. Efficient governance structures are essential for the success of an ecosystem framework. They enable the development of coherent and integrated policies that support the growth and development of startups. A well-designed governance structure ensures that resources are allocated effectively, and data is managed in a way that supports innovation and growth.

One of the main benefits of a solid governance structure is the elimination of inefficiencies. With a clear and coordinated structure, resources can be allocated effectively, and data can be managed in a way that supports the needs of startups. This enables startups to access the resources and support they need to grow and succeed (Kitchin & Moore-Cherry, 2021, p. 1917). Another important benefit of a solid governance structure is the ability to reduce data incompatibilities. With a clear governance structure, data can be managed in a way that supports the needs of all stakeholders. This reduces the risk of data incompatibilities, which can reduce spatial intelligence and stifle the benefits of open data (Kitchin & Moore-Cherry, 2021, p. 1918). Finally, a solid governance structure enables the development of a regional culture that supports innovation and growth. With a coordinated approach to governance, stakeholders can work together to build an ecosystem that supports the needs of startups. This enables the development of a regional culture that is supportive of innovation and growth, which can attract investment and support the development of new startups (Kitchin & Moore-Cherry, 2021, p. 1918). Overall, a well-designed governance structure is essential for maintaining and evolving the shared ecosystem framework. By promoting transparency, accountability, and trust, the governance structure can help to ensure the long-term success of the ecosystem.

5 CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

The research topic of this study was focused on the problems associated with startup ecosystem orchestration and digital solutions to address these challenges. This research aimed to explore the current state of startup ecosystem orchestration, identify the challenges associated with it and provide digital solutions in the form of a shared ecosystem framework. This chapter summarises the key findings of the research, discusses its contributions to the field, and provides recommendations for future research.

5.1 Key results of the research

This thesis aimed to investigate the current state of startup ecosystems, particularly with regard to ecosystem orchestration. The findings of the study revealed that there is currently no natural ecosystem orchestrator overseeing the entire startup ecosystem, which results cultural, process and technological challenges and siloed ecosystem data. Instead, each ecosystem actor is focused on their own part of the ecosystem, and there is a lack of a neutral orchestrator profile. The study further highlighted that technologies are mature enough to develop a digital ecosystem framework that can overcome the challenges faced by startup ecosystems. Such a framework can unlock ecosystem data in a data-driven manner to enable efficient ecosystem orchestration. However, the establishment of a neutral ecosystem orchestrator with strong ecosystem mandate is crucial for the success of such a framework. The study recommends transitioning from analogical orchestration processes to digital ones, given the current state of global digital disruption. The shared ecosystem framework involves identifying and collecting ecosystem data from different sources, aggregating it and distributing to the ecosystem, and managing the data through an orchestration structure.

The main research question explored what does orchestration mean in the context of startup ecosystem? Answer for that question was answered in this thesis in great detail in the chapter 2: Analysis of the startup ecosystem and ecosystem orchestration. This theses explored the current state of the startup ecosystem orchestration and compared it how other ecosystems are orchestrated. In the context of startup ecosystems, orchestration refers to the coordination and facilitating of various actors, resources, and knowledge within the ecosystem to create a

favourable environment for startups to thrive. Orchestration involves activities such as setting a shared vision, developing best practices, allocating resources, and managing relationships among different stakeholders in the ecosystem. It also involves addressing the challenges that the ecosystem faces, such as cultural differences, ecosystem processes and limited resources and tools. Digital solutions, such as a shared ecosystem framework, can help unlock ecosystem data and enable data-driven ecosystem orchestration. Overall, orchestration plays a crucial role in creating a supportive and collaborative ecosystem that can foster innovation and growth in the startup community.

First supporting research question in this thesis was: What are the main challenges or problems faced by ecosystem orchestrators in startup ecosystems? Answer for that question was presented in chapter 3: Analysis of challenges in ecosystem orchestration. Ecosystem orchestrators face significant challenges related to the cultural, social, and technological dimensions of ecosystem development. For example, they must navigate differences in language, norms, and business practices across different geographic regions, and address issues related to social fragmentation and disconnectivity within the ecosystem. They must also develop innovative technological solutions to facilitate communication and collaboration among ecosystem actors, and promote transparency, collaboration, and innovation across the ecosystem. These challenges can be identified in various ways in the ecosystem, with use case approach. For example, one of the key challenges is the need to balance the interests and goals of multiple stakeholders, including startups, investors, policymakers, and other ecosystem actors. This requires the ability to navigate complex social and political dynamics, build trust and cooperation among stakeholders, and develop effective communication and coordination mechanisms. Major challenge is the need to build and sustain a critical mass of startup activity within the ecosystem. This involves attracting and retaining talented entrepreneurs, providing access to funding and other resources, and fostering a culture of innovation and risk-taking. It also requires the ability to respond to changing market conditions and technological developments, and to anticipate and address potential barriers to growth and sustainability. Overall, the challenges and problems faced by ecosystem orchestrators in startup ecosystems are complex and multifaceted and require a range of skills, tools, and strategies to address.

Second supporting research question was: What is digitalisation's role in the startup ecosystem orchestration now and what possibilities it can unlock? In chapter 4 digitalisations current role and possibilities were explored in detail. This thesis was able to explain how digitalisation has a significant role to play in the orchestration of startup ecosystems and in chapter 4 concept of shared ecosystem framework was introduced as an answer for the challenges ecosystems are facing. In the current landscape, there is no actor that overlooks the entire startup ecosystem and current digital tools won't provide the answers that ecosystems are looking for. The data and resources of the ecosystem are often locked in silos, making it difficult for stakeholders to access and leverage them. By leveraging digital technologies, startup ecosystems have possibilities benefit from improved collaboration, increased efficiency, and better decision-making. The digital ecosystem framework can facilitate the sharing of information and resources among ecosystem stakeholders, making it easier for startups to find the resources they need to succeed. Overall, based on these findings, digitalisation has the potential to revolutionise the way startup ecosystems are orchestrated, enabling ecosystem stakeholders to work together more effectively and efficiently towards a shared vision.

5.2 Contributions to the field

The present thesis makes several contributions to the field of study by providing a comprehensive understanding of the concept of ecosystem orchestration in the context of startup ecosystems. One of the main contributions of this research is to harmonise the terminology about the ecosystems, and startups, providing a clear definition and holistic framework for understanding the concept of startup ecosystems. Additionally, this thesis has identified the challenges faced by startups in the ecosystem, including ecosystem fragmentation, cultural challenges, process challenges, and technology challenges. By highlighting these challenges, this research provides valuable insights for future researchers about the challenges that ecosystems face in practice and what are the challenges ecosystem orchestrators need to mitigate and remove. This study has proposed a framework for a shared digital ecosystem that can unlock the ecosystem data to orchestrate ecosystems in a data-driven manner. This framework can help overcome the challenges faced by startup ecosystems and provide a more efficient and effective way to support the growth and success of startups. The

proposed digital ecosystem framework emphasises the role of digitalisation in the startup ecosystem orchestration, highlighting the possibilities that it can unlock.

5.3 Recommendations for future research

As with any research project, this study has its limitations. One of the major limitations of this study is that the startup ecosystem orchestrator profile approach is relatively new, and there is limited research available in this area. This research has relied on some sources that are validated in practice, but further research is needed to validate these findings and develop a more comprehensive understanding of the startup ecosystem orchestrator profile.

Another limitation of this research is that the role of digitalisation in the ecosystem orchestration is still a relatively unexplored area, and there are not many applications out there. Therefore, future research could focus on exploring the impact of digitalisation on the startup ecosystem and how digitalisation can facilitate ecosystem orchestration in a data-driven manner. Moreover, the lack of available academic research material from some key areas of the research can be another limitation of this study. Therefore, future research could aim to address these gaps and provide a more neutral approach to the research.

To build on the findings of this research, there are several avenues for future research. Studies could explore the impact of ecosystem use case application on the ecosystem, using case studies to investigate the effects of different approaches to ecosystem use case applications. Studies could also investigate the impact of ecosystem data-driven orchestration, exploring how ecosystem data can be used to inform orchestration activities and facilitate ecosystem growth and development. Future research could focus on exploring the startup ecosystem orchestrator profile in more detail. This could involve investigating the differences in entity models between ecosystems that are private sector led than government led and exploring how different types of orchestrators may impact the growth and development of startup ecosystems. Digital orchestration solutions involve a complex interplay of different technologies and systems, each with their own unique technical requirements and considerations. While our study has provided valuable insights into the benefits and challenges of implementing digital orchestration

solutions in various industries, there are many technical aspects that we could not cover in depth due to their complexity and the need for separate topics.

One technical aspect that warrants further exploration is the integration of different systems and applications. Digital orchestration solutions often involve the integration of multiple legacy systems, cloud-based applications, and other software tools, each with its own unique data format, protocols, and interfaces. Integrating these systems requires careful planning, design, and implementation to ensure that they work seamlessly together, and data is transmitted accurately and securely. Another technical aspect that requires separate attention is data management and governance. Digital orchestration solutions rely on the collection, processing, and analysis of large volumes of data from different sources, which presents challenges related to data quality, privacy, security, and compliance. Effective data management and governance strategies are critical to ensure that data is accurate, timely, and trustworthy, and that it complies with relevant laws, regulations, and industry standards. In addition, the implementation of digital orchestration solutions often involves the use of advanced technologies such as artificial intelligence, machine learning, and natural language processing, which require specialised skills and expertise. These technologies have the potential to revolutionise the way businesses operate and interact with customers, but they also pose challenges related to data bias, algorithmic transparency, and ethical considerations. Overall, this research has provided valuable insights into the concept of ecosystem orchestration in the context of startup ecosystems. By identifying the challenges faced by startups in the ecosystem and providing a framework for a shared digital ecosystem, this research has laid the groundwork for future research to build on these findings and further develop our understanding of ecosystem orchestration.

REFERENCES

Ali, M. & Alexopoulos, C., 2023. *Data interoperability and the open data ecosystems: rolens and research areas.* s.l., International Conference on Open Data.

Andrews, R. ym., 2022. *Reprint of "The Startup Cartography Project: Measuring and mapping entrepreneurial ecosystems",* s.l.: Research Policy 51.

Autio, E. & Thomas, L. D., 2021. *Researching ecosystems in innovation contexts,* s.l.: Emerald Publishing Limited: Innovation & Management Review, Vol.19 (1), pp.12-25.

Barns, S., 2016. *Mine your data: open data, digital strategies and entrepreneurial governance by code,* s.l.: Urban Geography, Vol. 37, No. 4, 554–571.

Basole, R. C. ym., 2015. *Understanding Business Ecosystem Dynamics: A Data-Driven Approach,* s.l.: Management Information System, Vol. 6, No. 2, Article 6.

Blank, S., 2012. *The startup owner's manual : the step-by-step guide for building a great company.* s.l.:Pescadero, CA : K&S Ranch.

Blank, S., 2013. *Why the lean startup changes everything,* s.l.: Harvard Business Review. 91(5). pp 63–72..

Blank, S. & Dorf, B., 2012. *The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company,* s.l.: John Wiley & Sons, Inc..

Bowen, G. A., 2009. *Document analysis as a qualitative research method.,* s.l.: Qualitative Research Journal, 9(2), 27-40.

Brown, R., mawson, S., Lee, N. & Peterson, L., 2019. *Start-up factories, transnational entrepreneurs and entrepreneurial ecosystems: unpacking the lure of start-up accelerator programmes,* s.l.: European Planning Studies, Informa UK Limited, trading as Taylor & Francis Group.

Burstöm, T. ym., 2023. *A definition, review, and extension of global ecosystems theory: Trends, architecture and orchestration of global VCs and mechanisms behind unicorns,* s.l.: Journal of Business Research 157 (2023) 113605.

Curley, M. & Salmelin, B., 2018. *Open Innovation 2.0.* Singapore: Springer International Publishing.

Dhanaraj, C. & Parkhe, A., 2006. *Orchestrating Innovation Networks,* s.l.: Briarcliff Manor: Academy of Management Review Vol. 31 (3) pp. 659-669.

Dhauwers, R., Walravens, N. & Ballon, P., 2022. *Data Ecosystem Business Models: Value and control in Data Ecosystems,* s.l.: Journal of Business Models, Vol. 10, No. 2, pp. 1-30.

Dibbern, J. ym., 2022. *Digitalization across organizational levels,* Cham, Switzerland: Springer Nature Switzerland AG.

Digiole, 2022. *About Station App.* [Online]
Available at: https://www.ecosystemos.com/about-station-app.html
[Haettu 30 3 2023].

Digiole, 2022. *About Voyager App.* [Online]
Available at: https://www.ecosystemos.com/about-voyager-app.html
[Haettu 30 3 2023].

Digiole, 2022. *Digiole and SDEC announce startup ecosystem interoperability partnership.* [Online]
Available at: https://www.digiole.com/blog/digiole-and-sdec-announce-startup-ecosystem-interoperability-partnership
[Haettu 22 2 2023].

Digiole, 2022. *EOS Data Repository.* [Online]
Available at: https://www.ecosystemos.com/about-eos-data-repository.html
[Haettu 26 2 2023].

Digiole, 2022. *Open Standard Data Model.* [Online]
Available at: https://www.ecosystemos.com/about-open-standard-data-model.html
[Haettu 26 2 2023].

Ding, L. ym., 2011. *TWC LOGD: A portal for linked open government data ecosystems ,* s.l.: Web Semantics: Science, Services and Agents on the World Wide Web 9 (2011) 325–333.

Gobble, M. M., 2014. *Charting the innovation ecosystem.* s.l.:Research-Technology, 57 (4) 55-59.

Gupta, A., Panagiotopoulosa, P. & Bowenb, F., 2020. *An orchestration approach to smart city data ecosystems,* s.l.: Elsevier Inc. Technological forecasting & social change, Vol.153.

Harima, J., 2020. *Public Accelerators in Entrepreneurial Ecosystems Resource Orchestration in the Early Ecosystem Evolution.* 1st toim. Bremen: Springer Fachmedien Wiesbaden.

Herzog, P., 2011. *Open and Closed Innovation, Different Cultures for Different Strategies,.* 2nd revised edition toim. s.l.:Springer Fachmedien Wiesbaden GmbH 2011.

Hurmelinna-Laukkanen, P., Möller, K. & Nätti, S., 2022. *Orchestrating innovation networks: Alignment and orchestration profile approach,* s.l.: Journal of business research, Vol.140, pp.170-188.

Ianioglo, A., 2022. *Innovation and Entrepreneurial Ecosystems,* s.l.: IntechOpen, Research and Development Enterprise.

Iansiti, M. & Levien, R., 2004. *Strategy as Ecology,* s.l.: Harvard business review, 82, (3), pp. 68–78+126.

Isckia, T., Reuver, M. D. & Lescop, D., 2020. *Orchestrating Platformecosystems: The Interplay of Innovation and Business Development Subsystems,* s.l.: Journal of Innovation Economics & Management no. 32. pp. 197-223.

Ivarsson, F. M., 2018. *Ecosystem orchestration, how to thrive in the increasingly networked digital economy,* s.l.: Universty of Gothenburg, department if Applied Information Technology, Master thesis.

Janssen, M. & Estevez, E., 2012. *Lean government and platform-based governance—Doing more with less,* s.l.: Government Information Quarterly 30 pp.1–8.

Järvi, K., 2013. *Ecosystem architecture design: endogenous and exogenous structural properties,* s.l.: Lappeenranta University of Technology, Doctoral theses.

Kaihovaara, A., Härmälä, V. & Salminen, V., 2016. *Mitä innovaatioekosysteemit ovat ja miten niitä voi kehittää?,* s.l.: Policy Brief, Työ- ja elinkeinoministeriö, Valtioneuvoston kanslia.

Ketola, T., 2019. *The public sector in startup ecosystems,* Tampere: Council of Tampere Region.

Kitchin, R. & Moore-Cherry, N., 2021. *Fragmented governance, the urban data ecosystem and smart city-regions: the case of Metropolitan Boston,* s.l.: REGIONAL STUDIES, VOL. 55, NO. 12, 1913–1923.

Laasonen, V., Kolehmainen, J. & Sotarauta, M., 2020. *The complexity of contemporary innovation policy and its governance in Finland,* s.l.: Innovation: The European Journal of Social Science pp.1-22.

Leten, B. ym., 2013. *IP Models to Orchestrate Innovation Ecosystems: IMEC, a Public Resesarch Institute in Nano-Electronics,* s.l.: California Management Review, Vol. 55, (4) pp. 51–64.

Linde, L., Sjöldin, D., parida, V. & Wincent, J., 2021. *Dynamic capabilities for ecosystem orchestration A capability-based framework for smart city innovation initiatives,* s.l.: Technological forecasting & social change Vol.166, p.120614.

Lis, D. & Otto, B., 2020. *Data Governance in Data Ecosystems – Insights from organizations,* s.l.: AMCIS 2020 Proceedings. 12.

Margoni, T., Ducuing, C. & Schirru, L., 2023. *Data property, data governance and Common European Data Spaces,* s.l.: Kluwer.

Marinelli, L., Bartoloni, S., Pascucci, F. & Gregori, G. L., 2023. *Genesis of an innovation-based entrepreneurial ecosystem: exploring the role of intellectual capital,* s.l.: Journal of Intellectual Capital Vol. 24 No. 1, 2023 pp. 10-34.

Masucci, M., Brusoni, S. & Cennamo, C., 2019. *Removing bottlenecks in business ecosystems: The strategic role of outbound open innovation,* s.l.: Elsevier B.V: Research policy, Vol.49 (1).

Moore, J. F., 1993. *Predators and Prey: A New Ecology of Competition.* s.l.:Harvard Business Review 71, (3) 75–86.

Mulas, V., Minges, M. & Applebaum, H., 2015. *Boosting Tech Innovation Ecosystem In Cities,* Washington: Publishing and Knowledge Division, The World Bank.

My Data movement, 2017. *Declaration of MyData Principles.* [Online]
Available at: https://www.mydata.org/participate/declaration/
[Haettu 26 2 2023].

Okano, M. T. ym., 2018. *Digital Ecosystem and how it can benefit the business: A narrative review,* s.l.: International Conference on Management and Information Systems.

Papaioannou, T., Wield, D. & Chataway, J., 2009. *Knowledge ecologies and ecosystems? An empirically grounded reflection on recent developments in innovation systems theory,* s.l.: Environment and planning. C, Government & policy, Vol 27 (4) 319-339.

Ramirez, O., 2022. *Ecosystem mapping app in 5 minutes - Blogpost.* [Online]
Available at: https://www.linkedin.com/pulse/ecosystem-mapping-app-5-minutes-oscar-ramirez/
[Haettu 22 2 2023].

Ries, E., 2011. *The lean startup: How today's entrepreneurs use continuous innovation to create radically successfull businessess.* s.l.:Crown Books.

Rinkinen, S., 2016. *CLUSTERS, INNOVATION SYSTEMS AND ECOSYSTEMS, Studies on innovation policy's concept evolution and approaches for regional renewal,* Lappeenranta: Thesis for the degree of Doctor of Science. Lappeenrannan teknillinen yliopisto. Yliopistopaino.

Rinkinen, S. & Harmaakorpi, V., 2019. *Business and innovation ecosystems: innovation policy implications,* s.l.: Int. J. Public Policy, Vol. 15, Nos. 3/4, pp.248–265.

ScaleUp Nation, 2020. *The Art of Scaling,* s.l.: Scale Up Nation.

Shepherd, D. A. & Gruber, M., 2021. *The Lean Startup Framework: Closing the Academic–Practitioner Divide,* s.l.: Entrepreneurship Theory and Practice. Vol. 45(5). pp. 967-998.

Siegel, D. S., Feldman, M. & Wright, M., 2019. *New developments in innovation and entrepreneurial ecosystems,* s.l.: Oxford University press: Industrial and Corporate Change, Vol 28. (4) pp. 817-826.

Śledzik, K., 2013. *Schumpeter's view on innovation and entrepreneurship,* s.l.: SSRN Electronic Journal.

Smelund, A. & Faghankhani, H., 2015. *Platform Orchestration for Efficiency, Development, and Innovation,* s.l.: IEEE: 48th Hawaii International Conference on System Sciences pp.1380-1388.

Smelund, A., Lindblom, A. & Mitronen, L., 2018. *Collaborative Value Co-creation in platform economy.* Singapore: Springer International Publishing.

Spigel, B., 2015. *The Relational Organization of Entrepreneurial Ecosystems,* s.l.: Entrepreneurship: Theory and Practice 41 (1).

Stam, E., 2015. *Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique,* London: European Planning Studies, Routledge, Vol. 23 (9) pp.1759-1769.

Startup Commons Global, 2022. *The Main Purpose For Startup Ecosystem Orchestration.* [Online]

Available at:
https://www.youtube.com/watch?v=sWAnAEobBIA&ab_channel=StartupCommonsGlobal
[Haettu 17 12 2022].

Startup Commons, 2018. *Startup Development Phases.* [Online]
Available at: https://www.startupcommons.org/startup-development-phases.html
[Haettu 24 6 2022].

Startup Commons, 2022. *Initiating the startup ecosystem orchestration: the ecosystem operator role.* [Online]
Available at:
https://www.youtube.com/watch?v=EWXj9BILnG0&ab_channel=StartupCommonsGlobal
[Haettu 22 2 2023].

Startup Commons, 2022. *Support Providers.* [Online]
Available at: https://www.startupcommons.org/about-support-providers.html
[Haettu 13 11 2022].

Startup Commons, 2022. *What Is Startup Ecosystem?.* [Online]
Available at: https://www.startupcommons.org/what-is-startup-ecosystem.html
[Haettu 7 11 2022].

Thomas, L. D. W. & Autio, E., 2020. *Innovation ecosystems in management: An organizing typology,* s.l.: Oxford Encyclopedia of Business and Management. Oxford University Press.

Trček, D., 2019. *APIs and emerging economy – driving digital transformation through e-government,* s.l.: SHS Web of Conferences 65, 04009.

Tripathi, N., Oivio, M., Liukkonen, K. & Markkula, J., 2019. *Startup ecosystem effect on minimum viable product development in software startups,* s.l.: Elsevier B.V Information and Software Technology 114. pp. 77-91.

Valkokari, K., 2015. *Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them,* s.l.: Technology Innovation Management Review. vol. 5 (8). pp. 17-24.

van Rijnsoever, F. J., 2021. *Intermediaries for the greater good: How entrepreneurial support organizations can embed constrained sustainable development startups in entrepreneurial ecosystems,* s.l.: Research Policy 51.

Velt, H., 2020. *ENTREPRENEURIAL ECOSYSTEMS AND BORN GLOBAL START-UPS,* Lappeenranta: Lappeenranta-Lahti University of Technology LUT, LUT University Press 2020.

Weins, J. & Jackson, C., 2015. *The Importance of Young Firms for Economic Growth,* Kansas City: Ewing Marion Kauffmann Foundation.

Yaghmaie, P. & Vanhaverbeke, W., 2019. *Identifying and describing constituents of innovation ecosystems: A systematic review of the literature,* s.l.: EuroMed Journal of Business, Emerald Publishing Limited.

Ylijoki, O., 2019. *Big Data – Towards Data-driven Business,* s.l.: Lappeenranta-Lahti University of Technology LUT, Doctoral theses.